



## GRANT AGREEMENT FOR MEMBERS<sup>1</sup>

NUMBER 874464 — PJ10-W2 PROSA

This **Agreement** ('the Agreement') is **between** the following parties:

**on the one part,**

the **Single European Sky ATM Research Joint Undertaking** ('the JU'), represented for the purposes of signature of this Agreement by the JU Executive Director or his/her representative, Florian GUILLERMET,

**and**

**on the other part,**

1. 'the coordinator':

**DFS DEUTSCHE FLUGSICHERUNG GMBH (DFS)**, established in AM DFS CAMPUS 10, LANGEN 63225, Germany, VAT number: DE114110232, represented for the purposes of signing the Agreement by Gerhard TAUSS

and the following other beneficiaries, if they sign their 'Accession Form' (see Annex 3 and Article 56):

2. **DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV (DLR)**, established in Linder Hoehe, KOELN 51147, Germany,

3. **STICHTING NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM (NLR)**, established in Anthony Fokkerweg 2, AMSTERDAM 1059CM, Netherlands, VAT number: NL002760551B01,

4. **RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK (ANS CR (B4))**, established in JENEC NAVIGACNI 787, JENEC 252 61, Czechia, VAT number: CZ699004742,

5. **LETOVE PREVADZKOVE SLUZBY SLOVENSKEJ REPUBLIKY, STATNY PODNIK (LPS SR (B4))**, established in IVANSKA CESTA 93, BRATISLAVA 823 07, Slovakia, VAT number: SK2020244699, as 'beneficiary not receiving JU funding' (see Article 9),

6. **VALSTYBES IMONE ORO NAVIGACIJA (ON (B4))**, established in RODUNIOS KEL 2, VILNIAUS 02188, Lithuania, VAT number: LT100604610,

7. **POLSKA AGENCJA ZEGLUGI POWIETRZNEJ (PANS A (B4))**, established in UL. WIEZOWA 8, WARSZAWA 02 147, Poland, VAT number: PL5222838321,

---

<sup>1</sup> 'Members' means "members of the Joint Undertaking" as defined under Article 1(2) and 1(3) of the Statutes of the JU, Annex to the SESAR Regulation.

8. **AUSTRO CONTROL OSTERREICHISCHE GESELLSCHAFT FUR ZIVILLUFTFAHRT MBH (ACG/COOPANS)**, established in WAGRAMER STRASSE 19, WIEN 1220, Austria, VAT number: ATU37259408,
9. **CROATIA CONTROL, CROATIAN AIR NAVIGATION SERVICES LTD (CCL/COOPANS)**, established in RUDOLFA FIZIRA 2, VELIKA GORICA 10410, Croatia, VAT number: HR33052761319,
10. **UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY (IAA/COOPANS)**, established in D'OLIER STREET 11-12 THE TIMES BUILDING, DUBLIN D02 T449, Ireland, VAT number: IE8211082B,
11. **LUFTFARTSVERKET (LFV/COOPANS)**, established in HOSPITALSGATAN 30, NORRKOPING 602 27, Sweden, VAT number: SE202100079501,
12. **NAVIAIR (Naviair/COOPANS)**, established in NAVIAIR ALLE 1, KASTRUP 2770, Denmark, VAT number: DK26059763,
13. **DIRECTION DES SERVICES DE LA NAVIGATION AERIENNE (DSNA)**, established in 50 RUE HENRY FARMAN, PARIS 75720, France, VAT number: FR29120064019,
14. **ENAIRE (ENAIRE)**, established in AVENIDA DE ARAGON S/N BLOQUE 330, PORTAL 2 PARQUE EMPRESARIAL LAS MERCEDES, MADRID 28022, Spain, VAT number: ESQ2822001J,
15. **ENAV SPA (ENAV)**, established in VIA SALARIA 716, ROMA 00138, Italy, VAT number: IT02152021008,
16. **EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION (EUROCONTROL)**, established in Rue de la Fusée 96, BRUXELLES 1130, Belgium, VAT number: not applicable, as 'beneficiary not receiving JU funding' (see Article 9),
17. **FREQUENTIS AG (FRQ (FSP))**, established in Innovationsstrasse 1, WIEN 1100, Austria, VAT number: ATU14715600,
18. **HUNGAROCONTROL MAGYAR LEGIFORGALMISZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG (HC (FSP))**, established in IGLO UTCA 33 35, BUDAPEST 1185, Hungary, VAT number: HU13851325,
19. **INDRA SISTEMAS SA (INDRA)**, established in AVENIDA DE BRUSELAS 35, ALCOBENDAS MADRID 28108, Spain, VAT number: ESA28599033,
20. **LEONARDO - SOCIETA PER AZIONI (LDO)**, established in PIAZZA MONTE GRAPPA 4, ROMA 00195, Italy, VAT number: IT00881841001,
21. **SINTEF AS (SINTEF (NATMIG))**, established in STRINDVEGEN 4, TRONDHEIM 7034, Norway, VAT number: NO919303808MVA,
22. **NATS (EN ROUTE) PUBLIC LIMITED COMPANY (NATS)**, established in 4000 PARKWAY WHITELEY, FAREHAM PO15 7FL, United Kingdom, VAT number: GB440379456,

23. **SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIENNE CIVILS ET MILITAIRES (SKYGUIDE)**, established in ROUTE DE PRE BOIS 15-17, GENEVA 1215, Switzerland, VAT number: CH514204,

24. **THALES LAS FRANCE SAS (THALES AIR SYS)**, established in AVENUE GAY LUSSAC 2, ELANCOURT 78990, France, VAT number: FR15319159877,

25. **AIRBUS (AIRBUS SAS)**, established in 2 ROND POINT EMILE DEWOITINE, BLAGNAC 31700, France, VAT number: FR89383474814, as ‘beneficiary not receiving JU funding’ (see Article 9),

26. **ATOS BELGIUM (ATOS (FSP))**, established in DA VINCILAAN 5, ZAVENTEM 1930, Belgium, VAT number: BE0401848135, as ‘beneficiary not receiving JU funding’ (see Article 9),

27. **AIRTEL ATN LIMITED (AIRTEL (NATMIG))**, established in 2 HARBOUR SQUARE CROFTON ROAD, DUN LOAGHAIRE DUBLIN A96D6R0, Ireland, VAT number: IE8287698U, as ‘beneficiary not receiving JU funding’ (see Article 9),

28. **SAAB AKTIEBOLAG (SAAB (NATMIG))**, established in ., LINKOPING 581 88, Sweden, VAT number: SE556036079301, as ‘beneficiary not receiving JU funding’ (see Article 9),

Unless otherwise specified, references to ‘beneficiary’ or ‘beneficiaries’ include the coordinator.

The parties referred to above have agreed to enter into the Agreement under the terms and conditions below.

By signing the Agreement or the Accession Form, the beneficiaries accept the grant and agree to implement it under their own responsibility and in accordance with the Agreement, with all the obligations and conditions it sets out.

The Agreement is composed of:

#### Terms and Conditions

- |         |   |
|---------|---|
| Annex 1 | Description of the action   |
| Annex 2 | Estimated budget for the action                                       |
|         | 2a Additional information on the estimated budget                     |
| Annex 3 | Accession Forms   |
|         | 3a Declaration on joint and several liability of linked third parties |
| Annex 4 | Model for the financial statements                                    |
| Annex 5 | Model for the certificate on the financial statements                 |
| Annex 6 | Model for the certificate on the methodology                          |

# TERMS AND CONDITIONS

## TABLE OF CONTENTS

<b>CHAPTER 1 GENERAL.....</b>	<b>12</b>
ARTICLE 1 — SUBJECT OF THE AGREEMENT.....	12
<b>CHAPTER 2 ACTION.....</b>	<b>12</b>
ARTICLE 2 — ACTION TO BE IMPLEMENTED — COMPLEMENTARY GRANT.....	12
ARTICLE 3 — DURATION AND STARTING DATE OF THE ACTION.....	12
ARTICLE 4 — ESTIMATED BUDGET AND BUDGET TRANSFERS.....	12
4.1 Estimated budget.....	12
4.2 Budget transfers.....	12
<b>CHAPTER 3 GRANT.....</b>	<b>12</b>
ARTICLE 5 — GRANT AMOUNT, FORM OF GRANT, REIMBURSEMENT RATES AND FORMS OF COSTS.....	12
5.1 Maximum grant amount.....	12
5.2 Form of grant, reimbursement rates and forms of costs.....	13
5.3 Final grant amount — Calculation.....	13
5.4 Revised final grant amount — Calculation.....	15
ARTICLE 6 — ELIGIBLE AND INELIGIBLE COSTS.....	15
6.1 General conditions for costs to be eligible.....	15
6.2 Specific conditions for costs to be eligible.....	16
6.3 Conditions for costs of linked third parties to be eligible.....	22
6.4 Conditions for in-kind contributions provided by third parties free of charge to be eligible.....	22
6.5 Ineligible costs.....	22
6.6 Consequences of declaration of ineligible costs.....	23
<b>CHAPTER 4 RIGHTS AND OBLIGATIONS OF THE PARTIES.....</b>	<b>23</b>
<b>SECTION 1 RIGHTS AND OBLIGATIONS RELATED TO IMPLEMENTING THE ACTION.....</b>	<b>23</b>
ARTICLE 7 — GENERAL OBLIGATION TO PROPERLY IMPLEMENT THE ACTION.....	23
7.1 General obligation to properly implement the action.....	23
7.2 Consequences of non-compliance.....	23
ARTICLE 8 — RESOURCES TO IMPLEMENT THE ACTION — THIRD PARTIES INVOLVED IN THE ACTION.....	24
ARTICLE 9 — IMPLEMENTATION OF ACTION TASKS BY BENEFICIARIES NOT RECEIVING JU FUNDING.....	24
9.1 Rules for the implementation of action tasks by beneficiaries not receiving JU funding.....	24

9.2	Consequences of non-compliance.....	24
ARTICLE 10 — PURCHASE OF GOODS, WORKS OR SERVICES.....		25
10.1	Rules for purchasing goods, works or services.....	25
10.2	Consequences of non-compliance.....	25
ARTICLE 11 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES AGAINST PAYMENT.....		25
11.1	Rules for the use of in-kind contributions against payment.....	25
11.2	Consequences of non-compliance.....	26
ARTICLE 12 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES FREE OF CHARGE.....		26
12.1	Rules for the use of in-kind contributions free of charge.....	26
12.2	Consequences of non-compliance.....	26
ARTICLE 13 — IMPLEMENTATION OF ACTION TASKS BY SUBCONTRACTORS.....		27
13.1	Rules for subcontracting action tasks.....	27
13.2	Consequences of non-compliance.....	27
ARTICLE 14 — IMPLEMENTATION OF ACTION TASKS BY LINKED THIRD PARTIES.....		27
14.1	Rules for calling upon linked third parties to implement part of the action.....	27
14.2	Consequences of non-compliance.....	29
ARTICLE 14a — IMPLEMENTATION OF ACTION TASKS BY INTERNATIONAL PARTNERS.....		29
ARTICLE 15 — FINANCIAL SUPPORT TO THIRD PARTIES.....		29
15.1	Rules for providing financial support to third parties.....	29
15.2	Financial support in the form of prizes.....	29
15.3	Consequences of non-compliance.....	29
ARTICLE 16 — PROVISION OF TRANS-NATIONAL OR VIRTUAL ACCESS TO RESEARCH INFRASTRUCTURE.....		29
16.1	Rules for providing trans-national access to research infrastructure.....	29
16.2	Rules for providing virtual access to research infrastructure.....	29
16.3	Consequences of non-compliance.....	29
<b>SECTION 2 RIGHTS AND OBLIGATIONS RELATED TO THE GRANT ADMINISTRATION.....</b>		<b>30</b>
ARTICLE 17 — GENERAL OBLIGATION TO INFORM.....		30
17.1	General obligation to provide information upon request.....	30
17.2	Obligation to keep information up to date and to inform about events and circumstances likely to affect the Agreement.....	30
17.3	Consequences of non-compliance.....	30
ARTICLE 18 — KEEPING RECORDS — SUPPORTING DOCUMENTATION.....		30
18.1	Obligation to keep records and other supporting documentation.....	30

18.2	Consequences of non-compliance.....	32
ARTICLE 19 — SUBMISSION OF DELIVERABLES.....		32
19.1	Obligation to submit deliverables.....	32
19.2	Consequences of non-compliance.....	32
ARTICLE 20 — REPORTING — PAYMENT REQUESTS.....		32
20.1	Obligation to submit reports.....	32
20.2	Reporting periods.....	32
20.3	Periodic reports — Requests for interim payments.....	32
20.4	Final report — Request for payment of the balance.....	34
20.5	Information on cumulative expenditure incurred.....	34
20.6	Currency for financial statements and conversion into euro.....	34
20.7	Language of reports.....	35
20.8	Consequences of non-compliance.....	35
ARTICLE 21 — PAYMENTS AND PAYMENT ARRANGEMENTS.....		35
21.1	Payments to be made.....	35
21.2	Pre-financing payment — Amount — Amount retained for the Guarantee Fund.....	35
21.3	Interim payments — Amount — Calculation.....	36
21.4	Payment of the balance — Amount — Calculation — Release of the amount retained for the Guarantee Fund.....	36
21.5	Notification of amounts due.....	37
21.6	Currency for payments.....	37
21.7	Payments to the coordinator — Distribution to the beneficiaries.....	37
21.8	Bank account for payments.....	38
21.9	Costs of payment transfers.....	38
21.10	Date of payment.....	38
21.11	Consequences of non-compliance.....	38
ARTICLE 22 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS.....		39
22.1	Checks, reviews and audits by the JU and the Commission.....	39
22.2	Investigations by the European Anti-Fraud Office (OLAF).....	40
22.3	Checks and audits by the European Court of Auditors (ECA).....	41
22.4	Checks, reviews, audits and investigations for international organisations.....	41
22.5	Consequences of findings in checks, reviews, audits and investigations — Extension of findings.....	41
22.6	Consequences of non-compliance.....	43
ARTICLE 23 — EVALUATION OF THE IMPACT OF THE ACTION.....		43

23.1	Right to evaluate the impact of the action.....	43
23.2	Consequences of non-compliance.....	43
<b>SECTION 3 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND AND RESULTS.....</b>		<b>44</b>
<b>SUBSECTION 1 GENERAL.....</b>		<b>44</b>
ARTICLE 23a — MANAGEMENT OF INTELLECTUAL PROPERTY.....		44
23a.1	Obligation to take measures to implement the Commission Recommendation on the management of intellectual property in knowledge transfer activities.....	44
23a.2	Consequences of non-compliance.....	44
<b>SUBSECTION 2 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND.....</b>		<b>44</b>
ARTICLE 24 — AGREEMENT ON BACKGROUND.....		44
24.1	Agreement on background.....	44
24.2	Consequences of non-compliance.....	44
ARTICLE 25 — ACCESS RIGHTS TO BACKGROUND.....		45
25.1	Exercise of access rights — Waiving of access rights — No sub-licensing.....	45
25.2	Access rights for other beneficiaries, for implementing their own tasks under the action.....	45
25.3	Access rights for other beneficiaries, for exploiting their own results.....	45
25.4	Access rights for affiliated entities.....	45
25.5	Access rights for third parties.....	46
25.6	Consequences of non-compliance.....	46
<b>SUBSECTION 3 RIGHTS AND OBLIGATIONS RELATED TO RESULTS.....</b>		<b>46</b>
ARTICLE 26 — OWNERSHIP OF RESULTS.....		46
26.1	Ownership by the beneficiary that generates the results.....	46
26.2	Joint ownership by several beneficiaries.....	46
26.3	Rights of third parties (including personnel).....	47
26.4	JU ownership, to protect results.....	47
26.5	Consequences of non-compliance.....	48
ARTICLE 27 — PROTECTION OF RESULTS — VISIBILITY OF JU FUNDING AND SUPPORT FROM JU MEMBERS.....		48
27.1	Obligation to protect the results.....	48
27.2	JU ownership, to protect the results.....	48
27.3	Information on JU funding and support from JU members.....	48
27.4	Consequences of non-compliance.....	49
ARTICLE 28 — EXPLOITATION OF RESULTS.....		49
28.1	Obligation to exploit the results.....	49
28.2	Results that could contribute to European or international standards — Information on JU funding and support from JU members .....	49

28.3	Consequences of non-compliance.....	49
ARTICLE 29 — DISSEMINATION OF RESULTS — OPEN ACCESS — VISIBILITY OF JU FUNDING AND SUPPORT FROM JU MEMBERS.....		
29.1	Obligation to disseminate results.....	50
29.2	Open access to scientific publications.....	50
29.3	Open access to research data.....	51
29.4	Information on JU funding and support from JU members — Obligation and right to use the JU logo and the EU emblem .....	51
29.5	Disclaimer excluding JU responsibility.....	51
29.6	Consequences of non-compliance.....	51
ARTICLE 30 — TRANSFER AND LICENSING OF RESULTS.....		
30.1	Transfer of ownership.....	51
30.2	Granting licenses.....	52
30.3	JU right to object to transfers or exclusive licensing.....	52
30.4	Consequences of non-compliance.....	52
ARTICLE 31 — ACCESS RIGHTS TO RESULTS.....		
31.1	Exercise of access rights — Waiving of access rights — No sub-licensing.....	52
31.2	Access rights for other beneficiaries, for implementing their own tasks under the action.....	52
31.3	Access rights for other beneficiaries, for exploiting their own results.....	53
31.4	Access rights of affiliated entities.....	53
31.5	Access rights for the JU, the EU institutions, other EU bodies, offices or agencies and EU Member States.....	53
31.6	Access rights for third parties.....	53
31.7	Consequences of non-compliance.....	53
<b>SECTION 4 OTHER RIGHTS AND OBLIGATIONS.....</b>		
ARTICLE 32 — RECRUITMENT AND WORKING CONDITIONS FOR RESEARCHERS.....		
32.1	Obligation to take measures to implement the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers.....	54
32.2	Consequences of non-compliance.....	54
ARTICLE 33 — GENDER EQUALITY.....		
33.1	Obligation to aim for gender equality.....	54
33.2	Consequences of non-compliance.....	54
ARTICLE 34 — ETHICS AND RESEARCH INTEGRITY.....		
34.1	Obligation to comply with ethical and research integrity principles.....	54
34.2	Activities raising ethical issues.....	55
34.3	Activities involving human embryos or human embryonic stem cells.....	56

34.4	Consequences of non-compliance.....	56
ARTICLE 35 — CONFLICT OF INTERESTS.....		56
35.1	Obligation to avoid a conflict of interests.....	56
35.2	Consequences of non-compliance.....	56
ARTICLE 36 — CONFIDENTIALITY.....		56
36.1	General obligation to maintain confidentiality.....	56
36.2	Consequences of non-compliance.....	57
ARTICLE 37 — SECURITY-RELATED OBLIGATIONS.....		57
37.1	Results with a security recommendation.....	58
37.2	Classified information.....	58
37.3	Activities involving dual-use goods or dangerous materials and substances.....	58
37.4	Consequences of non-compliance.....	58
ARTICLE 38 — PROMOTING THE ACTION — VISIBILITY OF JU FUNDING AND SUPPORT FROM JU MEMBERS.....		58
38.1	Communication activities by beneficiaries.....	58
38.2	Communication activities by the JU.....	59
38.3	Consequences of non-compliance.....	60
ARTICLE 39 — PROCESSING OF PERSONAL DATA.....		60
39.1	Processing of personal data by the JU and the Commission.....	60
39.2	Processing of personal data by the beneficiaries.....	61
39.3	Consequences of non-compliance.....	61
ARTICLE 40 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE JU.....		61
<b>CHAPTER 5 DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES — RELATIONSHIP WITH COMPLEMENTARY BENEFICIARIES — RELATIONSHIP WITH PARTNERS OF A JOINT ACTION.....</b>		<b>61</b>
ARTICLE 41 — DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES — RELATIONSHIP WITH COMPLEMENTARY BENEFICIARIES — RELATIONSHIP WITH PARTNERS OF A JOINT ACTION.....		61
41.1	Roles and responsibility towards the JU.....	61
41.2	Internal division of roles and responsibilities.....	61
41.3	Internal arrangements between beneficiaries — Consortium agreement.....	62
41.4	Relationship with complementary beneficiaries — Collaboration agreement.....	62
41.5	Relationship with partners of a joint action — Coordination agreement.....	63
<b>CHAPTER 6 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — SANCTIONS — DAMAGES — SUSPENSION — TERMINATION — FORCE MAJEURE.....</b>		<b>63</b>
<b>SECTION 1 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — SANCTIONS.....</b>		<b>63</b>
ARTICLE 42 — REJECTION OF INELIGIBLE COSTS.....		63

42.1	Conditions.....	63
42.2	Ineligible costs to be rejected — Calculation — Procedure.....	63
42.3	Effects.....	64
ARTICLE 43 — REDUCTION OF THE GRANT.....		64
43.1	Conditions.....	64
43.2	Amount to be reduced — Calculation — Procedure.....	64
43.3	Effects.....	65
ARTICLE 44 — RECOVERY OF UNDUE AMOUNTS.....		65
44.1	Amount to be recovered — Calculation — Procedure.....	65
ARTICLE 45 — ADMINISTRATIVE SANCTIONS.....		69
<b>SECTION 2 LIABILITY FOR DAMAGES.....</b>		<b>69</b>
ARTICLE 46 — LIABILITY FOR DAMAGES.....		69
46.1	Liability of the JU.....	69
46.2	Liability of the beneficiaries.....	69
<b>SECTION 3 SUSPENSION AND TERMINATION.....</b>		<b>69</b>
ARTICLE 47 — SUSPENSION OF PAYMENT DEADLINE.....		69
47.1	Conditions.....	69
47.2	Procedure.....	70
ARTICLE 48 — SUSPENSION OF PAYMENTS.....		70
48.1	Conditions.....	70
48.2	Procedure.....	71
ARTICLE 49 — SUSPENSION OF THE ACTION IMPLEMENTATION.....		71
49.1	Suspension of the action implementation, by the beneficiaries.....	71
49.2	Suspension of the action implementation, by the JU.....	72
ARTICLE 50 — TERMINATION OF THE AGREEMENT OR OF THE PARTICIPATION OF ONE OR MORE BENEFICIARIES.....		73
50.1	Termination of the Agreement, by the beneficiaries.....	73
50.2	Termination of the participation of one or more beneficiaries, by the beneficiaries.....	73
50.3	Termination of the Agreement or the participation of one or more beneficiaries, by the JU.....	76
<b>SECTION 4 FORCE MAJEURE.....</b>		<b>80</b>
ARTICLE 51 — FORCE MAJEURE.....		80
<b>CHAPTER 7 FINAL PROVISIONS.....</b>		<b>81</b>
ARTICLE 52 — COMMUNICATION BETWEEN THE PARTIES.....		81
52.1	Form and means of communication.....	81
52.2	Date of communication.....	81

52.3	Addresses for communication.....	82
ARTICLE 53 — INTERPRETATION OF THE AGREEMENT.....		82
53.1	Precedence of the Terms and Conditions over the Annexes.....	82
53.2	Privileges and immunities.....	82
ARTICLE 54 — CALCULATION OF PERIODS, DATES AND DEADLINES.....		82
ARTICLE 55 — AMENDMENTS TO THE AGREEMENT.....		82
55.1	Conditions.....	82
55.2	Procedure.....	83
ARTICLE 56 — ACCESSION TO THE AGREEMENT.....		83
56.1	Accession of the beneficiaries mentioned in the Preamble.....	83
56.2	Addition of new beneficiaries.....	83
ARTICLE 57 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES.....		84
57.1	Applicable law.....	84
57.2	Dispute settlement.....	84
ARTICLE 58 — ENTRY INTO FORCE OF THE AGREEMENT.....		85

## **CHAPTER 1 GENERAL**

### **ARTICLE 1 — SUBJECT OF THE AGREEMENT**

This Agreement sets out the rights and obligations and the terms and conditions applicable to the grant awarded to the beneficiaries for implementing the action set out in Chapter 2.

## **CHAPTER 2 ACTION**

### **ARTICLE 2 — ACTION TO BE IMPLEMENTED — COMPLEMENTARY GRANT**

The grant is awarded for the action entitled ‘**Separation Management and Controller Tools**’ — ‘**PJ10-W2 PROSA**’ (**‘action’**), as described in Annex 1.

The grant is a ‘**complementary grant**’ to the grant agreement(s) under the call(s) for proposals H2020-SESAR-2019-1.

### **ARTICLE 3 — DURATION AND STARTING DATE OF THE ACTION**

The duration of the action will be **37 months** as of 1 December 2019 (**‘starting date of the action’**).

### **ARTICLE 4 — ESTIMATED BUDGET AND BUDGET TRANSFERS**

#### **4.1 Estimated budget**

The ‘**estimated budget**’ for the action is set out in Annex 2.

It contains the estimated eligible costs and the forms of costs, broken down by beneficiary (and linked third party) and budget category (see Articles 5, 6, and 14). It also shows the estimated costs of the beneficiaries not receiving JU funding (see Article 9).

#### **4.2 Budget transfers**

The estimated budget breakdown indicated in Annex 2 may be adjusted — without an amendment (see Article 55) — by transfers of amounts between beneficiaries, budget categories and/or forms of costs set out in Annex 2, if the action is implemented as described in Annex 1.

However, the beneficiaries may not add costs relating to subcontracts not provided for in Annex 1, unless such additional subcontracts are approved by an amendment or in accordance with Article 13.

## **CHAPTER 3 GRANT**

### **ARTICLE 5 — GRANT AMOUNT, FORM OF GRANT, REIMBURSEMENT RATES AND FORMS OF COSTS**

#### **5.1 Maximum grant amount**

The '**maximum grant amount**' is **EUR 12 943 562.65** (twelve million nine hundred and forty three thousand five hundred and sixty two EURO and sixty five eurocents).

## 5.2 Form of grant, reimbursement rates and forms of costs

The grant reimburses **70% of the action's eligible costs** (see Article 6) ('**reimbursement of eligible costs grant**') (see Annex 2).

The estimated eligible costs of the action are **EUR 28 653 908.79** (twenty eight million six hundred and fifty three thousand nine hundred and eight EURO and seventy nine eurocents).

Eligible costs (see Article 6) must be declared under the following forms ('**forms of costs**'):

(a) for **direct personnel costs**:

- as actually incurred costs ('**actual costs**') or
- on the basis of an amount per unit calculated by the beneficiary in accordance with its usual cost accounting practices ('**unit costs**').

Personnel **costs for SME owners or beneficiaries that are natural persons** not receiving a salary (see Article 6.2, Points A.4 and A.5) must be declared on the basis of the amount per unit set out in Annex 2a (**unit costs**);

(b) for **direct costs for subcontracting**: as actually incurred costs (**actual costs**);

(c) for **direct costs of providing financial support to third parties**: not applicable;

(d) for **other direct costs**:

- for costs of internally invoiced goods and services: on the basis of an amount per unit calculated by the beneficiary in accordance with its usual cost accounting practices ('**unit costs**');
- for all other costs: as actually incurred costs (**actual costs**);

(e) for **indirect costs**: on the basis of a flat-rate applied as set out in Article 6.2, Point E ('**flat-rate costs**');

(f) **specific cost category(ies)**: not applicable.

## 5.3 Final grant amount — Calculation

The '**final grant amount**' depends on the actual extent to which the action is implemented in accordance with the Agreement's terms and conditions.

This amount is calculated by the JU — when the payment of the balance is made (see Article 21.4) — in the following steps:

Step 1 — Application of the reimbursement rates to the eligible costs

Step 2 — Limit to the maximum grant amount

Step 3 — Reduction due to the no-profit rule

Step 4 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations

### 5.3.1 Step 1 — Application of the reimbursement rates to the eligible costs

The reimbursement rate(s) (see Article 5.2) are applied to the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) declared by the beneficiaries and linked third parties (see Article 20) and approved by the JU (see Article 21).

### 5.3.2 Step 2 — Limit to the maximum grant amount

If the amount obtained following Step 1 is higher than the maximum grant amount set out in Article 5.1, it will be limited to the latter.

### 5.3.3 Step 3 — Reduction due to the no-profit rule

The grant must not produce a profit.

‘**Profit**’ means the surplus of the amount obtained following Steps 1 and 2 plus the action’s total receipts, over the action’s total eligible costs.

The ‘**action’s total eligible costs**’ are the consolidated total eligible costs approved by the JU.

The ‘**action’s total receipts**’ are the consolidated total receipts generated during its duration (see Article 3).

The following are considered **receipts**:

- (a) income generated by the action; if the income is generated from selling equipment or other assets purchased under the Agreement, the receipt is up to the amount declared as eligible under the Agreement;
- (b) financial contributions given by third parties to the beneficiary or to a linked third party specifically to be used for the action, and
- (c) in-kind contributions provided by third parties free of charge and specifically to be used for the action, if they have been declared as eligible costs.

The following are however not considered receipts:

- (a) income generated by exploiting the action’s results (see Article 28);
- (b) financial contributions by third parties, if they may be used to cover costs other than the eligible costs (see Article 6);
- (c) financial contributions by third parties with no obligation to repay any amount unused at the end of the period set out in Article 3.

If there is a profit, it will be deducted from the amount obtained following Steps 1 and 2.

### 5.3.4 Step 4 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations — Reduced grant amount — Calculation

If the grant is reduced (see Article 43), the JU will calculate the reduced grant amount by deducting the amount of the reduction (calculated in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations, in accordance with Article 43.2) from the maximum grant amount set out in Article 5.1.

The final grant amount will be the lower of the following two:

- the amount obtained following Steps 1 to 3 or
- the reduced grant amount following Step 4.

### 5.4 Revised final grant amount — Calculation

If — after the payment of the balance (in particular, after checks, reviews, audits or investigations; see Article 22) — the JU rejects costs (see Article 42) or reduces the grant (see Article 43), it will calculate the ‘**revised final grant amount**’ for the beneficiary concerned by the findings.

This amount is calculated by the JU on the basis of the findings, as follows:

- in case of **rejection of costs**: by applying the reimbursement rate to the revised eligible costs approved by the JU for the beneficiary concerned;
- in case of **reduction of the grant**: by calculating the concerned beneficiary’s share in the grant amount reduced in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations (see Article 43.2).

In case of **rejection of costs and reduction of the grant**, the revised final grant amount for the beneficiary concerned will be the lower of the two amounts above.

## ARTICLE 6 — ELIGIBLE AND INELIGIBLE COSTS

### 6.1 General conditions for costs to be eligible

‘**Eligible costs**’ are costs that meet the following criteria:

(a) for **actual costs**:

- (i) they must be actually incurred by the beneficiary;
- (ii) they must be incurred in the period set out in Article 3, with the exception of costs relating to the submission of the periodic report for the last reporting period and the final report (see Article 20);
- (iii) they must be indicated in the estimated budget set out in Annex 2;
- (iv) they must be incurred in connection with the action as described in Annex 1 and necessary for its implementation;
- (v) they must be identifiable and verifiable, in particular recorded in the beneficiary’s accounts

in accordance with the accounting standards applicable in the country where the beneficiary is established and with the beneficiary's usual cost accounting practices;

- (vi) they must comply with the applicable national law on taxes, labour and social security, and
- (vii) they must be reasonable, justified and must comply with the principle of sound financial management, in particular regarding economy and efficiency;

(b) for **unit costs**:

- (i) they must be calculated as follows:

{amounts per unit set out in Annex 2a or calculated by the beneficiary in accordance with its usual cost accounting practices (see Article 6.2, Point A and Article 6.2.D.5)

multiplied by

the number of actual units};

- (ii) the number of actual units must comply with the following conditions:

- the units must be actually used or produced in the period set out in Article 3;
- the units must be necessary for implementing the action or produced by it, and
- the number of units must be identifiable and verifiable, in particular supported by records and documentation (see Article 18);

(c) for **flat-rate costs**:

- (i) they must be calculated by applying the flat-rate set out in Annex 2, and
- (ii) the costs (actual costs or unit costs) to which the flat-rate is applied must comply with the conditions for eligibility set out in this Article.

## 6.2 Specific conditions for costs to be eligible

Costs are eligible if they comply with the general conditions (see above) and the specific conditions set out below for each of the following budget categories:

- A. direct personnel costs;
- B. direct costs of subcontracting;
- C. not applicable;
- D. other direct costs;
- E. indirect costs;
- F. not applicable.

'Direct costs' are costs that are directly linked to the action implementation and can therefore be attributed to it directly. They must not include any indirect costs (see Point E below).

'Indirect costs' are costs that are not directly linked to the action implementation and therefore cannot be attributed directly to it.

### A. Direct personnel costs

## Types of eligible personnel costs

A.1 Personnel costs are eligible, if they are related to personnel working for the beneficiary under an employment contract (or equivalent appointing act) and assigned to the action (**‘costs for employees (or equivalent)’**). They must be limited to salaries (including during parental leave), social security contributions, taxes and other costs included in the **remuneration**, if they arise from national law or the employment contract (or equivalent appointing act).

Beneficiaries that are non-profit legal entities<sup>2</sup> may also declare as personnel costs **additional remuneration** for personnel assigned to the action (including payments on the basis of supplementary contracts regardless of their nature), if:

- (a) it is part of the beneficiary’s usual remuneration practices and is paid in a consistent manner whenever the same kind of work or expertise is required;
- (b) the criteria used to calculate the supplementary payments are objective and generally applied by the beneficiary, regardless of the source of funding used.

‘Additional remuneration’ means any part of the remuneration which exceeds what the person would be paid for time worked in projects funded by national schemes.

Additional remuneration for personnel assigned to the action is eligible up to the following amount:

- (a) if the person works full time and exclusively on the action during the full year: up to EUR 8 000;
- (b) if the person works exclusively on the action but not full-time or not for the full year: up to the corresponding pro-rata amount of EUR 8 000, or
- (c) if the person does not work exclusively on the action: up to a pro-rata amount calculated as follows:

$$\left\{ \begin{array}{l} \text{EUR 8 000} \\ \text{divided by} \\ \text{the number of annual productive hours (see below)}, \\ \text{multiplied by} \\ \text{the number of hours that the person has worked on the action during the year} \end{array} \right\}.$$

A.2 The **costs for natural persons working under a direct contract** with the beneficiary other than an employment contract are eligible personnel costs, if:

- (a) the person works under conditions similar to those of an employee (in particular regarding the way the work is organised, the tasks that are performed and the premises where they are performed);
- (b) the result of the work carried out belongs to the beneficiary (unless exceptionally agreed otherwise), and

<sup>2</sup> For the definition, see Article 2.1(14) of the Rules for Participation Regulation No 1290/2013: ‘**non-profit legal entity**’ means a legal entity which by its legal form is non-profit-making or which has a legal or statutory obligation not to distribute profits to its shareholders or individual members.

- (c) the costs are not significantly different from those for personnel performing similar tasks under an employment contract with the beneficiary.

A.3 The **costs of personnel seconded by a third party against payment** are eligible personnel costs, if the conditions in Article 11.1 are met.

A.4 **Costs of owners** of beneficiaries that are small and medium-sized enterprises ('**SME owners**') who are working on the action and who do not receive a salary are eligible personnel costs, if they correspond to the amount per unit set out in Annex 2a multiplied by the number of actual hours worked on the action.

A.5 **Costs of 'beneficiaries that are natural persons'** not receiving a salary are eligible personnel costs, if they correspond to the amount per unit set out in Annex 2a multiplied by the number of actual hours worked on the action.

### Calculation

Personnel costs must be calculated by the beneficiaries as follows:

{ {hourly rate  
multiplied by  
the number of actual hours worked on the action},  
plus  
for non-profit legal entities: additional remuneration to personnel assigned to the action under the  
conditions set out above (Point A.1)}.

The number of actual hours declared for a person must be identifiable and verifiable (see Article 18).

The total number of hours declared in JU, EU or Euratom grants, for a person for a year, cannot be higher than the annual productive hours used for the calculations of the hourly rate. Therefore, the maximum number of hours that can be declared for the grant are:

{number of annual productive hours for the year (see below)  
minus  
total number of hours declared by the beneficiary, for that person in that year, for other JU, EU or  
Euratom grants}.

The '**hourly rate**' is one of the following:

- (a) for personnel costs declared as **actual costs** (i.e. budget categories A.1, A.2, A.3): the hourly rate is calculated *per full financial year*, as follows:

{actual annual personnel costs (excluding additional remuneration) for the person  
divided by  
number of annual productive hours}.

using the personnel costs and the number of productive hours for each full financial year covered by the reporting period concerned. If a financial year is not closed at the end of the



reporting period, the beneficiaries must use the hourly rate of the last closed financial year available.

For the ‘number of annual productive hours’, the beneficiaries may choose one of the following:

- (i) ‘fixed number of hours’: 1 720 hours for persons working full time (or corresponding pro-rata for persons not working full time);
- (ii) ‘individual annual productive hours’: the total number of hours worked by the person in the year for the beneficiary, calculated as follows:

{annual workable hours of the person (according to the employment contract, applicable collective labour agreement or national law)

plus

overtime worked

minus

absences (such as sick leave and special leave)}.

‘Annual workable hours’ means the period during which the personnel must be working, at the employer’s disposal and carrying out his/her activity or duties under the employment contract, applicable collective labour agreement or national working time legislation.

If the contract (or applicable collective labour agreement or national working time legislation) does not allow to determine the annual workable hours, this option cannot be used;

- (iii) ‘standard annual productive hours’: the ‘standard number of annual hours’ generally applied by the beneficiary for its personnel in accordance with its usual cost accounting practices. This number must be at least 90% of the ‘standard annual workable hours’.

If there is no applicable reference for the standard annual workable hours, this option cannot be used.

For all options, the actual time spent on **parental leave** by a person assigned to the action may be deducted from the number of annual productive hours.

As an alternative, beneficiaries may calculate the hourly rate *per month*, as follows:

{actual monthly personnel cost (excluding additional remuneration) for the person

divided by

{number of annual productive hours / 12}}}

using the personnel costs for each month and (one twelfth of) the annual productive hours calculated according to either option (i) or (iii) above, i.e.:

- fixed number of hours or
- standard annual productive hours.

Time spent on **parental leave** may not be deducted when calculating the hourly rate per month. However, beneficiaries may declare personnel costs incurred in periods of parental leave in proportion to the time the person worked on the action in that financial year.

If parts of a basic remuneration are generated over a period longer than a month, the beneficiaries may include only the share which is generated in the month (irrespective of the amount actually paid for that month).

Each beneficiary must use only one option (per full financial year or per month) for each full financial year;

(b) for personnel costs declared on the basis of **unit costs** (i.e. budget categories A.1, A.2, A.4, A.5): the hourly rate is one of the following:

- (i) for SME owners or beneficiaries that are natural persons: the hourly rate set out in Annex 2a (see Points A.4 and A.5 above), or
- (ii) for personnel costs declared on the basis of the beneficiary's usual cost accounting practices: the hourly rate calculated by the beneficiary in accordance with its usual cost accounting practices, if:
  - the cost accounting practices used are applied in a consistent manner, based on objective criteria, regardless of the source of funding;
  - the hourly rate is calculated using the actual personnel costs recorded in the beneficiary's accounts, excluding any ineligible cost or costs included in other budget categories.

The actual personnel costs may be adjusted by the beneficiary on the basis of budgeted or estimated elements. Those elements must be relevant for calculating the personnel costs, reasonable and correspond to objective and verifiable information;

and

- the hourly rate is calculated using the number of annual productive hours (see above).

**B. Direct costs of subcontracting** (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible if the conditions in Article 13.1.1 are met.

**C. Direct costs of providing financial support to third parties**

Not applicable

**D. Other direct costs**

**D.1 Travel costs and related subsistence allowances** (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible if they are in line with the beneficiary's usual practices on travel.

**D.2 The depreciation costs of equipment, infrastructure or other assets** (new or second-hand) as recorded in the beneficiary's accounts are eligible, if they were purchased in accordance with

Article 10.1.1 and written off in accordance with international accounting standards and the beneficiary's usual accounting practices.

The **costs of renting or leasing** equipment, infrastructure or other assets (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are also eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets and do not include any financing fees.

The costs of equipment, infrastructure or other assets **contributed in-kind against payment** are eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets, do not include any financing fees and if the conditions in Article 11.1 are met.

The only portion of the costs that will be taken into account is that which corresponds to the duration of the action and rate of actual use for the purposes of the action.

**D.3 Costs of other goods and services** (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible, if they are:

- (a) purchased specifically for the action and in accordance with Article 10.1.1 or
- (b) contributed in kind against payment and in accordance with Article 11.1.

Such goods and services include, for instance, consumables and supplies, dissemination (including open access), protection of results, certificates on the financial statements (if they are required by the Agreement), certificates on the methodology, translations and publications.

**D.4 Capitalised and operating costs of 'large research infrastructure'**<sup>3</sup>: Not applicable

**D.5 Costs of internally invoiced goods and services** directly used for the action are eligible, if:

- (a) they are declared on the basis of a unit cost calculated in accordance with the beneficiary's usual cost accounting practices;
- (b) the cost accounting practices used are applied in a consistent manner, based on objective criteria, regardless of the source of funding;
- (c) the unit cost is calculated using the actual costs for the good or service recorded in the beneficiary's accounts, excluding any ineligible cost or costs included in other budget categories.

The actual costs may be adjusted by the beneficiary on the basis of budgeted or estimated elements. Those elements must be relevant for calculating the costs, reasonable and correspond to objective and verifiable information;

- (d) the unit cost excludes any costs of items which are not directly linked to the production of the invoiced goods or service.

'Internally invoiced goods and services' means goods or services which are provided by the

---

<sup>3</sup> **'Large research infrastructure'** means research infrastructure of a total value of at least EUR 20 million, for a beneficiary, calculated as the sum of historical asset values of each individual research infrastructure of that beneficiary, as they appear in its last closed balance sheet before the date of the signature of the Agreement or as determined on the basis of the rental and leasing costs of the research infrastructure.

beneficiary directly for the action and which the beneficiary values on the basis of its usual cost accounting practices.

## E. Indirect costs

**Indirect costs** are eligible if they are declared on the basis of the flat-rate of 25% of the eligible direct costs (see Article 5.2 and Points A to D above), from which are excluded:

- (a) costs of subcontracting and
- (b) costs of in-kind contributions provided by third parties which are not used on the beneficiary's premises;
- (c) not applicable;
- (d) not applicable.

Beneficiaries receiving an operating grant<sup>5</sup> financed by the EU or Euratom budget cannot declare indirect costs for the period covered by the operating grant, unless they can demonstrate that the operating grant does not cover any costs of the action.

## F. Specific cost category(ies)

Not applicable

## 6.3 Conditions for costs of linked third parties to be eligible

**Costs incurred by linked third parties** are eligible if they fulfil — *mutatis mutandis* — the general and specific conditions for eligibility set out in this Article (Article 6.1 and 6.2) and Article 14.1.1.

## 6.4 Conditions for in-kind contributions provided by third parties free of charge to be eligible

**In-kind contributions provided free of charge** are eligible direct costs (for the beneficiary or linked third party), if the costs incurred by the third party fulfil — *mutatis mutandis* — the general and specific conditions for eligibility set out in this Article (Article 6.1 and 6.2) and Article 12.1.

## 6.5 Ineligible costs

**'Ineligible costs'** are:

- (a) costs that do not comply with the conditions set out above (Article 6.1 to 6.4), in particular:
  - (i) costs related to return on capital;
  - (ii) debt and debt service charges;

---

<sup>5</sup> For the definition, see Article 121(1)(b) of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002 ('**Financial Regulation No 966/2012**') (OJ L 218, 26.10.2012, p.1): '**operating grant**' means direct financial contribution, by way of donation, from the budget in order to finance the functioning of a body which pursues an aim of general EU interest or has an objective forming part of and supporting an EU policy.

- (iii) provisions for future losses or debts;
  - (iv) interest owed;
  - (v) doubtful debts;
  - (vi) currency exchange losses;
  - (vii) bank costs charged by the beneficiary's bank for transfers from the JU;
  - (viii) excessive or reckless expenditure;
  - (ix) deductible VAT;
  - (x) costs incurred during suspension of the implementation of the action (see Article 49);
- (b) costs declared under another JU, EU or Euratom grant (including other grants awarded by the JU, grants awarded by a Member State and financed by the EU or Euratom budget and grants awarded by bodies other than the JU for the purpose of implementing the EU or Euratom budget); in particular, indirect costs if the beneficiary is already receiving an operating grant financed by the EU or Euratom budget in the same period, unless it can demonstrate that the operating grant does not cover any costs of the action.

## **6.6 Consequences of declaration of ineligible costs**

Declared costs that are ineligible will be rejected (see Article 42).

This may also lead to any of the other measures described in Chapter 6.

# **CHAPTER 4 RIGHTS AND OBLIGATIONS OF THE PARTIES**

## **SECTION 1 RIGHTS AND OBLIGATIONS RELATED TO IMPLEMENTING THE ACTION**

### **ARTICLE 7 — GENERAL OBLIGATION TO PROPERLY IMPLEMENT THE ACTION**

#### **7.1 General obligation to properly implement the action**

The beneficiaries must implement the action as described in Annex 1 and in compliance with the provisions of the Agreement and all legal obligations under applicable EU, international and national law.

#### **7.2 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

## **ARTICLE 8 — RESOURCES TO IMPLEMENT THE ACTION — THIRD PARTIES INVOLVED IN THE ACTION**

The beneficiaries must have the appropriate resources to implement the action.

If it is necessary to implement the action, the beneficiaries may:

- purchase goods, works and services (see Article 10);
- use in-kind contributions provided by third parties against payment (see Article 11);
- use in-kind contributions provided by third parties free of charge (see Article 12);
- call upon subcontractors to implement action tasks described in Annex 1 (see Article 13);
- call upon linked third parties to implement action tasks described in Annex 1 (see Article 14);
- call upon international partners to implement action tasks described in Annex 1 (see Article 14a).

In these cases, the beneficiaries retain sole responsibility towards the JU and the other beneficiaries for implementing the action.

## **ARTICLE 9 — IMPLEMENTATION OF ACTION TASKS BY BENEFICIARIES NOT RECEIVING JU FUNDING**

### **9.1 Rules for the implementation of action tasks by beneficiaries not receiving JU funding**

Beneficiaries that are not eligible for JU funding or request zero JU funding (**‘beneficiaries not receiving JU funding’**) must implement the action tasks attributed to them in Annex 1 in accordance with Article 7.1.

Their costs are estimated in Annex 2 but:

- will not be reimbursed and
- will not be taken into account for the calculation of the grant (see Articles 5.2, 5.3 and 5.4, and 21).

Chapter 3, Articles 10 to 15, 18.1.2, 20.3(b), 20.4(b), 20.6, 21, 23a, 26.4, 27.2, 28.1, 28.2, 30.3, 31.5, 40, 42, 43, 44, 47 and 48 do not apply to these beneficiaries.

They will not be subject to financial checks, reviews and audits under Article 22.

Beneficiaries not receiving JU funding may provide in-kind contributions to another beneficiary. In this case, they will be considered as a third party for the purpose of Articles 11 and 12.

If a beneficiary requesting zero funding receives funding later on (through an amendment; see Article 55), all obligations will apply retroactively.

### **9.2 Consequences of non-compliance**

If a beneficiary not receiving JU funding breaches any of its obligations under this Article, its participation in the Agreement may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6 that are applicable to it.

## **ARTICLE 10 — PURCHASE OF GOODS, WORKS OR SERVICES**

### **10.1 Rules for purchasing goods, works or services**

10.1.1 If necessary to implement the action, the beneficiaries may purchase goods, works or services.

The beneficiaries must make such purchases ensuring the best value for money or, if appropriate, the lowest price. In doing so, they must avoid any conflict of interests (see Article 35).

The beneficiaries must ensure that the JU, the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their contractors.

10.1.2 Beneficiaries that are ‘contracting authorities’ within the meaning of Directive 2004/18/EC<sup>6</sup> (or 2014/24/EU<sup>7</sup>) or ‘contracting entities’ within the meaning of Directive 2004/17/EC<sup>8</sup> (or 2014/25/EU<sup>9</sup>) must comply with the applicable national law on public procurement.

### **10.2 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under Article 10.1.1, the costs related to the contract concerned will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Article 10.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

## **ARTICLE 11 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES AGAINST PAYMENT**

### **11.1 Rules for the use of in-kind contributions against payment**

If necessary to implement the action, the beneficiaries may use in-kind contributions provided by third parties against payment.

---

<sup>6</sup> Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public work contracts, public supply contracts and public service contracts (OJ L 134, 30.04.2004, p. 114).

<sup>7</sup> Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC. (OJ L 94, 28.03.2014, p. 65).

<sup>8</sup> Directive 2004/17/EC of the European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors (OJ L 134, 30.04.2004, p. 1)

<sup>9</sup> Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014 on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC (OJ L 94, 28.03.2014, p. 243).

The beneficiaries may declare costs related to the payment of in-kind contributions as eligible (see Article 6.1 and 6.2), up to the third parties' costs for the seconded persons, contributed equipment, infrastructure or other assets or other contributed goods and services.

The third parties and their contributions must be set out in Annex 1. The JU may however approve in-kind contributions not set out in Annex 1 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that the JU, the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards the third parties.

## **11.2 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, the costs related to the payment of the in-kind contribution will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

## **ARTICLE 12 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES FREE OF CHARGE**

### **12.1 Rules for the use of in-kind contributions free of charge**

If necessary to implement the action, the beneficiaries may use in-kind contributions provided by third parties free of charge.

The beneficiaries may declare costs incurred by the third parties for the seconded persons, contributed equipment, infrastructure or other assets or other contributed goods and services as eligible in accordance with Article 6.4.

The third parties and their contributions must be set out in Annex 1. The JU may however approve in-kind contributions not set out in Annex 1 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that the JU, the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards the third parties.

### **12.2 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, the costs incurred by the third parties related to the in-kind contribution will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

## **ARTICLE 13 — IMPLEMENTATION OF ACTION TASKS BY SUBCONTRACTORS**

### **13.1 Rules for subcontracting action tasks**

13.1.1 If necessary to implement the action, the beneficiaries may award subcontracts covering the implementation of certain action tasks described in Annex 1.

Subcontracting may cover only a limited part of the action.

The beneficiaries must award the subcontracts ensuring the best value for money or, if appropriate, the lowest price. In doing so, they must avoid any conflict of interests (see Article 35).

The tasks to be implemented and the estimated cost for each subcontract must be set out in Annex 1 and the total estimated costs of subcontracting per beneficiary must be set out in Annex 2. The JU may however approve subcontracts not set out in Annex 1 and 2 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- they do not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that the JU, the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their subcontractors.

13.1.2 The beneficiaries must ensure that their obligations under Articles 35, 36, 38 and 46 also apply to the subcontractors.

Beneficiaries that are ‘contracting authorities’ within the meaning of Directive 2004/18/EC (or 2014/24/EU) or ‘contracting entities’ within the meaning of Directive 2004/17/EC (or 2014/25/EU) must comply with the applicable national law on public procurement.

### **13.2 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under Article 13.1.1, the costs related to the subcontract concerned will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Article 13.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

## **ARTICLE 14 — IMPLEMENTATION OF ACTION TASKS BY LINKED THIRD PARTIES**

### **14.1 Rules for calling upon linked third parties to implement part of the action**

14.1.1 The following **affiliated entities**<sup>11</sup> and **third parties with a legal link to a beneficiary**<sup>12</sup> (**‘linked third parties’**) may implement the action tasks attributed to them in Annex 1:

- AGENTFLY TECHNOLOGIES SRO (AFT), affiliated or linked to ANS CR (B4), if it has accepted joint and several liability with the beneficiary (see Annex 3a)
- INTEGRA CONSULT AS (Integra), affiliated or linked to ANS CR (B4), if it has accepted joint and several liability with the beneficiary (see Annex 3a)
- CENTRO DE REFERENCIA INVESTIGACION DESARROLLO E INNOVACION ATM, A.I.E. (CRIDA), affiliated or linked to ENAIRE, if it has accepted joint and several liability with the beneficiary (see Annex 3a)
- INGENIERIA Y ECONOMIA DEL TRANSPORTE SME MP SA (INECO), affiliated or linked to ENAIRE
- NEXTANT APPLICATIONS & INNOVATIVE SOLUTION SRL (NAIS), affiliated or linked to ENAV
- TECHNO SKY S.R.L. (TECHNO SKY), affiliated or linked to ENAV, if it has accepted joint and several liability with the beneficiary (see Annex 3a)
- BUSINESS INTEGRATION PARTNERS SPA (BIP), affiliated or linked to ENAV
- VMWARE BULGARIA EOOD (VMware), affiliated or linked to ENAV
- PDTS GMBH (PDTS), affiliated or linked to FRQ (FSP), if it has accepted joint and several liability with the beneficiary (see Annex 3a)
- SKYSOFT-ATM SA (SKYSOFT), affiliated or linked to SKYGUIDE, if it has accepted joint and several liability with the beneficiary (see Annex 3a)

The linked third parties may declare as eligible the costs they incur for implementing the action tasks in accordance with Article 6.3.

The beneficiaries must ensure that the JU, the Commission, the European Court of Auditors (ECA)

<sup>11</sup> For the definition see Article 2.1(2) Rules for Participation Regulation No 1290/2013: **‘affiliated entity’** means any legal entity that is:

- under the direct or indirect control of a participant, or
- under the same direct or indirect control as the participant, or
- directly or indirectly controlling a participant.

‘Control’ may take any of the following forms:

- (a) the direct or indirect holding of more than 50% of the nominal value of the issued share capital in the legal entity concerned, or of a majority of the voting rights of the shareholders or associates of that entity;
- (b) the direct or indirect holding, in fact or in law, of decision-making powers in the legal entity concerned.

However the following relationships between legal entities shall not in themselves be deemed to constitute controlling relationships:

- (a) the same public investment corporation, institutional investor or venture-capital company has a direct or indirect holding of more than 50% of the nominal value of the issued share capital or a majority of voting rights of the shareholders or associates;
- (b) the legal entities concerned are owned or supervised by the same public body.

<sup>12</sup> **‘Third party with a legal link to a beneficiary’** is any legal entity which has a legal link to the beneficiary implying collaboration that is not limited to the action.

and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their linked third parties.

14.1.2 The beneficiaries must ensure that their obligations under Articles 18, 20, 35, 36 and 38 also apply to their linked third parties.

#### **14.2 Consequences of non-compliance**

If any obligation under Article 14.1.1 is breached, the costs of the linked third party will be ineligible (see Article 6) and will be rejected (see Article 42).

If any obligation under Article 14.1.2 is breached, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

### **ARTICLE 14a — IMPLEMENTATION OF ACTION TASKS BY INTERNATIONAL PARTNERS**

Not applicable

### **ARTICLE 15 — FINANCIAL SUPPORT TO THIRD PARTIES**

#### **15.1 Rules for providing financial support to third parties**

Not applicable

#### **15.2 Financial support in the form of prizes**

Not applicable

#### **15.3 Consequences of non-compliance**

Not applicable

### **ARTICLE 16 — PROVISION OF TRANS-NATIONAL OR VIRTUAL ACCESS TO RESEARCH INFRASTRUCTURE**

#### **16.1 Rules for providing trans-national access to research infrastructure**

Not applicable

#### **16.2 Rules for providing virtual access to research infrastructure**

Not applicable

#### **16.3 Consequences of non-compliance**

Not applicable

## **SECTION 2 RIGHTS AND OBLIGATIONS RELATED TO THE GRANT ADMINISTRATION**

### **ARTICLE 17 — GENERAL OBLIGATION TO INFORM**

#### **17.1 General obligation to provide information upon request**

The beneficiaries must provide — during implementation of the action or afterwards and in accordance with Article 41.2 — any information requested in order to verify eligibility of the costs, proper implementation of the action and compliance with any other obligation under the Agreement.

#### **17.2 Obligation to keep information up to date and to inform about events and circumstances likely to affect the Agreement**

Each beneficiary must keep information stored in the Participant Portal Beneficiary Register (via the electronic exchange system; see Article 52) up to date, in particular, its name, address, legal representatives, legal form and organisation type.

Each beneficiary must immediately inform the coordinator — which must immediately inform the JU and the other beneficiaries — of any of the following:

- (a) **events** which are likely to affect significantly or delay the implementation of the action or the EU's or the JU's financial interests, in particular:
  - (i) changes in its legal, financial, technical, organisational or ownership situation or those of its linked third parties and
  - (ii) changes in the name, address, legal form, organisation type of its linked third parties;
- (b) **circumstances** affecting:
  - (i) the decision to award the grant or
  - (ii) compliance with requirements under the Agreement.

#### **17.3 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

### **ARTICLE 18 — KEEPING RECORDS — SUPPORTING DOCUMENTATION**

#### **18.1 Obligation to keep records and other supporting documentation**

The beneficiaries must — for a period of five years after the payment of the balance — keep records and other supporting documentation in order to prove the proper implementation of the action and the costs they declare as eligible.

They must make them available upon request (see Article 17) or in the context of checks, reviews, audits or investigations (see Article 22).

If there are on-going checks, reviews, audits, investigations, litigation or other pursuits of claims under the Agreement (including the extension of findings; see Article 22), the beneficiaries must keep the records and other supporting documentation until the end of these procedures.

The beneficiaries must keep the original documents. Digital and digitalised documents are considered originals if they are authorised by the applicable national law. The JU or the Commission may accept non-original documents if it considers that they offer a comparable level of assurance.

### 18.1.1 Records and other supporting documentation on the scientific and technical implementation

The beneficiaries must keep records and other supporting documentation on scientific and technical implementation of the action in line with the accepted standards in the respective field.

### 18.1.2 Records and other documentation to support the costs declared

The beneficiaries must keep the records and documentation supporting the costs declared, in particular the following:

- (a) for **actual costs**: adequate records and other supporting documentation to prove the costs declared, such as contracts, subcontracts, invoices and accounting records. In addition, the beneficiaries' usual cost accounting practices and internal control procedures must enable direct reconciliation between the amounts declared, the amounts recorded in their accounts and the amounts stated in the supporting documentation;
- (b) for **unit costs**: adequate records and other supporting documentation to prove the number of units declared. Beneficiaries do not need to identify the actual eligible costs covered or to keep or provide supporting documentation (such as accounting statements) to prove the amount per unit.

In addition, for **unit costs calculated in accordance with the beneficiary's usual cost accounting practices**, the beneficiaries must keep adequate records and documentation to prove that the cost accounting practices used comply with the conditions set out in Article 6.2.

The beneficiaries and linked third parties may submit to the JU, for approval by the Commission, a certificate (drawn up in accordance with Annex 6) stating that their usual cost accounting practices comply with these conditions (**'certificate on the methodology'**). If the certificate is approved, costs declared in line with this methodology will not be challenged subsequently, unless the beneficiaries have concealed information for the purpose of the approval.

- (c) for **flat-rate costs**: adequate records and other supporting documentation to prove the eligibility of the costs to which the flat-rate is applied. The beneficiaries do not need to identify the costs covered or provide supporting documentation (such as accounting statements) to prove the amount declared at a flat-rate.

In addition, for **personnel costs** (declared as actual costs or on the basis of unit costs), the beneficiaries must keep **time records** for the number of hours declared. The time records must be in writing and approved by the persons working on the action and their supervisors, at least monthly. In the absence of reliable time records of the hours worked on the action, the JU or the Commission may accept

alternative evidence supporting the number of hours declared, if it considers that it offers an adequate level of assurance.

As an exception, for **persons working exclusively on the action**, there is no need to keep time records, if the beneficiary signs a **declaration** confirming that the persons concerned have worked exclusively on the action.

For costs declared by linked third parties (see Article 14), it is the beneficiary that must keep the originals of the financial statements and the certificates on the financial statements of the linked third parties.

## **18.2 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, costs insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 42), and the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

## **ARTICLE 19 — SUBMISSION OF DELIVERABLES**

### **19.1 Obligation to submit deliverables**

The coordinator must submit the ‘**deliverables**’ identified in Annex 1, in accordance with the timing and conditions set out in it.

### **19.2 Consequences of non-compliance**

If the coordinator breaches any of its obligations under this Article, the JU may apply any of the measures described in Chapter 6.

## **ARTICLE 20 — REPORTING — PAYMENT REQUESTS**

### **20.1 Obligation to submit reports**

The coordinator must submit to the JU (see Article 52) the technical and financial reports set out in this Article. These reports include requests for payment and must be drawn up using the forms and templates provided in the electronic exchange system (see Article 52).

### **20.2 Reporting periods**

The action is divided into the following ‘**reporting periods**’:

- RP1: from month 1 to month 13
- RP2: from month 14 to month 25
- RP3: from month 26 to month 37

### **20.3 Periodic reports — Requests for interim payments**

The coordinator must submit a periodic report within 60 days following the end of each reporting period.

The **periodic report** must include the following:

(a) a '**periodic technical report**' containing:

- (i) an **explanation of the work carried out** by the beneficiaries;
- (ii) an **overview of the progress** towards the objectives of the action, including milestones and deliverables identified in Annex 1.

This report must include explanations justifying the differences between work expected to be carried out in accordance with Annex 1 and that actually carried out.

The report must detail the exploitation and dissemination of the results and — if required in Annex 1 — an updated '**plan for the exploitation and dissemination of the results**'.

The report must indicate the communication activities;

- (iii) a **summary** for publication by the JU;
- (iv) the answers to the '**questionnaire**', covering issues related to the action implementation and the economic and societal impact, notably in the context of the JU and the Horizon 2020 key performance indicators and JU and the Horizon 2020 monitoring requirements;

(b) a '**periodic financial report**' containing:

- (i) an '**individual financial statement**' (see Annex 4) from each beneficiary and from each linked third party, for the reporting period concerned.

The individual financial statement must detail the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) for each budget category (see Annex 2).

The beneficiaries and linked third parties must declare all eligible costs, even if — for actual costs, unit costs and flat-rate costs — they exceed the amounts indicated in the estimated budget (see Annex 2). Amounts which are not declared in the individual financial statement will not be taken into account by the JU.

If an individual financial statement is not submitted for a reporting period, it may be included in the periodic financial report for the next reporting period.

The individual financial statements of the last reporting period must also detail the **receipts of the action** (see Article 5.3.3).

Each beneficiary and each linked third party must **certify** that:

- the information provided is full, reliable and true;
- the costs declared are eligible (see Article 6);
- the costs can be substantiated by adequate records and supporting documentation (see Article 18) that will be produced upon request (see Article 17) or in the context of checks, reviews, audits and investigations (see Article 22), and

- for the last reporting period: that all the receipts have been declared (see Article 5.3.3);
- (ii) an **explanation of the use of resources** and the information on subcontracting (see Article 13) and in-kind contributions provided by third parties (see Articles 11 and 12) from each beneficiary and from each linked third party, for the reporting period concerned;
- (iii) not applicable;
- (iv) a '**periodic summary financial statement**', created automatically by the electronic exchange system, consolidating the individual financial statements for the reporting period concerned and including — except for the last reporting period — the **request for interim payment**.

#### 20.4 Final report — Request for payment of the balance

In addition to the periodic report for the last reporting period, the coordinator must submit the final report within 60 days following the end of the last reporting period.

The **final report** must include the following:

- (a) a '**final technical report**' with a **summary** for publication containing:
  - (i) an overview of the results and their exploitation and dissemination;
  - (ii) the conclusions on the action, and
  - (iii) the socio-economic impact of the action;
- (b) a '**final financial report**' containing:
  - (i) a '**final summary financial statement**', created automatically by the electronic exchange system, consolidating the individual financial statements for all reporting periods and including the **request for payment of the balance** and
  - (ii) a '**certificate on the financial statements**' (drawn up in accordance with Annex 5) for each beneficiary and for each linked third party, if it requests a total contribution of EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices (see Article 5.2 and Article 6.2).

#### 20.5 Information on cumulative expenditure incurred

Not applicable

#### 20.6 Currency for financial statements and conversion into euro

Financial statements must be drafted in euro.

Beneficiaries and linked third parties with accounting established in a currency other than the euro must convert the costs recorded in their accounts into euro, at the average of the daily exchange

rates published in the C series of the *Official Journal of the European Union*, calculated over the corresponding reporting period.

If no daily euro exchange rate is published in the *Official Journal of the European Union* for the currency in question, they must be converted at the average of the monthly accounting rates published on the Commission's website, calculated over the corresponding reporting period.

Beneficiaries and linked third parties with accounting established in euro must convert costs incurred in another currency into euro according to their usual accounting practices.

## 20.7 Language of reports

All reports (technical and financial reports, including financial statements) must be submitted in the language of the Agreement.

## 20.8 Consequences of non-compliance

If the reports submitted do not comply with this Article, the JU may suspend the payment deadline (see Article 47) and apply any of the other measures described in Chapter 6.

If the coordinator breaches its obligation to submit the reports and if it fails to comply with this obligation within 30 days following a written reminder, the JU may terminate the Agreement (see Article 50) or apply any of the other measures described in Chapter 6.

# ARTICLE 21 — PAYMENTS AND PAYMENT ARRANGEMENTS

## 21.1 Payments to be made

The following payments will be made to the coordinator:

- one **pre-financing payment**;
- one or more **interim payments**, on the basis of the request(s) for interim payment (see Article 20), and
- one **payment of the balance**, on the basis of the request for payment of the balance (see Article 20).

## 21.2 Pre-financing payment — Amount — Amount retained for the Guarantee Fund

The aim of the pre-financing is to provide the beneficiaries with a float.

It remains the property of the JU until the payment of the balance.

The amount of the pre-financing payment will be EUR **7 766 137.58** (seven million seven hundred and sixty six thousand one hundred and thirty seven EURO and fifty eight eurocents).

The JU will — except if Article 48 applies — make the pre-financing payment to the coordinator within 30 days, either from the entry into force of the Agreement (see Article 58) or from 10 days before the starting date of the action (see Article 3), whichever is the latest.

An amount of EUR **647 178.13** (six hundred and forty seven thousand one hundred and seventy eight

EURO and thirteen eurocents), corresponding to 5% of the maximum grant amount (see Article 5.1), is retained by the JU from the pre-financing payment and transferred into the ‘**Guarantee Fund**’.

### 21.3 Interim payments — Amount — Calculation

Interim payments reimburse the eligible costs incurred for the implementation of the action during the corresponding reporting periods.

The JU will pay to the coordinator the amount due as interim payment within 90 days from receiving the periodic report (see Article 20.3), except if Articles 47 or 48 apply.

Payment is subject to the approval of the periodic report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content.

The **amount due as interim payment** is calculated by the JU in the following steps:

Step 1 — Application of the reimbursement rates

Step 2 — Limit to 90% of the maximum grant amount

#### 21.3.1 Step 1 — Application of the reimbursement rates

The reimbursement rate(s) (see Article 5.2) are applied to the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) declared by the beneficiaries and the linked third parties (see Article 20) and approved by the JU (see above) for the concerned reporting period.

#### 21.3.2 Step 2 — Limit to 90% of the maximum grant amount

The total amount of pre-financing and interim payments must not exceed 90% of the maximum grant amount set out in Article 5.1. The maximum amount for the interim payment will be calculated as follows:

$$\begin{aligned} & \{90\% \text{ of the maximum grant amount (see Article 5.1)} \\ & \text{minus} \\ & \{\text{pre-financing and previous interim payments}\} \}. \end{aligned}$$

### 21.4 Payment of the balance — Amount — Calculation — Release of the amount retained for the Guarantee Fund

The payment of the balance reimburses the remaining part of the eligible costs incurred by the beneficiaries for the implementation of the action.

If the total amount of earlier payments is greater than the final grant amount (see Article 5.3), the payment of the balance takes the form of a recovery (see Article 44).

If the total amount of earlier payments is lower than the final grant amount, the JU will pay the balance within 90 days from receiving the final report (see Article 20.4), except if Articles 47 or 48 apply.

Payment is subject to the approval of the final report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content.

The **amount due as the balance** is calculated by the JU by deducting the total amount of pre-financing

and interim payments (if any) already made, from the final grant amount determined in accordance with Article 5.3:

$$\begin{aligned} & \{ \text{final grant amount (see Article 5.3)} \\ & \text{minus} \\ & \{ \text{pre-financing and interim payments (if any) made} \} \}. \end{aligned}$$

At the payment of the balance, the amount retained for the Guarantee Fund (see above) will be released and:

- if the balance is positive: the amount released will be paid in full to the coordinator together with the amount due as the balance;
- if the balance is negative (payment of the balance taking the form of recovery): it will be deducted from the amount released (see Article 44.1.2). If the resulting amount:
  - is positive, it will be paid to the coordinator
  - is negative, it will be recovered.

The amount to be paid may however be offset — without the beneficiaries' consent — against any other amount owed by a beneficiary to the JU up to the maximum JU contribution indicated, for that beneficiary, in the estimated budget (see Annex 2).

## 21.5 Notification of amounts due

When making payments, the JU will formally notify to the coordinator the amount due, specifying whether it concerns an interim payment or the payment of the balance.

For the payment of the balance, the notification will also specify the final grant amount.

In the case of reduction of the grant or recovery of undue amounts, the notification will be preceded by the contradictory procedure set out in Articles 43 and 44.

## 21.6 Currency for payments

The JU will make all payments in euro.

## 21.7 Payments to the coordinator — Distribution to the beneficiaries

Payments will be made to the coordinator.

Payments to the coordinator will discharge the JU from its payment obligation.

The coordinator must distribute the payments between the beneficiaries without unjustified delay.

Pre-financing may however be distributed only:

- (a) if the minimum number of beneficiaries set out in the call for proposals has acceded to the Agreement (see Article 56) and
- (b) to beneficiaries that have acceded to the Agreement (see Article 56).

## 21.8 Bank account for payments

All payments will be made to the following bank account:

Name of bank: DEUTSCHE BANK AG

Full name of the account holder: DEUTSCHE FLUGSICHERUNG DFS GMBH

IBAN code: DE66500700100091673400

## 21.9 Costs of payment transfers

The cost of the payment transfers is borne as follows:

- the JU bears the cost of transfers charged by its bank;
- the beneficiary bears the cost of transfers charged by its bank;
- the party causing a repetition of a transfer bears all costs of the repeated transfer.

## 21.10 Date of payment

Payments by the JU are considered to have been carried out on the date when they are debited to its account.

## 21.11 Consequences of non-compliance

21.11.1 If the JU does not pay within the payment deadlines (see above), the beneficiaries are entitled to **late-payment interest** at the rate applied by the European Central Bank (ECB) for its main refinancing operations in euros ('reference rate'), plus three and a half points. The reference rate is the rate in force on the first day of the month in which the payment deadline expires, as published in the C series of the *Official Journal of the European Union*.

If the late-payment interest is lower than or equal to EUR 200, it will be paid to the coordinator only upon request submitted within two months of receiving the late payment.

Late-payment interest is not due if all beneficiaries are EU Member States (including regional and local government authorities or other public bodies acting on behalf of a Member State for the purpose of this Agreement).

Suspension of the payment deadline or payments (see Articles 47 and 48) will not be considered as late payment.

Late-payment interest covers the period running from the day following the due date for payment (see above), up to and including the date of payment.

Late-payment interest is not considered for the purposes of calculating the final grant amount.

21.11.2 If the coordinator breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or the participation of the coordinator may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

## ARTICLE 22 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS

### 22.1 Checks, reviews and audits by the JU and the Commission

#### 22.1.1 Right to carry out checks

The JU will — during the implementation of the action or afterwards — check the proper implementation of the action and compliance with the obligations under the Agreement, including assessing deliverables and reports.

For this purpose the JU may be assisted by external persons or bodies.

The JU may also request additional information in accordance with Article 17. The JU may request beneficiaries to provide such information to it directly.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

#### 22.1.2 Right to carry out reviews

The JU may — during the implementation of the action or afterwards — carry out reviews on the proper implementation of the action (including assessment of deliverables and reports), compliance with the obligations under the Agreement and continued scientific or technological relevance of the action.

Reviews may be started up to two years after the payment of the balance. They will be formally notified to the coordinator or beneficiary concerned and will be considered to have started on the date of the formal notification.

If the review is carried out on a third party (see Articles 10 to 16), the beneficiary concerned must inform the third party.

The JU may carry out reviews directly (using its own staff) or indirectly (using external persons or bodies appointed to do so). It will inform the coordinator or beneficiary concerned of the identity of the external persons or bodies. They have the right to object to the appointment on grounds of commercial confidentiality.

The coordinator or beneficiary concerned must provide — within the deadline requested — any information and data in addition to deliverables and reports already submitted (including information on the use of resources). The JU may request beneficiaries to provide such information to it directly.

The coordinator or beneficiary concerned may be requested to participate in meetings, including with external experts.

For **on-the-spot** reviews, the beneficiaries must allow access to their sites and premises, including to external persons or bodies, and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the review findings, a ‘**review report**’ will be drawn up.

The JU will formally notify the review report to the coordinator or beneficiary concerned, which has 30 days to formally notify observations (**‘contradictory review procedure’**).

Reviews (including review reports) are in the language of the Agreement.

### 22.1.3 Right to carry out audits

The JU or the Commission may — during the implementation of the action or afterwards — carry out audits on the proper implementation of the action and compliance with the obligations under the Agreement.

Audits may be started up to two years after the payment of the balance. They will be formally notified to the coordinator or beneficiary concerned and will be considered to have started on the date of the formal notification.

If the audit is carried out on a third party (see Articles 10 to 16), the beneficiary concerned must inform the third party.

The JU or the Commission may carry out audits directly (using its own staff) or indirectly (using external persons or bodies appointed to do so). It will inform the coordinator or beneficiary concerned of the identity of the external persons or bodies. They have the right to object to the appointment on grounds of commercial confidentiality.

The coordinator or beneficiary concerned must provide — within the deadline requested — any information (including complete accounts, individual salary statements or other personal data) to verify compliance with the Agreement. The JU or the Commission may request beneficiaries to provide such information to it directly.

For **on-the-spot** audits, the beneficiaries must allow access to their sites and premises, including to external persons or bodies, and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the audit findings, a **‘draft audit report’** will be drawn up.

The JU or the Commission will formally notify the draft audit report to the coordinator or beneficiary concerned, which has 30 days to formally notify observations (**‘contradictory audit procedure’**). This period may be extended by the JU or the Commission in justified cases.

The **‘final audit report’** will take into account observations by the coordinator or beneficiary concerned. The report will be formally notified to it.

Audits (including audit reports) are in the language of the Agreement.

The JU or the Commission may also access the beneficiaries’ statutory records for the periodical assessment of unit costs or flat-rate amounts.

## 22.2 Investigations by the European Anti-Fraud Office (OLAF)

Under Regulations No 883/2013<sup>16</sup> and No 2185/96<sup>17</sup> (and in accordance with their provisions and procedures), and Article 110 of the JU Financial Rules<sup>18</sup>, the European Anti-Fraud Office (OLAF) may — at any moment during implementation of the action or afterwards — carry out investigations, including on-the-spot checks and inspections, to establish whether there has been fraud, corruption or any other illegal activity affecting the financial interests of the EU.

### 22.3 Checks and audits by the European Court of Auditors (ECA)

Under Article 287 of the Treaty on the Functioning of the European Union (TFEU) and Article 110 of the JU Financial Rules, the European Court of Auditors (ECA) may — at any moment during implementation of the action or afterwards — carry out audits.

The ECA has the right of access for the purpose of checks and audits.

### 22.4 Checks, reviews, audits and investigations for international organisations

In conformity with its financial regulations, the European Union, including the European Anti-Fraud Office (OLAF) and the European Court of Auditors (ECA), may undertake, including on the spot, checks, reviews, audits and investigations.

This Article will be applied in accordance with any specific agreement concluded in this respect by the international organisation and the European Union.

### 22.5 Consequences of findings in checks, reviews, audits and investigations — Extension of findings

#### 22.5.1 Findings in this grant

Findings in checks, reviews, audits or investigations carried out in the context of this grant may lead to the rejection of ineligible costs (see Article 42), reduction of the grant (see Article 43), recovery of undue amounts (see Article 44) or to any of the other measures described in Chapter 6.

Rejection of costs or reduction of the grant after the payment of the balance will lead to a revised final grant amount (see Article 5.4).

Findings in checks, reviews, audits or investigations may lead to a request for amendment for the modification of Annex 1 (see Article 55).

Checks, reviews, audits or investigations that find systemic or recurrent errors, irregularities, fraud or breach of obligations may also lead to consequences in other JU, EU or Euratom grants awarded under similar conditions (**‘extension of findings from this grant to other grants’**).

<sup>16</sup> Regulation (EU, Euratom) No 883/2013 of the European Parliament and of the Council of 11 September 2013 concerning investigations conducted by the European Anti-Fraud Office (OLAF) and repealing Regulation (EC) No 1073/1999 of the European Parliament and of the Council and Council Regulation (Euratom) No 1074/1999 (OJ L 248, 18.09.2013, p. 1).

<sup>17</sup> Council Regulation (Euratom, EC) No 2185/1996 of 11 November 1996 concerning on-the-spot checks and inspections carried out by the Commission in order to protect the European Communities' financial interests against fraud and other irregularities (OJ L 292, 15.11.1996, p. 2).

<sup>18</sup> The SESAR JU Financial Rules are made publicly available on the SESAR JU official website.

Moreover, findings arising from an OLAF investigation may lead to criminal prosecution under national law.

### 22.5.2 Findings in other grants

The JU or the Commission may extend findings from other grants to this grant (**‘extension of findings from other grants to this grant’**), if:

- (a) the beneficiary concerned is found, in other JU, EU or Euratom grants awarded under similar conditions, to have committed systemic or recurrent errors, irregularities, fraud or breach of obligations that have a material impact on this grant and
- (b) those findings are formally notified to the beneficiary concerned — together with the list of grants affected by the findings — no later than two years after the payment of the balance of this grant.

The extension of findings may lead to the rejection of costs (see Article 42), reduction of the grant (see Article 43), recovery of undue amounts (see Article 44), suspension of payments (see Article 48), suspension of the action implementation (see Article 49) or termination (see Article 50).

### 22.5.3 Procedure

The JU or the Commission will formally notify the beneficiary concerned the systemic or recurrent errors and its intention to extend these audit findings, together with the list of grants affected.

22.5.3.1 If the findings concern **eligibility of costs**: the formal notification will include:

- (a) an invitation to submit observations on the list of grants affected by the findings;
- (b) the request to submit **revised financial statements** for all grants affected;
- (c) the **correction rate for extrapolation** established by the JU or the Commission on the basis of the systemic or recurrent errors, to calculate the amounts to be rejected if the beneficiary concerned:
  - (i) considers that the submission of revised financial statements is not possible or practicable or
  - (ii) does not submit revised financial statements.

The beneficiary concerned has 90 days from receiving notification to submit observations, revised financial statements or to propose a duly substantiated **alternative correction method**. This period may be extended by the JU or the Commission in justified cases.

The JU or the Commission may then start a rejection procedure in accordance with Article 42, on the basis of:

- the revised financial statements, if approved;
- the proposed alternative correction method, if accepted

or

- the initially notified correction rate for extrapolation, if it does not receive any observations or revised financial statements, does not accept the observations or the proposed alternative correction method or does not approve the revised financial statements.

22.5.3.2 If the findings concern **substantial errors, irregularities or fraud or serious breach of obligations**: the formal notification will include:

- (a) an invitation to submit observations on the list of grants affected by the findings and
- (b) the flat-rate the JU or the Commission intends to apply according to the principle of proportionality.

The beneficiary concerned has 90 days from receiving notification to submit observations or to propose a duly substantiated alternative flat-rate.

The JU or the Commission may then start a reduction procedure in accordance with Article 43, on the basis of:

- the proposed alternative flat-rate, if accepted
- or
- the initially notified flat-rate, if it does not receive any observations or does not accept the observations or the proposed alternative flat-rate.

## 22.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, any insufficiently substantiated costs will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

## ARTICLE 23 — EVALUATION OF THE IMPACT OF THE ACTION

### 23.1 Right to evaluate the impact of the action

The JU or the Commission may carry out interim and final evaluations of the impact of the action measured against the objective of the EU programme.

Evaluations may be started during implementation of the action and up to five years after the payment of the balance. The evaluation is considered to start on the date of the formal notification to the coordinator or beneficiaries.

The JU or the Commission may make these evaluations directly (using its own staff) or indirectly (using external bodies or persons it has authorised to do so).

The coordinator or beneficiaries must provide any information relevant to evaluate the impact of the action, including information in electronic format.

### 23.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the JU may apply the measures described in Chapter 6.

## **SECTION 3 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND AND RESULTS**

### **SUBSECTION 1 GENERAL**

#### **ARTICLE 23a — MANAGEMENT OF INTELLECTUAL PROPERTY**

##### **23a.1 Obligation to take measures to implement the Commission Recommendation on the management of intellectual property in knowledge transfer activities**

Beneficiaries that are universities or other public research organisations must take measures to implement the principles set out in Points 1 and 2 of the Code of Practice annexed to the Commission Recommendation on the management of intellectual property in knowledge transfer activities<sup>19</sup>.

This does not change the obligations set out in Subsections 2 and 3 of this Section.

The beneficiaries must ensure that researchers and third parties involved in the action are aware of them.

##### **23a.2 Consequences of non-compliance**

If a beneficiary breaches its obligations under this Article, the JU may apply any of the measures described in Chapter 6.

### **SUBSECTION 2 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND**

#### **ARTICLE 24 — AGREEMENT ON BACKGROUND**

##### **24.1 Agreement on background**

The beneficiaries must identify and agree (in writing) on the background for the action (**‘agreement on background’**).

**‘Background’** means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that:

- (a) is held by the beneficiaries before they acceded to the Agreement, and
- (b) is needed to implement the action or exploit the results.

##### **24.2 Consequences of non-compliance**

---

<sup>19</sup> Commission Recommendation C(2008) 1329 of 10.4.2008 on the management of intellectual property in knowledge transfer activities and the Code of Practice for universities and other public research institutions attached to this recommendation.

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

## **ARTICLE 25 — ACCESS RIGHTS TO BACKGROUND**

### **25.1 Exercise of access rights — Waiving of access rights — No sub-licensing**

To exercise access rights, this must first be requested in writing (**‘request for access’**).

**‘Access rights’** means rights to use results or background under the terms and conditions laid down in this Agreement.

Waivers of access rights are not valid unless in writing.

Unless agreed otherwise, access rights do not include the right to sub-license.

### **25.2 Access rights for other beneficiaries, for implementing their own tasks under the action**

The beneficiaries must give each other access — on a royalty-free basis — to background needed to implement their own tasks under the action, unless the beneficiary that holds the background has — before acceding to the Agreement —:

- (a) informed the other beneficiaries that access to its background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel), or
- (b) agreed with the other beneficiaries that access would not be on a royalty-free basis.

### **25.3 Access rights for other beneficiaries, for exploiting their own results**

The beneficiaries must give each other access — under fair and reasonable conditions — to background needed for exploiting their own results, unless the beneficiary that holds the background has — before acceding to the Agreement — informed the other beneficiaries that access to its background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel).

**‘Fair and reasonable conditions’** means appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for access, for example the actual or potential value of the results or background to which access is requested and/or the scope, duration or other characteristics of the exploitation envisaged.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

### **25.4 Access rights for affiliated entities**

Unless otherwise agreed in the consortium agreement, access to background must also be given — under fair and reasonable conditions (see above; Article 25.3) and unless it is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel) —

to affiliated entities<sup>20</sup> established in an EU Member State or ‘**associated country**’<sup>21</sup>, if this is needed to exploit the results generated by the beneficiaries to which they are affiliated.

Unless agreed otherwise (see above; Article 25.1), the affiliated entity concerned must make the request directly to the beneficiary that holds the background.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

### **25.5 Access rights for third parties**

Not applicable

### **25.6 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

## **SUBSECTION 3 RIGHTS AND OBLIGATIONS RELATED TO RESULTS**

### **ARTICLE 26 — OWNERSHIP OF RESULTS**

#### **26.1 Ownership by the beneficiary that generates the results**

Results are owned by the beneficiary that generates them.

‘**Results**’ means any (tangible or intangible) output of the action such as data, knowledge or information — whatever its form or nature, whether it can be protected or not — that is generated in the action, as well as any rights attached to it, including intellectual property rights.

#### **26.2 Joint ownership by several beneficiaries**

Two or more beneficiaries own results jointly if:

- (a) they have jointly generated them and
- (b) it is not possible to:
  - (i) establish the respective contribution of each beneficiary, or
  - (ii) separate them for the purpose of applying for, obtaining or maintaining their protection (see Article 27).

<sup>20</sup> For the definition, see ‘affiliated entity’ footnote (Article 14.1).

<sup>21</sup> For the definition, see Article 2.1(3) of the Rules for Participation Regulation No 1290/2013: ‘**associated country**’ means a third country which is party to an international agreement with the Union, as identified in Article 7 of Horizon 2020 Framework Programme Regulation No 1291/2013. Article 7 sets out the conditions for association of non-EU countries to Horizon 2020.

The joint owners must agree (in writing) on the allocation and terms of exercise of their joint ownership (**‘joint ownership agreement’**), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement, each joint owner may grant non-exclusive licences to third parties to exploit jointly-owned results (without any right to sub-license), if the other joint owners are given:

- (a) at least 45 days advance notice and
- (b) fair and reasonable compensation.

Once the results have been generated, joint owners may agree (in writing) to apply another regime than joint ownership (such as, for instance, transfer to a single owner (see Article 30) with access rights for the others).

### **26.3 Rights of third parties (including personnel)**

If third parties (including personnel) may claim rights to the results, the beneficiary concerned must ensure that it complies with its obligations under the Agreement.

If a third party generates results, the beneficiary concerned must obtain all necessary rights (transfer, licences or other) from the third party, in order to be able to respect its obligations as if those results were generated by the beneficiary itself.

If obtaining the rights is impossible, the beneficiary must refrain from using the third party to generate the results.

### **26.4 JU ownership, to protect results**

26.4.1 The JU may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to disseminate its results without protecting them, except in any of the following cases:

- (a) the lack of protection is because protecting the results is not possible, reasonable or justified (given the circumstances);
- (b) the lack of protection is because there is a lack of potential for commercial or industrial exploitation, or
- (c) the beneficiary intends to transfer the results to another beneficiary or third party established in an EU Member State or associated country, which will protect them.

Before the results are disseminated and unless any of the cases above under Points (a), (b) or (c) applies, the beneficiary must formally notify the JU and at the same time inform it of any reasons for refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the JU decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

No dissemination relating to these results may take place before the end of this period or, if the JU takes a positive decision, until it has taken the necessary steps to protect the results.

26.4.2 The JU may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to stop protecting them or not to seek an extension of protection, except in any of the following cases:

- (a) the protection is stopped because of a lack of potential for commercial or industrial exploitation;
- (b) an extension would not be justified given the circumstances.

A beneficiary that intends to stop protecting results or not seek an extension must — unless any of the cases above under Points (a) or (b) applies — formally notify the JU at least 60 days before the protection lapses or its extension is no longer possible and at the same time inform it of any reasons for refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the JU decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

## **26.5 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to the any of the other measures described in Chapter 6.

## **ARTICLE 27 — PROTECTION OF RESULTS — VISIBILITY OF JU FUNDING AND SUPPORT FROM JU MEMBERS**

### **27.1 Obligation to protect the results**

Each beneficiary must examine the possibility of protecting its results and must adequately protect them — for an appropriate period and with appropriate territorial coverage — if:

- (a) the results can reasonably be expected to be commercially or industrially exploited and
- (b) protecting them is possible, reasonable and justified (given the circumstances).

When deciding on protection, the beneficiary must consider its own legitimate interests and the legitimate interests (especially commercial) of the other beneficiaries.

### **27.2 JU ownership, to protect the results**

If a beneficiary intends not to protect its results, to stop protecting them or not seek an extension of protection, the JU may — under certain conditions (see Article 26.4) — assume ownership to ensure their (continued) protection.

### **27.3 Information on JU funding and support from JU members**

Applications for protection of results (including patent applications) filed by or on behalf of a beneficiary must — unless the JU requests or agrees otherwise or unless it is impossible — include the following:

“The project leading to this application has received funding from the SESAR Joint Undertaking (JU) under grant agreement No 874464. The JU receives support from the European Union’s Horizon 2020 research and innovation programme and the SESAR JU members other than the Union”.

## 27.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

## ARTICLE 28 — EXPLOITATION OF RESULTS

### 28.1 Obligation to exploit the results

Each beneficiary must — up to four years after the period set out in Article 3 — take measures aiming to ensure ‘**exploitation**’ of its results (either directly or indirectly, in particular through transfer or licensing; see Article 30) by:

- (a) using them in further research activities (outside the action);
- (b) developing, creating or marketing a product or process;
- (c) creating and providing a service, or
- (d) using them in standardisation activities.

This does not change the security obligations in Article 37, which still apply.

### 28.2 Results that could contribute to European or international standards — Information on JU funding and support from JU members

If results could reasonably be expected to contribute to European or international standards, the beneficiary concerned must — up to four years after the period set out in Article 3 — inform the JU.

If results are incorporated in a standard, the beneficiary concerned must — unless the JU requests or agrees otherwise or unless it is impossible — ask the standardisation body to include the following statement in (information related to) the standard:

“Results incorporated in this standard received funding from the SESAR Joint Undertaking (JU) under grant agreement No 874464. The JU receives support from the European Union’s Horizon 2020 research and innovation programme and the SESAR JU members other than the Union”.

### 28.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced in accordance with Article 43.

Such a breach may also lead to any of the other measures described in Chapter 6.

## ARTICLE 29 — DISSEMINATION OF RESULTS — OPEN ACCESS — VISIBILITY OF JU FUNDING AND SUPPORT FROM JU MEMBERS

## 29.1 Obligation to disseminate results

Unless it goes against their legitimate interests, each beneficiary must — as soon as possible — ‘**disseminate**’ its results by disclosing them to the public by appropriate means (other than those resulting from protecting or exploiting the results), including in scientific publications (in any medium).

This does not change the obligation to protect results in Article 27, the confidentiality obligations in Article 36, the security obligations in Article 37 or the obligations to protect personal data in Article 39, all of which still apply.

A beneficiary that intends to disseminate its results must give advance notice to the other beneficiaries of — unless agreed otherwise — at least 45 days, together with sufficient information on the results it will disseminate.

Any other beneficiary may object within — unless agreed otherwise — 30 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the dissemination may not take place unless appropriate steps are taken to safeguard these legitimate interests.

If a beneficiary intends not to protect its results, it may — under certain conditions (see Article 26.4.1) — need to formally notify the JU before dissemination takes place.

## 29.2 Open access to scientific publications

Each beneficiary must ensure open access (free of charge online access for any user) to all peer-reviewed scientific publications relating to its results.

In particular, it must:

- (a) as soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications;

Moreover, the beneficiary must aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications.

- (b) ensure open access to the deposited publication — via the repository — at the latest:
  - (i) on publication, if an electronic version is available for free via the publisher, or
  - (ii) within six months of publication (twelve months for publications in the social sciences and humanities) in any other case.
- (c) ensure open access — via the repository — to the bibliographic metadata that identify the deposited publication.

The bibliographic metadata must be in a standard format and must include all of the following:

- the terms “SESAR Joint Undertaking”, “European Union (EU)” and “Horizon 2020”;
- the name of the action, acronym and grant number;

- the publication date, and length of embargo period if applicable, and
- a persistent identifier.

### **29.3 Open access to research data**

Not applicable;

### **29.4 Information on JU funding and support from JU members — Obligation and right to use the JU logo and the EU emblem**

Unless the JU requests or agrees otherwise or unless it is impossible, any dissemination of results (in any form, including electronic) must:

- (a) display the JU logo and
- (b) display the EU emblem and
- (c) include the following text:

“This project has received funding from the SESAR Joint Undertaking (JU) under grant agreement No 874464. The JU receives support from the European Union’s Horizon 2020 research and innovation programme and the SESAR JU members other than the Union”.

When displayed together with another logo, the JU logo and the EU emblem must have appropriate prominence.

For the purposes of their obligations under this Article, the beneficiaries may use the JU logo and the EU emblem without first obtaining approval from the JU or the Commission.

This does not however give them the right to exclusive use.

Moreover, they may not appropriate the JU logo and the EU emblem or any similar trademark or logo, either by registration or by any other means.

### **29.5 Disclaimer excluding JU responsibility**

Any dissemination of results must indicate that it reflects only the author's view and that the JU is not responsible for any use that may be made of the information it contains.

### **29.6 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

## **ARTICLE 30 — TRANSFER AND LICENSING OF RESULTS**

### **30.1 Transfer of ownership**

Each beneficiary may transfer ownership of its results.

It must however ensure that its obligations under Articles 26.2, 26.4, 27, 28, 29, 30 and 31 also apply to the new owner and that this owner has the obligation to pass them on in any subsequent transfer.

This does not change the security obligations in Article 37, which still apply.

Unless agreed otherwise (in writing) for specifically-identified third parties or unless impossible under applicable EU and national laws on mergers and acquisitions, a beneficiary that intends to transfer ownership of results must give at least 45 days advance notice (or less if agreed in writing) to the other beneficiaries that still have (or still may request) access rights to the results. This notification must include sufficient information on the new owner to enable any beneficiary concerned to assess the effects on its access rights.

Unless agreed otherwise (in writing) for specifically-identified third parties, any other beneficiary may object within 30 days of receiving notification (or less if agreed in writing), if it can show that the transfer would adversely affect its access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned.

### **30.2 Granting licenses**

Each beneficiary may grant licences to its results (or otherwise give the right to exploit them), if:

- (a) this does not impede the access rights under Article 31 and
- (b) not applicable.

In addition to Points (a) and (b), exclusive licences for results may be granted only if all the other beneficiaries concerned have waived their access rights (see Article 31.1).

This does not change the dissemination obligations in Article 29 or security obligations in Article 37, which still apply.

### **30.3 JU right to object to transfers or exclusive licensing**

Not applicable

### **30.4 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

## **ARTICLE 31 — ACCESS RIGHTS TO RESULTS**

### **31.1 Exercise of access rights — Waiving of access rights — No sub-licensing**

The conditions set out in Article 25.1 apply.

The obligations set out in this Article do not change the security obligations in Article 37, which still apply.

### **31.2 Access rights for other beneficiaries, for implementing their own tasks under the action**

The beneficiaries must give each other access — on a royalty-free basis — to results needed for implementing their own tasks under the action.

### **31.3 Access rights for other beneficiaries, for exploiting their own results**

The beneficiaries must give each other — under fair and reasonable conditions (see Article 25.3) — access to results needed for exploiting their own results.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

### **31.4 Access rights of affiliated entities**

Unless agreed otherwise in the consortium agreement, access to results must also be given — under fair and reasonable conditions (Article 25.3) — to affiliated entities established in an EU Member State or associated country, if this is needed for those entities to exploit the results generated by the beneficiaries to which they are affiliated.

Unless agreed otherwise (see above; Article 31.1), the affiliated entity concerned must make any such request directly to the beneficiary that owns the results.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

### **31.5 Access rights for the JU, the EU institutions, other EU bodies, offices or agencies and EU Member States**

The beneficiaries must give access to their results — on a royalty-free basis — to the JU and to EU institutions, other EU bodies, offices or agencies, for developing, implementing or monitoring EU policies or programmes.

Such access rights are limited to non-commercial and non-competitive use.

This does not change the right to use any material, document or information received from the beneficiaries for communication and publicising activities (see Article 38.2).

### **31.6 Access rights for third parties**

The beneficiaries must give — under the conditions set out in Article 31.2 — access to their results to complementary beneficiaries<sup>22</sup> (see Article 2).

### **31.7 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

## **SECTION 4 OTHER RIGHTS AND OBLIGATIONS**

<sup>22</sup> ‘Complementary beneficiary’ means a beneficiary of a complementary grant agreement.

## **ARTICLE 32 — RECRUITMENT AND WORKING CONDITIONS FOR RESEARCHERS**

### **32.1 Obligation to take measures to implement the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers**

The beneficiaries must take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers<sup>23</sup>, in particular regarding:

- working conditions;
- transparent recruitment processes based on merit, and
- career development.

The beneficiaries must ensure that researchers and third parties involved in the action are aware of them.

### **32.2 Consequences of non-compliance**

If a beneficiary breaches its obligations under this Article, the JU may apply any of the measures described in Chapter 6.

## **ARTICLE 33 — GENDER EQUALITY**

### **33.1 Obligation to aim for gender equality**

The beneficiaries must take all measures to promote equal opportunities between men and women in the implementation of the action. They must aim, to the extent possible, for a gender balance at all levels of personnel assigned to the action, including at supervisory and managerial level.

### **33.2 Consequences of non-compliance**

If a beneficiary breaches its obligations under this Article, the JU may apply any of the measures described in Chapter 6.

## **ARTICLE 34 — ETHICS AND RESEARCH INTEGRITY**

### **34.1 Obligation to comply with ethical and research integrity principles**

The beneficiaries must carry out the action in compliance with:

- (a) ethical principles (including the highest standards of research integrity)
- and
- (b) applicable international, EU and national law.

---

<sup>23</sup> Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).

Funding will not be granted for activities carried out outside the EU if they are prohibited in all Member States or for activities which destroy human embryos (for example, for obtaining stem cells).

The beneficiaries must ensure that the activities under the action have an exclusive focus on civil applications.

The beneficiaries must ensure that the activities under the action do not:

- (a) aim at human cloning for reproductive purposes;
- (b) intend to modify the genetic heritage of human beings which could make such changes heritable (with the exception of research relating to cancer treatment of the gonads, which may be financed), or
- (c) intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer.

In addition, the beneficiaries must respect the fundamental principle of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity<sup>24</sup>.

This implies compliance with the following fundamental principles:

- **reliability** in ensuring the quality of research reflected in the design, the methodology, the analysis and the use of resources;
- **honesty** in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair and unbiased way;
- **respect** for colleagues, research participants, society, ecosystems, cultural heritage and the environment;
- **accountability** for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts

and means that beneficiaries must ensure that persons carrying out research tasks follow the good research practices and refrain from the research integrity violations described in this Code.

This does not change the other obligations under this Agreement or obligations under applicable international, EU or national law, all of which still apply.

### 34.2 Activities raising ethical issues

Activities raising ethical issues must comply with the ‘**ethics requirements**’ set out as deliverables in Annex 1.

Before the beginning of an activity raising an ethical issue, each beneficiary must have obtained:

- (a) any ethics committee opinion required under national law and

<sup>24</sup> European Code of Conduct for Research Integrity of ALLEA (All European Academies)  
[http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics\\_code-of-conduct\\_en.pdf](http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf)

- (b) any notification or authorisation for activities raising ethical issues required under national and/or European law

needed for implementing the action tasks in question.

The documents must be kept on file and be submitted upon request by the coordinator to the JU (see Article 52). If they are not in English, they must be submitted together with an English summary, which shows that the action tasks in question are covered and includes the conclusions of the committee or authority concerned (if available).

### **34.3 Activities involving human embryos or human embryonic stem cells**

Activities involving research on human embryos or human embryonic stem cells may be carried out, in addition to Article 34.1, only if:

- they are set out in Annex 1 or
- the coordinator has obtained explicit approval (in writing) from the JU (see Article 52).

### **34.4 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or participation of the beneficiary may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

## **ARTICLE 35 — CONFLICT OF INTERESTS**

### **35.1 Obligation to avoid a conflict of interests**

The beneficiaries must take all measures to prevent any situation where the impartial and objective implementation of the action is compromised for reasons involving economic interest, political or national affinity, family or emotional ties or any other shared interest ('**conflict of interests**').

They must formally notify to the JU without delay any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation.

The JU may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

### **35.2 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or participation of the beneficiary may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

## **ARTICLE 36 — CONFIDENTIALITY**

### **36.1 General obligation to maintain confidentiality**

During implementation of the action and for four years after the period set out in Article 3, the

parties must keep confidential any data, documents or other material (in any form) that is identified as confidential at the time it is disclosed (**‘confidential information’**).

If a beneficiary requests, the JU may agree to keep such information confidential for an additional period beyond the initial four years.

If information has been identified as confidential only orally, it will be considered to be confidential only if this is confirmed in writing within 15 days of the oral disclosure.

Unless otherwise agreed between the parties, they may use confidential information only to implement the Agreement.

The beneficiaries may disclose confidential information to their personnel or third parties involved in the action only if they:

- (a) need to know to implement the Agreement and
- (b) are bound by an obligation of confidentiality.

This does not change the security obligations in Article 37, which still apply.

The JU may disclose confidential information to its staff, other EU institutions and bodies. It may disclose confidential information to third parties, if:

- (a) this is necessary to implement the Agreement or safeguard the EU’s or JU’s financial interests and
- (b) the recipients of the information are bound by an obligation of confidentiality.

The confidentiality obligations no longer apply if:

- (a) the disclosing party agrees to release the other party;
- (b) the information was already known by the recipient or is given to him without obligation of confidentiality by a third party that was not bound by any obligation of confidentiality;
- (c) the recipient proves that the information was developed without the use of confidential information;
- (d) the information becomes generally and publicly available, without breaching any confidentiality obligation, or
- (e) the disclosure of the information is required by EU or national law.

## **36.2 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

## **ARTICLE 37 — SECURITY-RELATED OBLIGATIONS**

**37.1 Results with a security recommendation**

Not applicable

**37.2 Classified information**

Not applicable

**37.3 Activities involving dual-use goods or dangerous materials and substances**

Not applicable

**37.4 Consequences of non-compliance**

Not applicable

## **ARTICLE 38 — PROMOTING THE ACTION — VISIBILITY OF JU FUNDING AND SUPPORT FROM JU MEMBERS**

**38.1 Communication activities by beneficiaries****38.1.1 Obligation to promote the action and its results**

The beneficiaries must promote the action and its results, by providing targeted information to multiple audiences (including the media and the public) in a strategic and effective manner.

This does not change the dissemination obligations in Article 29, the confidentiality obligations in Article 36 or the security obligations in Article 37, all of which still apply.

Before engaging in a communication activity expected to have a major media impact, the beneficiaries must inform the JU (see Article 52).

**38.1.2 Information on JU funding and support from JU members — Obligation and right to use the JU logo and the EU emblem**

Unless the JU requests or agrees otherwise or unless it is impossible, any communication activity related to the action (including in electronic form, via social media, etc.) and any infrastructure, equipment and major results funded by the grant must:

- (a) display the JU logo and
- (b) display the EU emblem and
- (c) include the following text:

For communication activities:

“This project has received funding from the SESAR Joint Undertaking (JU) under grant agreement No 874464. The JU receives support from the European Union’s Horizon 2020 research and innovation programme and the SESAR JU members other than the Union”.

For infrastructure, equipment and major results:

“This *[infrastructure][equipment][insert type of result]* is part of a project that has received funding from the SESAR Joint Undertaking (JU) under grant agreement No 874464. The JU receives support from the

European Union's Horizon 2020 research and innovation programme and the SESAR JU members other than the Union".

When displayed together with another logo, the JU logo and the EU emblem must have appropriate prominence.

For the purposes of their obligations under this Article, the beneficiaries may use the JU logo and the EU emblem without first obtaining approval from the JU or the Commission.

This does not, however, give them the right to exclusive use.

Moreover, they may not appropriate the JU logo and the EU emblem or any similar trademark or logo, either by registration or by any other means.

### 38.1.3 Disclaimer excluding JU responsibility

Any communication activity related to the action must indicate that it reflects only the author's view and that the JU is not responsible for any use that may be made of the information it contains.

## 38.2 Communication activities by the JU

### 38.2.1 Right to use beneficiaries' materials, documents or information

The JU may use, for its communication and publicising activities, information relating to the action, documents notably summaries for publication and public deliverables as well as any other material, such as pictures or audio-visual material received from any beneficiary (including in electronic form).

This does not change the confidentiality obligations in Article 36 and the security obligations in Article 37, all of which still apply.

If the JU's use of these materials, documents or information would risk compromising legitimate interests, the beneficiary concerned may request the JU not to use it (see Article 52).

The right to use a beneficiary's materials, documents and information includes:

- (a) **use for its own purposes** (in particular, making them available to persons working for the JU or any other EU institution, body, office or agency or body or institutions in EU Member States; and copying or reproducing them in whole or in part, in unlimited numbers);
- (b) **distribution to the public** (in particular, publication as hard copies and in electronic or digital format, publication on the internet, as a downloadable or non-downloadable file, broadcasting by any channel, public display or presentation, communicating through press information services, or inclusion in widely accessible databases or indexes);
- (c) **editing or redrafting** for communication and publicising activities (including shortening, summarising, inserting other elements (such as meta-data, legends, other graphic, visual, audio or text elements), extracting parts (e.g. audio or video files), dividing into parts, use in a compilation);
- (d) translation;

- (e) giving **access in response to individual requests** under Regulation No 1049/2001<sup>27</sup>, without the right to reproduce or exploit;
- (f) **storage** in paper, electronic or other form;
- (g) **archiving**, in line with applicable document-management rules, and
- (h) the right to authorise **third parties** to act on its behalf or sub-license the modes of use set out in Points (b), (c), (d) and (f) to third parties if needed for the communication and publicising activities of the JU.

If the right of use is subject to rights of a third party (including personnel of the beneficiary), the beneficiary must ensure that it complies with its obligations under this Agreement (in particular, by obtaining the necessary approval from the third parties concerned).

Where applicable (and if provided by the beneficiaries), the JU will insert the following information:

“© – [year] – [name of the copyright owner]. All rights reserved. Licensed to the SESAR Joint Undertaking under conditions.”

### 38.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

## ARTICLE 39 — PROCESSING OF PERSONAL DATA

### 39.1 Processing of personal data by the JU and the Commission

Any personal data under the Agreement will be processed by the JU or the Commission under Regulation No 45/2001<sup>28</sup> and according to the ‘notifications of the processing operations’ to the Data Protection Officer (DPO) of the JU or the Commission (publicly accessible in the DPO register).

Such data will be processed by the ‘**data controller**’ of the JU or the Commission for the purposes of implementing, managing and monitoring the Agreement or protecting the financial interests of the JU, EU or Euratom (including checks, reviews, audits and investigations; see Article 22).

The persons whose personal data are processed have the right to access and correct their own personal data. For this purpose, they must send any queries about the processing of their personal data to the data controller, via the contact point indicated in the ‘privacy statement’ that are published on the JU and the Commission websites.

They also have the right to have recourse at any time to the European Data Protection Supervisor (EDPS).

<sup>27</sup> Regulation (EC) No 1049/2001 of the European Parliament and of the Council of 30 May 2001 regarding public access to European Parliament, Council and Commission documents, OJ L 145, 31.5.2001, p. 43.

<sup>28</sup> Regulation (EC) No 45/2001 of the European Parliament and of the Council of 18 December 2000 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data (OJ L 8, 12.01.2001, p. 1).

### **39.2 Processing of personal data by the beneficiaries**

The beneficiaries must process personal data under the Agreement in compliance with applicable EU and national law on data protection (including authorisations or notification requirements).

The beneficiaries may grant their personnel access only to data that is strictly necessary for implementing, managing and monitoring the Agreement.

The beneficiaries must inform the personnel whose personal data are collected and processed by the JU or the Commission. For this purpose, they must provide them with the privacy statement(s) (see above), before transmitting their data to the JU or the Commission.

### **39.3 Consequences of non-compliance**

If a beneficiary breaches any of its obligations under Article 39.2, the JU may apply any of the measures described in Chapter 6.

## **ARTICLE 40 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE JU**

The beneficiaries may not assign any of their claims for payment against the JU to any third party, except if approved by the JU on the basis of a reasoned, written request by the coordinator (on behalf of the beneficiary concerned).

If the JU has not accepted the assignment or the terms of it are not observed, the assignment will have no effect on it.

In no circumstances will an assignment release the beneficiaries from their obligations towards the JU.

## **CHAPTER 5 DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES** **— RELATIONSHIP WITH COMPLEMENTARY BENEFICIARIES —** **RELATIONSHIP WITH PARTNERS OF A JOINT ACTION**

### **ARTICLE 41 — DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES** **— RELATIONSHIP WITH COMPLEMENTARY BENEFICIARIES —** **RELATIONSHIP WITH PARTNERS OF A JOINT ACTION**

#### **41.1 Roles and responsibility towards the JU**

The beneficiaries have full responsibility for implementing the action and complying with the Agreement.

The beneficiaries are jointly and severally liable for the **technical implementation** of the action as described in Annex 1. If a beneficiary fails to implement its part of the action, the other beneficiaries become responsible for implementing this part (without being entitled to any additional JU funding for doing so), unless the JU expressly relieves them of this obligation.

The **financial responsibility** of each beneficiary is governed by Article 44.

#### **41.2 Internal division of roles and responsibilities**

The internal roles and responsibilities of the beneficiaries are divided as follows:

(a) Each **beneficiary** must:

- (i) keep information stored in the Participant Portal Beneficiary Register (via the electronic exchange system) up to date (see Article 17);
- (ii) inform the coordinator immediately of any events or circumstances likely to affect significantly or delay the implementation of the action (see Article 17);
- (iii) submit to the coordinator in good time:
  - individual financial statements for itself and its linked third parties and, if required, certificates on the financial statements (see Article 20);
  - the data needed to draw up the technical reports (see Article 20);
  - ethics committee opinions and notifications or authorisations for activities raising ethical issues (see Article 34);
  - any other documents or information required by the JU under the Agreement, unless the Agreement requires the beneficiary to submit this information directly to the JU.

(b) The **coordinator** must:

- (i) monitor that the action is implemented properly (see Article 7);
- (ii) act as the intermediary for all communications between the beneficiaries and the JU (in particular, providing the JU with the information described in Article 17), unless the Agreement specifies otherwise;
- (iii) request and review any documents or information required by the JU and verify their completeness and correctness before passing them on to the JU;
- (iv) submit the deliverables and reports to the JU (see Articles 19 and 20);
- (v) ensure that all payments are made to the other beneficiaries without unjustified delay (see Article 21);
- (vi) inform the JU of the amounts paid to each beneficiary, when required under the Agreement (see Articles 44 and 50) or requested by the JU.

The coordinator may not delegate or subcontract the above-mentioned tasks to any other beneficiary or third party (including linked third parties).

### 41.3 Internal arrangements between beneficiaries — Consortium agreement

Not applicable

### 41.4 Relationship with complementary beneficiaries — Collaboration agreement

The beneficiaries must conclude a written ‘collaboration agreement’ with the complementary

beneficiaries to coordinate the work under the Agreement and the complementary grant agreement(s) (see Article 2), covering for instance:

- efficient decision making processes and
- settlement of disputes.

The collaboration agreement must not contain any provision contrary to the Agreement.

The beneficiaries and complementary beneficiaries must create and participate in common boards and advisory structures to decide on collaboration and synchronisation of activities, including on management of outcomes, common approaches towards standardisation, SME involvement, links with regulatory and policy activities, and commonly shared dissemination and awareness raising activities.

The beneficiaries must give access to their results to the complementary beneficiaries, for the purposes of the complementary grant agreement(s) (see Article 31.6).

The beneficiaries must share the technical reports (see Article 20.3 and 20.4). The confidentiality obligations in Article 36 apply.

#### **41.5 Relationship with partners of a joint action — Coordination agreement**

Not applicable

### **CHAPTER 6 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — SANCTIONS — DAMAGES — SUSPENSION — TERMINATION — FORCE MAJEURE**

#### **SECTION 1 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — SANCTIONS**

#### **ARTICLE 42 — REJECTION OF INELIGIBLE COSTS**

##### **42.1 Conditions**

The JU will — after **termination of the participation of a beneficiary**, at the time of an **interim payment, at the payment of the balance or afterwards** — reject any costs which are ineligible (see Article 6), in particular following checks, reviews, audits or investigations (see Article 22).

The rejection may also be based on the **extension of findings from other grants to this grant** (see Article 22.5.2).

##### **42.2 Ineligible costs to be rejected — Calculation — Procedure**

Ineligible costs will be rejected in full.

If the rejection of costs does not lead to a recovery (see Article 44), the JU will formally notify the coordinator or beneficiary concerned of the rejection of costs, the amounts and the reasons why (if applicable, together with the notification of amounts due; see Article 21.5). The coordinator or

beneficiary concerned may — within 30 days of receiving notification — formally notify the JU of its disagreement and the reasons why.

If the rejection of costs leads to a recovery, the JU will follow the contradictory procedure with pre-information letter set out in Article 44.

### 42.3 Effects

If the JU rejects costs at the time of an **interim payment** or **the payment of the balance**, it will deduct them from the total eligible costs declared, for the action, in the periodic or final summary financial statement (see Articles 20.3 and 20.4). It will then calculate the interim payment or payment of the balance as set out in Articles 21.3 or 21.4.

If the JU rejects costs **after termination of the participation of a beneficiary**, it will deduct them from the costs declared by the beneficiary in the termination report and include the rejection in the calculation after termination (see Article 50.2 and 50.3).

If the JU — **after an interim payment but before the payment of the balance** — rejects costs declared in a periodic summary financial statement, it will deduct them from the total eligible costs declared, for the action, in the next periodic summary financial statement or in the final summary financial statement. It will then calculate the interim payment or payment of the balance as set out in Articles 21.3 or 21.4.

If the JU rejects costs **after the payment of the balance**, it will deduct the amount rejected from the total eligible costs declared, by the beneficiary, in the final summary financial statement. It will then calculate the revised final grant amount as set out in Article 5.4.

## ARTICLE 43 — REDUCTION OF THE GRANT

### 43.1 Conditions

The JU may — **after termination of the participation of a beneficiary, at the payment of the balance** or **afterwards** — reduce the grant amount (see Article 5.1), if :

- (a) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed:
  - (i) substantial errors, irregularities or fraud or
  - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles) or
- (b) a beneficiary (or a natural person who has the power to represent or take decision on its behalf) has committed — in other EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2).

### 43.2 Amount to be reduced — Calculation — Procedure

The amount of the reduction will be proportionate to the seriousness of the errors, irregularities or fraud or breach of obligations.

Before reduction of the grant, the JU will formally notify a **‘pre-information letter’** to the coordinator or beneficiary concerned:

- informing it of its intention to reduce the grant, the amount it intends to reduce and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the JU does not receive any observations or decides to pursue reduction despite the observations it has received, it will formally notify **confirmation** of the reduction (if applicable, together with the notification of amounts due; see Article 21).

### 43.3 Effects

If the JU reduces the grant **after termination of the participation of a beneficiary**, it will calculate the reduced grant amount for that beneficiary and then determine the amount due to that beneficiary (see Article 50.2 and 50.3).

If the JU reduces the grant **at the payment of the balance**, it will calculate the reduced grant amount for the action and then determine the amount due as payment of the balance (see Articles 5.3.4 and 21.4).

If the JU reduces the grant **after the payment of the balance**, it will calculate the revised final grant amount for the beneficiary concerned (see Article 5.4). If the revised final grant amount for the beneficiary concerned is lower than its share of the final grant amount, the JU will recover the difference (see Article 44).

## ARTICLE 44 — RECOVERY OF UNDUE AMOUNTS

### 44.1 Amount to be recovered — Calculation — Procedure

The JU will — after **termination of the participation of a beneficiary, at the payment of the balance or afterwards** — claim back any amount that was paid, but is not due under the Agreement.

Each beneficiary’s financial responsibility in case of recovery is limited to its own debt (including undue amounts paid by the JU for costs declared by its linked third parties), except for the amount retained for the Guarantee Fund (see Article 21.4).

#### 44.1.1 Recovery after termination of a beneficiary’s participation

If recovery takes place after termination of a beneficiary’s participation (including the coordinator), the JU will claim back the undue amount from the beneficiary concerned, by formally notifying it a debit note (see Article 50.2 and 50.3). This note will specify the amount to be recovered, the terms and the date for payment.

If payment is not made by the date specified in the debit note, the JU will **recover** the amount:

- (a) by **‘offsetting’** it — without the beneficiary’s consent — against any amounts owed to the beneficiary concerned by the JU.



In exceptional circumstances, to safeguard the EU's or JU's financial interests, the JU may offset before the payment date specified in the debit note;

(b) if a linked third party has accepted joint and several liability (see Article 14), by **holding the third party liable** up to the maximum JU contribution indicated, for the linked third party, in the estimated budget (see Annex 2) and/or

(c) by **taking legal action** (see Article 57).

If payment is not made by the date specified in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the JU receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC<sup>29</sup> applies.

#### 44.1.2 Recovery at payment of the balance

If the payment of the balance takes the form of a recovery (see Article 21.4), the JU will formally notify a '**pre-information letter**' to the coordinator:

- informing it of its intention to recover, the amount due as the balance and the reasons why;
- specifying that it intends to deduct the amount to be recovered from the amount retained for the Guarantee Fund;
- requesting the coordinator to submit a report on the distribution of payments to the beneficiaries within 30 days of receiving notification, and
- inviting the coordinator to submit observations within 30 days of receiving notification.

If no observations are submitted or the JU decides to pursue recovery despite the observations it has received, it will **confirm recovery** (together with the notification of amounts due; see Article 21.5) and:

- pay the difference between the amount to be recovered and the amount retained for the Guarantee Fund, **if the difference is positive** or
- formally notify to the coordinator a **debit note** for the difference between the amount to be recovered and the amount retained for the Guarantee Fund, **if the difference is negative**. This note will also specify the terms and the date for payment.

If the coordinator does not repay the JU by the date in the debit note and has not submitted the report

<sup>29</sup> Directive 2007/64/EC of the European Parliament and of the Council of 13 November 2007 on payment services in the internal market amending Directives 97/7/EC, 2002/65/EC, 2005/60/EC and 2006/48/EC and repealing Directive 97/5/EC (OJ L 319, 05.12.2007, p. 1).

on the distribution of payments: the JU will **recover** the amount set out in the debit note from the coordinator (see below).

If the coordinator does not repay the JU by the date in the debit note, but has submitted the report on the distribution of payments: the JU will:

- (a) identify the beneficiaries for which the amount calculated as follows is negative:

$\{ \{ \{ \text{beneficiary's costs declared in the final summary financial statement and approved by the JU} \}$   
multiplied by the reimbursement rate set out in Article 5.2 for the beneficiary concerned

plus

its linked third parties' costs declared in the final summary financial statement and approved by the JU  
multiplied by the reimbursement rate set out in Article 5.2 for each linked third party concerned}

divided by

the JU contribution for the action calculated according to Article 5.3.1}

multiplied by

the final grant amount (see Article 5.3)},

minus

{pre-financing and interim payments received by the beneficiary}}.

- (b) formally notify to each beneficiary identified according to point (a) a **debit note** specifying the terms and date for payment. The amount of the debit note is calculated as follows:

$\{ \{ \text{amount calculated according to point (a) for the beneficiary concerned} \}$

divided by

the sum of the amounts calculated according to point (a) for all the beneficiaries identified according  
to point (a)}

multiplied by

the amount set out in the debit note formally notified to the coordinator}.

If payment is not made by the date specified in the debit note, the JU will **recover** the amount:

- (a) by **offsetting** it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the JU.

In exceptional circumstances, to safeguard the EU's or JU's financial interests, the JU may offset before the payment date specified in the debit note;

- (b) by **drawing on the Guarantee Fund**. The JU will formally notify the beneficiary concerned the debit note on behalf of the Guarantee Fund and recover the amount:

- (i) if a linked third party has accepted joint and several liability (see Article 14), by **holding the third party liable** up to the maximum JU contribution indicated, for the linked third party, in the estimated budget (see Annex 2) and/or
- (ii) by **taking legal action** (see Article 57).

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the JU receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

#### 44.1.3 Recovery of amounts after payment of the balance

If, for a beneficiary, the revised final grant amount (see Article 5.4) is lower than its share of the final grant amount, it must repay the difference to the JU.

The beneficiary's share of the final grant amount is calculated as follows:

$$\left\{ \left\{ \begin{array}{l} \text{beneficiary's costs declared in the final summary financial statement and approved by the JU multiplied by} \\ \text{the reimbursement rate set out in Article 5.2 for the beneficiary concerned} \end{array} \right\} \right.$$

plus

$$\left\{ \begin{array}{l} \text{its linked third parties' costs declared in the final summary financial statement and approved by the JU} \\ \text{multiplied by the reimbursement rate set out in Article 5.2 for each linked third party concerned} \end{array} \right\}$$

divided by

$$\left\{ \begin{array}{l} \text{the JU contribution for the action calculated according to Article 5.3.1} \end{array} \right\}$$

multiplied by

$$\left\{ \begin{array}{l} \text{the final grant amount (see Article 5.3)} \end{array} \right\}.$$

If the coordinator has not distributed amounts received (see Article 21.7), the JU will also recover these amounts.

The JU will formally notify a **pre-information letter** to the beneficiary concerned:

- informing it of its intention to recover, the due amount and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If no observations are submitted or the JU decides to pursue recovery despite the observations it has received, it will **confirm** the amount to be recovered and formally notify to the beneficiary concerned a **debit note**. This note will also specify the terms and the date for payment.

If payment is not made by the date specified in the debit note, the JU will **recover** the amount:

- (a) by **offsetting** it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the JU.

In exceptional circumstances, to safeguard the EU's or JU's financial interests, the JU may offset before the payment date specified in the debit note;

(b) by **drawing on the Guarantee Fund**. The JU will formally notify the beneficiary concerned the debit note on behalf of the Guarantee Fund and recover the amount:

- (i) if a linked third party has accepted joint and several liability (see Article 14), by **holding the third party liable** up to the maximum JU contribution indicated, for the linked third party, in the estimated budget (see Annex 2) and/or
- (ii) by **taking legal action** (see Article 57).

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the date for payment in the debit note, up to and including the date the JU receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

## ARTICLE 45 — ADMINISTRATIVE SANCTIONS

In addition to contractual measures, the JU may also adopt administrative sanctions under Articles 84 and 89 of the JU Financial Rules read in conjunction with Articles 106 and 131(4) of the Financial Regulation No 966/2012 (i.e. exclusion from future procurement contracts, grants, prizes and expert contracts and/or financial penalties).

## SECTION 2 LIABILITY FOR DAMAGES

### ARTICLE 46 — LIABILITY FOR DAMAGES

#### 46.1 Liability of the JU

The JU cannot be held liable for any damage caused to the beneficiaries or to third parties as a consequence of implementing the Agreement, including for gross negligence.

The JU cannot be held liable for any damage caused by any of the beneficiaries or third parties involved in the action, as a consequence of implementing the Agreement.

#### 46.2 Liability of the beneficiaries

Except in case of force majeure (see Article 51), the beneficiaries must compensate the JU for any damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement.

## SECTION 3 SUSPENSION AND TERMINATION

### ARTICLE 47 — SUSPENSION OF PAYMENT DEADLINE

#### 47.1 Conditions

The JU may — at any moment — suspend the payment deadline (see Article 21.2 to 21.4) if a request for payment (see Article 20) cannot be approved because:

- (a) it does not comply with the provisions of the Agreement (see Article 20);
- (b) the technical or financial reports have not been submitted or are not complete or additional information is needed, or
- (c) there is doubt about the eligibility of the costs declared in the financial statements and additional checks, reviews, audits or investigations are necessary.

## 47.2 Procedure

The JU will formally notify the coordinator of the suspension and the reasons why.

The suspension will **take effect** the day notification is sent by the JU (see Article 52).

If the conditions for suspending the payment deadline are no longer met, the suspension will be **lifted** — and the remaining period will resume.

If the suspension exceeds two months, the coordinator may request the JU if the suspension will continue.

If the payment deadline has been suspended due to the non-compliance of the technical or financial reports (see Article 20) and the revised report or statement is not submitted or was submitted but is also rejected, the JU may also terminate the Agreement or the participation of the beneficiary (see Article 50.3.1(i)).

## ARTICLE 48 — SUSPENSION OF PAYMENTS

### 48.1 Conditions

The JU may — at any moment — suspend payments, in whole or in part and for one or more beneficiaries, if:

- (a) a beneficiary (or a natural person who has the power to represent or take decision on its behalf) has committed or is suspected of having committed:
  - (i) substantial errors, irregularities or fraud or
  - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles) or
- (b) a beneficiary (or a natural person who has the power to represent or take decision on its behalf) has committed — in other JU, EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2).

If payments are suspended for one or more beneficiaries, the JU will make partial payment(s) for the part(s) not suspended. If suspension concerns the payment of the balance, — once suspension is lifted

— the payment or the recovery of the amount(s) concerned will be considered the payment of the balance that closes the action.

## 48.2 Procedure

Before suspending payments, the JU will formally notify the coordinator or beneficiary concerned:

- informing it of its intention to suspend payments and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the JU does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify **confirmation** of the suspension. Otherwise, it will formally notify that the suspension procedure is not continued.

The suspension will **take effect** the day the confirmation notification is sent by the JU.

If the conditions for resuming payments are met, the suspension will be **lifted**. The JU will formally notify the coordinator or beneficiary concerned.

During the suspension, the periodic report(s) for all reporting periods except the last one (see Article 20.3), must not contain any individual financial statements from the beneficiary concerned and its linked third parties. The coordinator must include them in the next periodic report after the suspension is lifted or — if suspension is not lifted before the end of the action — in the last periodic report.

The beneficiaries may suspend implementation of the action (see Article 49.1) or terminate the Agreement or the participation of the beneficiary concerned (see Article 50.1 and 50.2).

## ARTICLE 49 — SUSPENSION OF THE ACTION IMPLEMENTATION

### 49.1 Suspension of the action implementation, by the beneficiaries

#### 49.1.1 Conditions

The beneficiaries may suspend implementation of the action or any part of it, if exceptional circumstances — in particular *force majeure* (see Article 51) — make implementation impossible or excessively difficult.

#### 49.1.2 Procedure

The coordinator must immediately formally notify to the JU the suspension (see Article 52), stating:

- the reasons why and
- the expected date of resumption.

The suspension will **take effect** the day this notification is received by the JU.

Once circumstances allow for implementation to resume, the coordinator must immediately formally notify the JU and request an **amendment** of the Agreement to set the date on which the action will be resumed, extend the duration of the action and make other changes necessary to adapt the action

to the new situation (see Article 55) — unless the Agreement or the participation of a beneficiary has been terminated (see Article 50).

The suspension will be **lifted** with effect from the resumption date set out in the amendment. This date may be before the date on which the amendment enters into force.

Costs incurred during suspension of the action implementation are not eligible (see Article 6).

## 49.2 Suspension of the action implementation, by the JU

### 49.2.1 Conditions

The JU may suspend implementation of the action or any part of it, if:

- (a) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed or is suspected of having committed:
  - (i) substantial errors, irregularities or fraud or
  - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles);
- (b) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed — in other JU, EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2), or
- (c) the action is suspected of having lost its scientific or technological relevance.

### 49.2.2 Procedure

Before suspending implementation of the action, the JU will formally notify the coordinator or beneficiary concerned:

- informing it of its intention to suspend the implementation and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the JU does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify **confirmation** of the suspension. Otherwise, it will formally notify that the procedure is not continued.

The suspension will **take effect** five days after confirmation notification is received (or on a later date specified in the notification).

It will be **lifted** if the conditions for resuming implementation of the action are met.

The coordinator or beneficiary concerned will be formally notified of the lifting and the Agreement will be **amended** to set the date on which the action will be resumed, extend the duration of the action and make other changes necessary to adapt the action to the new situation (see Article 55) — unless the Agreement has already been terminated (see Article 50).

The suspension will be lifted with effect from the resumption date set out in the amendment. This date may be before the date on which the amendment enters into force.

Costs incurred during suspension are not eligible (see Article 6).

The beneficiaries may not claim damages due to suspension by the JU (see Article 46).

Suspension of the action implementation does not affect the JU's right to terminate the Agreement or participation of a beneficiary (see Article 50), reduce the grant or recover amounts unduly paid (see Articles 43 and 44).

## **ARTICLE 50 — TERMINATION OF THE AGREEMENT OR OF THE PARTICIPATION OF ONE OR MORE BENEFICIARIES**

### **50.1 Termination of the Agreement, by the beneficiaries**

#### **50.1.1 Conditions and procedure**

The beneficiaries may terminate the Agreement.

The coordinator must formally notify termination to the JU (see Article 52), stating:

- the reasons why and
- the date the termination will take effect. This date must be after the notification.

If no reasons are given or if the JU considers the reasons do not justify termination, the Agreement will be considered to have been '**terminated improperly**'.

The termination will **take effect** on the day specified in the notification.

#### **50.1.2 Effects**

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a periodic report (for the open reporting period until termination; see Article 20.3) and
- (ii) the final report (see Article 20.4).

If the JU does not receive the reports within the deadline (see above), only costs which are included in an approved periodic report will be taken into account.

The JU will **calculate** the final grant amount (see Article 5.3) and the balance (see Article 21.4) on the basis of the reports submitted. Only costs incurred until termination are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Improper termination may lead to a reduction of the grant (see Article 43).

After termination, the beneficiaries' obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

### **50.2 Termination of the participation of one or more beneficiaries, by the beneficiaries**

### 50.2.1 Conditions and procedure

The participation of one or more beneficiaries may be terminated by the coordinator, on request of the beneficiary concerned or on behalf of the other beneficiaries.

The coordinator must formally notify termination to the JU (see Article 52) and inform the beneficiary concerned.

If the coordinator's participation is terminated without its agreement, the formal notification must be done by another beneficiary (acting on behalf of the other beneficiaries).

The notification must include:

- the reasons why;
- the opinion of the beneficiary concerned (or proof that this opinion has been requested in writing);
- the date the termination takes effect. This date must be after the notification, and
- a request for amendment (see Article 55), with a proposal for reallocation of the tasks and the estimated budget of the beneficiary concerned (see Annexes 1 and 2) and, if necessary, the addition of one or more new beneficiaries (see Article 56). If termination takes effect after the period set out in Article 3, no request for amendment must be included unless the beneficiary concerned is the coordinator. In this case, the request for amendment must propose a new coordinator.

If this information is not given or if the JU considers that the reasons do not justify termination, the participation will be considered to have been **terminated improperly**.

The termination will **take effect** on the day specified in the notification.

### 50.2.2 Effects

The coordinator must — within 30 days from when termination takes effect — submit:

- (i) a report on the distribution of payments to the beneficiary concerned and
- (ii) if termination takes effect during the period set out in Article 3, a '**termination report**' from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, an overview of the use of resources, the individual financial statement and, if applicable, the certificate on the financial statement (see Articles 20.3 and 20.4).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 20.3).

If the request for amendment is rejected by the JU (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the Agreement may be terminated according to Article 50.3.1(c).

If the request for amendment is accepted by the JU, the Agreement is **amended** to introduce the necessary changes (see Article 55).

The JU will — on the basis of the periodic reports, the termination report and the report on the distribution of payments — **calculate** the amount which is due to the beneficiary and if the (pre-financing and interim) payments received by the beneficiary exceed this amount.

The **amount which is due** is calculated in the following steps:

Step 1 — Application of the reimbursement rate to the eligible costs

The grant amount for the beneficiary is calculated by applying the reimbursement rate(s) to the total eligible costs declared by the beneficiary and its linked third parties in the termination report and approved by the JU.

Only costs incurred by the beneficiary concerned until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Step 2 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations

In case of a reduction (see Article 43), the JU will calculate the reduced grant amount for the beneficiary by deducting the amount of the reduction (calculated in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations, in accordance with Article 43.2) from the grant amount for the beneficiary.

If the payments received **exceed the amounts due**:

- if termination takes effect during the period set out in Article 3 and the request for amendment is accepted, the beneficiary concerned must repay to the coordinator the amount unduly received. The JU will formally notify the amount unduly received and request the beneficiary concerned to repay it to the coordinator within 30 days of receiving notification. If it does not repay the coordinator, the JU will draw upon the Guarantee Fund to pay the coordinator and then notify a **debit note** on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- in all other cases, in particular if termination takes effect after the period set out in Article 3, the JU will formally notify a **debit note** to the beneficiary concerned. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the JU the amount due and the JU will notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- if the beneficiary concerned is the former coordinator, it must repay the new coordinator according to the procedure above, unless:
  - termination takes effect after an interim payment and
  - the former coordinator has not distributed amounts received as pre-financing or interim payments (see Article 21.7).

In this case, the JU will formally notify a **debit note** to the former coordinator. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the JU the amount due. The JU will then pay the new coordinator and notify a debit note on behalf of the Guarantee Fund to the former coordinator (see Article 44).

If the payments received **do not exceed the amounts due**: amounts owed to the beneficiary concerned will be included in the next interim or final payment.

If the JU does not receive the termination report within the deadline (see above), only costs included in an approved periodic report will be taken into account.

If the JU does not receive the report on the distribution of payments within the deadline (see above), it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

Improper termination may lead to a reduction of the grant (see Article 43) or termination of the Agreement (see Article 50).

After termination, the concerned beneficiary's obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

### **50.3 Termination of the Agreement or the participation of one or more beneficiaries, by the JU**

#### **50.3.1 Conditions**

The JU may terminate the Agreement or the participation of one or more beneficiaries, if:

- (a) one or more beneficiaries do not accede to the Agreement (see Article 56);
- (b) a change to their legal, financial, technical, organisational or ownership situation (or those of its linked third parties) is likely to substantially affect or delay the implementation of the action or calls into question the decision to award the grant;
- (c) following termination of participation for one or more beneficiaries (see above), the necessary changes to the Agreement would call into question the decision awarding the grant or breach the principle of equal treatment of applicants (see Article 55);
- (d) implementation of the action is prevented by force majeure (see Article 51) or suspended by the coordinator (see Article 49.1) and either:
  - (i) resumption is impossible, or
  - (ii) the necessary changes to the Agreement would call into question the decision awarding the grant or breach the principle of equal treatment of applicants;
- (e) a beneficiary is declared bankrupt, being wound up, having its affairs administered by the courts, has entered into an arrangement with creditors, has suspended business activities, or is subject to any other similar proceedings or procedures under national law;
- (f) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has been found guilty of professional misconduct, proven by any means;
- (g) a beneficiary does not comply with the applicable national law on taxes and social security;

- (h) the action has lost scientific or technological relevance;
- (i) not applicable;
- (j) not applicable;
- (k) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed fraud, corruption, or is involved in a criminal organisation, money laundering or any other illegal activity;
- (l) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed:
  - (i) substantial errors, irregularities or fraud or
  - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles);
- (m) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed — in other JU, EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2);
- (n) despite a specific request by the JU, a beneficiary does not request — through the coordinator — an amendment to the Agreement to end the participation of one of its linked third parties or international partners that is in one of the situations under points (e), (f), (g), (k), (l) or (m) and to reallocate its tasks.

### 50.3.2 Procedure

Before terminating the Agreement or participation of one or more beneficiaries, the JU will formally notify the coordinator or beneficiary concerned:

- informing it of its intention to terminate and the reasons why and
- inviting it, within 30 days of receiving notification, to submit observations and — in case of Point (l.ii) above — to inform the JU of the measures to ensure compliance with the obligations under the Agreement.

If the JU does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify to the coordinator or beneficiary concerned **confirmation** of the termination and the date it will take effect. Otherwise, it will formally notify that the procedure is not continued.

The termination will **take effect**:

- for terminations under Points (b), (c), (e), (g), (h), (j), (l.ii) and (n) above: on the day specified in the notification of the confirmation (see above);
- for terminations under Points (a), (d), (f), (i), (k), (l.i) and (m) above: on the day after the notification of the confirmation is received.

### 50.3.3 Effects

#### (a) for **termination of the Agreement**:

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a periodic report (for the last open reporting period until termination; see Article 20.3) and
- (ii) a final report (see Article 20.4).

If the Agreement is terminated for breach of the obligation to submit reports (see Articles 20.8 and 50.3.1(l)), the coordinator may not submit any reports after termination.

If the JU does not receive the reports within the deadline (see above), only costs which are included in an approved periodic report will be taken into account.

The JU will **calculate** the final grant amount (see Article 5.3) and the balance (see Article 21.4) on the basis of the reports submitted. Only costs incurred until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

This does not affect the JU's right to reduce the grant (see Article 43) or to impose administrative sanctions (Article 45).

The beneficiaries may not claim damages due to termination by the JU (see Article 46).

After termination, the beneficiaries' obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

#### (b) for **termination of the participation of one or more beneficiaries**:

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a report on the distribution of payments to the beneficiary concerned;
- (ii) a request for amendment (see Article 55), with a proposal for reallocation of the tasks and estimated budget of the beneficiary concerned (see Annexes 1 and 2) and, if necessary, the addition of one or more new beneficiaries (see Article 56). If termination is notified after the period set out in Article 3, no request for amendment must be submitted unless the beneficiary concerned is the coordinator. In this case the request for amendment must propose a new coordinator, and
- (iii) if termination takes effect during the period set out in Article 3, a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, an overview of the use of resources, the individual financial statement and, if applicable, the certificate on the financial statement (see Article 20).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 20.3).

If the request for amendment is rejected by the JU (because it calls into question the decision

awarding the grant or breaches the principle of equal treatment of applicants), the Agreement may be terminated according to Article 50.3.1(c).

If the request for amendment is accepted by the JU, the Agreement is **amended** to introduce the necessary changes (see Article 55).

The JU will — on the basis of the periodic reports, the termination report and the report on the distribution of payments — **calculate** the amount which is due to the beneficiary and if the (pre-financing and interim) payments received by the beneficiary exceed this amount.

The **amount which is due** is calculated in the following steps:

Step 1 — Application of the reimbursement rate to the eligible costs

The grant amount for the beneficiary is calculated by applying the reimbursement rate(s) to the total eligible costs declared by the beneficiary and its linked third parties in the termination report and approved by the JU.

Only costs incurred by the beneficiary concerned until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Step 2 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations

In case of a reduction (see Article 43), the JU will calculate the reduced grant amount for the beneficiary by deducting the amount of the reduction (calculated in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations, in accordance with Article 43.2) from the grant amount for the beneficiary.

If the payments received **exceed the amounts due**:

- if termination takes effect during the period set out in Article 3 and the request for amendment is accepted, the beneficiary concerned must repay to the coordinator the amount unduly received. The JU will formally notify the amount unduly received and request the beneficiary concerned to repay it to the coordinator within 30 days of receiving notification. If it does not repay the coordinator, the JU will draw upon the Guarantee Fund to pay the coordinator and then notify a **debit note** on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- in all other cases, in particular if termination takes effect after the period set out in Article 3, the JU will formally notify a **debit note** to the beneficiary concerned. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the JU the amount due and the JU will notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- if the beneficiary concerned is the former coordinator, it must repay the new coordinator according to the procedure above, unless:
  - termination takes effect after an interim payment and



- the former coordinator has not distributed amounts received as pre-financing or interim payments (see Article 21.7).

In this case, the JU will formally notify a **debit note** to the former coordinator. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the JU the amount due. The JU will then pay the new coordinator and notify a debit note on behalf of the Guarantee Fund to the former coordinator (see Article 44).

If the payments received **do not exceed the amounts due**: amounts owed to the beneficiary concerned will be included in the next interim or final payment.

If the JU does not receive the termination report within the deadline (see above), only costs included in an approved periodic report will be taken into account.

If the JU does not receive the report on the distribution of payments within the deadline (see above), it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

After termination, the concerned beneficiary's obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

## **SECTION 4 — FORCE MAJEURE**

### **ARTICLE 51 — FORCE MAJEURE**

'Force majeure' means any situation or event that:

- prevents either party from fulfilling their obligations under the Agreement,
- was unforeseeable, exceptional situation and beyond the parties' control,
- was not due to error or negligence on their part (or on the part of third parties involved in the action), and
- proves to be inevitable in spite of exercising all due diligence.

The following cannot be invoked as force majeure:

- any default of a service, defect in equipment or material or delays in making them available, unless they stem directly from a relevant case of force majeure,
- labour disputes or strikes, or
- financial difficulties.

Any situation constituting force majeure must be formally notified to the other party without delay, stating the nature, likely duration and foreseeable effects.

The parties must immediately take all the necessary steps to limit any damage due to force majeure and do their best to resume implementation of the action as soon as possible.

The party prevented by force majeure from fulfilling its obligations under the Agreement cannot be considered in breach of them.

## **CHAPTER 7 FINAL PROVISIONS**

### **ARTICLE 52 — COMMUNICATION BETWEEN THE PARTIES**

#### **52.1 Form and means of communication**

Communication under the Agreement (information, requests, submissions, ‘formal notifications’, etc.) must:

- be made in writing and
- bear the number of the Agreement.

All communication must be made through the Participant Portal **electronic** exchange system and using the forms and templates provided there.

If — after the payment of the balance — the JU finds that a formal notification was not accessed, a second formal notification will be made by registered post with proof of delivery (‘formal notification on **paper**’). Deadlines will be calculated from the moment of the second notification.

Communications in the electronic exchange system must be made by persons authorised according to the Participant Portal Terms & Conditions. For naming the authorised persons, each beneficiary must have designated — before the signature of this Agreement — a ‘legal entity appointed representative (LEAR)’. The role and tasks of the LEAR are stipulated in his/her appointment letter (see Participant Portal Terms & Conditions).

If the electronic exchange system is temporarily unavailable, instructions will be given on the JU and Commission websites.

#### **52.2 Date of communication**

**Communications** are considered to have been made when they are sent by the sending party (i.e. on the date and time they are sent through the electronic exchange system).

**Formal notifications** through the **electronic** exchange system are considered to have been made when they are received by the receiving party (i.e. on the date and time of acceptance by the receiving party, as indicated by the time stamp). A formal notification that has not been accepted within 10 days after sending is considered to have been accepted.

Formal notifications **on paper** sent by **registered post** with proof of delivery (only after the payment of the balance) are considered to have been made on either:

- the delivery date registered by the postal service or
- the deadline for collection at the post office.

If the electronic exchange system is temporarily unavailable, the sending party cannot be considered in breach of its obligation to send a communication within a specified deadline.

### 52.3 Addresses for communication

The **electronic** exchange system must be accessed via the following URL:

<https://ec.europa.eu/research/participants/portal/desktop/en/projects/>

The JU will formally notify the coordinator and beneficiaries in advance any changes to this URL.

**Formal notifications on paper** (only after the payment of the balance) addressed **to the JU** must be sent to the official mailing address indicated on the JU's website.

Formal notifications on paper (only after the payment of the balance) addressed **to the beneficiaries** must be sent to their legal address as specified in the Participant Portal Beneficiary Register.

## ARTICLE 53 — INTERPRETATION OF THE AGREEMENT

### 53.1 Precedence of the Terms and Conditions over the Annexes

The provisions in the Terms and Conditions of the Agreement take precedence over its Annexes.

Annex 2 takes precedence over Annex 1.

### 53.2 Privileges and immunities

Nothing in the Agreement may be interpreted as a waiver of any privileges or immunities accorded to the *EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION* by its constituent documents or international law.

## ARTICLE 54 — CALCULATION OF PERIODS, DATES AND DEADLINES

In accordance with Regulation No 1182/71<sup>30</sup>, periods expressed in days, months or years are calculated from the moment the triggering event occurs.

The day during which that event occurs is not considered as falling within the period.

## ARTICLE 55 — AMENDMENTS TO THE AGREEMENT

### 55.1 Conditions

The Agreement may be amended, unless the amendment entails changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

Amendments may be requested by any of the parties.

---

<sup>30</sup> Regulation (EEC, Euratom) No 1182/71 of the Council of 3 June 1971 determining the rules applicable to periods, dates and time-limits (OJ L 124, 8.6.1971, p. 1).

## 55.2 Procedure

The party requesting an amendment must submit a request for amendment signed in the electronic exchange system (see Article 52).

The coordinator submits and receives requests for amendment on behalf of the beneficiaries (see Annex 3).

If a change of coordinator is requested without its agreement, the submission must be done by another beneficiary (acting on behalf of the other beneficiaries).

The request for amendment must include:

- the reasons why;
- the appropriate supporting documents, and
- for a change of coordinator without its agreement: the opinion of the coordinator (or proof that this opinion has been requested in writing).

The JU may request additional information.

If the party receiving the request agrees, it must sign the amendment in the electronic exchange system within 45 days of receiving notification (or any additional information the JU has requested). If it does not agree, it must formally notify its disagreement within the same deadline. The deadline may be extended, if necessary for the assessment of the request. If no notification is received within the deadline, the request is considered to have been rejected

An amendment **enters into force** on the day of the signature of the receiving party.

An amendment **takes effect** on the date agreed by the parties or, in the absence of such an agreement, on the date on which the amendment enters into force.

## ARTICLE 56 — ACCESSION TO THE AGREEMENT

### 56.1 Accession of the beneficiaries mentioned in the Preamble

The other beneficiaries must accede to the Agreement by signing the Accession Form (see Annex 3) in the electronic exchange system (see Article 52) within 30 days after its entry into force (see Article 58) and for beneficiaries for which the JU has requested joint and several liability of a linked third party, by also submitting — at accession — a declaration on joint and several liability (see Annex 3a) signed by the third party.

They will assume the rights and obligations under the Agreement with effect from the date of its entry into force (see Article 58).

If a beneficiary does not accede to the Agreement within the above deadline, the coordinator must — within 30 days — request an amendment to make any changes necessary to ensure proper implementation of the action. This does not affect the JU's right to terminate the Agreement (see Article 50).

### 56.2 Addition of new beneficiaries



In justified cases, the beneficiaries may request the addition of a new beneficiary.

For this purpose, the coordinator must submit a request for amendment in accordance with Article 55. It must include an Accession Form (see Annex 3) signed by the new beneficiary in the electronic exchange system (see Article 52).

New beneficiaries must assume the rights and obligations under the Agreement with effect from the date of their accession specified in the Accession Form (see Annex 3).

## **ARTICLE 57 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES**

### **57.1 Applicable law**

The Agreement is governed by the applicable EU law, supplemented if necessary by the law of Belgium.

### **57.2 Dispute settlement**

If a dispute concerning the interpretation, application or validity of the Agreement cannot be settled amicably, the General Court — or, on appeal, the Court of Justice of the European Union — has sole jurisdiction. Such actions must be brought under Article 272 of the Treaty on the Functioning of the EU (TFEU).

As an exception, if such a dispute is between the JU and SINTEF AS, SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIENNE CIVILS ET MILITAIRES, the competent Belgian courts have sole jurisdiction.

As an exception, for the following beneficiaries:

- EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION

such disputes must — if they cannot be settled amicably — be referred to arbitration. Each party must formally notify to the other party its intention of resorting to arbitration and the identity of the arbitrator. The Permanent Court of Arbitration Optional Rules for Arbitration Involving International Organisations and States in force at the date of entry into force of the Agreement will apply. The appointing authority will be the Secretary-General of the Permanent Court of Arbitration following a written request submitted by either party. The arbitration proceedings must take place in Brussels and the language used in the arbitral proceedings will be English. The arbitral award will be binding on all parties and will not be subject to appeal.

If a dispute concerns administrative sanctions or offsetting, the beneficiaries must bring action before the General Court — or, on appeal, the Court of Justice of the European Union — under Article 263 TFEU.

## **ARTICLE 58 — ENTRY INTO FORCE OF THE AGREEMENT**

The Agreement will enter into force on the day of signature by the JU or the coordinator, depending on which is later.

### **SIGNATURES**

For the coordinator

For the JU



## **ANNEX 1 (part A)**

**Research and Innovation action**

**NUMBER — 874464 — PJ10-W2 PROSA**

## Table of Contents

1.1. The project summary.....	3
1.2. The list of beneficiaries.....	4
1.3. Workplan Tables - Detailed implementation.....	6
1.3.1. WT1 List of work packages.....	6
1.3.2. WT2 List of deliverables.....	7
1.3.3. WT3 Work package descriptions.....	9
Work package 1.....	9
Work package 2.....	11
Work package 3.....	14
Work package 4.....	17
Work package 5.....	21
1.3.4. WT4 List of milestones.....	23
1.3.5. WT5 Critical Implementation risks and mitigation actions.....	24
1.3.6 WT6 Summary of project effort in person-months.....	25
1.3.7. WT7 Tentative schedule of project reviews.....	27

# 1.1. The project summary

Project Number <sup>1</sup>	874464	Project Acronym <sup>2</sup>	PJ10-W2 PROSA
-----------------------------	--------	------------------------------	---------------

## One form per project

### General information

Project title <sup>3</sup>	Separation Management and Controller Tools
Starting date <sup>4</sup>	01/12/2019
Duration in months <sup>5</sup>	37
Call (part) identifier <sup>6</sup>	H2020-SESAR-2019-1
Topic	SESAR-IR-VLD-WAVE2-10-2019 PJ.10 W2 Separation Management and Controller Tools
Fixed EC Keywords	
Free keywords	Controller Support Tools, Separation Management, Controller License, Validation, Flight Centric ATC, Collaborative Control, Delegation of Airspace, HMI Interaction Modes, Speech Recognition, CWP

### Abstract <sup>7</sup>

This project is part of the Industrial Research & Validation phase, developed under the SJU Private Public Partnership and will contribute to the SESAR2020 Programme Lifecycle. It will build upon previous work in SESAR2020 Wave 1. The project will further mature the concept of “Flight Centric ATC” where an air traffic controller is responsible for a certain number of aircraft throughout their entire flight segment within a given airspace whereas other controllers are responsible for different aircraft within the same airspace. Another objective is to enable collaborative control operations, where ATCOs will be able to issue instructions to aircraft that involve out-of-sector manoeuvring, without the coordination required in conventional operations. This will be accompanied by an activity to identify and validate needs that might allow a Controller to operate in any airspace classified as a particular type. That is, the ATCO will be validated on method and tools rather than a geographic specified airspace. In addition, the project will investigate and develop the Contingency and Delegation of Airspace Operational Use Cases. It will identify the impacts on the services defined in the Virtual Centre concept and validate the concept within a realistic environment based on contingency needs or on organisation needs (either static, on a fixed-time transfer schedule, or dynamic, when the traffic density is below/above a certain level). In order to reduce the workload and mental strain on the controllers in the ATC centre, especially under high traffic density/complexity situations, the project will investigate new human machine interface interaction modes and technologies. This work will consider modern design and development approaches as well as methodologies such as modularity, service-oriented architecture, adaptive automation. The project will in particular address Automatic Speech Recognition, Attention Guidance and enhanced User Profile Management Systems.

## 1.2. List of Beneficiaries

Project Number <sup>1</sup>	874464	Project Acronym <sup>2</sup>	PJ10-W2 PROSA
-----------------------------	--------	------------------------------	---------------

### List of Beneficiaries

No	Name	Short name	Country	Project entry month <sup>8</sup>	Project exit month
1	DFS DEUTSCHE FLUGSICHERUNG GMBH	DFS	Germany	1	37
2	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	DLR	Germany	1	37
3	STICHTING NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM	NLR	Netherlands	1	37
4	RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK	ANS CR (B4)	Czechia	1	37
5	LETOVE PREVADZKOVE SLUZBY SLOVENSKEJ REPUBLIKY, STATNY PODNIK	LPS SR (B4)	Slovakia	1	37
6	VALSTYBES IMONE ORO NAVIGACIJA	ON (B4)	Lithuania	1	37
7	POLSKA AGENCJA ZEGLUGI POWIETRZNEJ	PANSA (B4)	Poland	1	37
8	AUSTRO CONTROL OSTERREICHISCHE GESELLSCHAFT FUR ZIVILLUFTFAHRT MBH	ACG/COOPANS	Austria	1	37
9	CROATIA CONTROL, CROATIAN AIR NAVIGATION SERVICES LTD	CCL/COOPANS	Croatia	1	37
10	UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY	IAA/COOPANS	Ireland	1	37
11	LUFTFARTSVERKET	LFV/COOPANS	Sweden	1	37
12	NAVIAIR	Naviair/COOPANS	Denmark	1	37
13	DIRECTION DES SERVICES DE LA NAVIGATION AERIENNE	DSNA	France	1	37
14	ENAIRES	ENAIRES	Spain	1	37
15	ENAV SPA	ENAV	Italy	1	37
16	EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION	EUROCONTROL	Belgium	1	37
17	FREQUENTIS AG	FRQ (FSP)	Austria	1	37
18	HUNGAROCONTROL MAGYAR LEGIFORGALMISZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG	HC (FSP)	Hungary	1	37
19	INDRA SISTEMAS SA	INDRA	Spain	1	37
20	LEONARDO - SOCIETA PER AZIONI	LDO	Italy	1	37
21	SINTEF AS	SINTEF (NATMIG)	Norway	1	37

## 1.2. List of Beneficiaries

No	Name	Short name	Country	Project entry month <sup>8</sup>	Project exit month
22	NATS (EN ROUTE) PUBLIC LIMITED COMPANY	NATS	United Kingdom	1	37
23	SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIENNE CIVILS ET MILITAIRES	SKYGUIDE	Switzerland	1	37
24	THALES LAS FRANCE SAS	THALES AIR SYS	France	1	37
25	AIRBUS	AIRBUS SAS	France	1	37
26	ATOS BELGIUM	ATOS (FSP)	Belgium	1	37
27	AIRTEL ATN LIMITED	AIRTEL (NATMIG)	Ireland	1	37
28	SAAB AKTIEBOLAG	SAAB (NATMIG)	Sweden	1	37

## 1.3. Workplan Tables - Detailed Implementation

Associated with document Ref. Ares(2019)7261339 - 25/11/2019

### 1.3.1. WT1 List of work packages

WP Number <sup>9</sup>	WP Title	Lead beneficiary <sup>10</sup>	Person-months <sup>11</sup>	Start month <sup>12</sup>	End month <sup>13</sup>
WP1	Management	1 - DFS	37.50	1	37
WP2	Flight-centric ATC and Improved Distribution of Separation	22 - NATS	1,065.35	1	37
WP3	Delegation of Airspace amongst ATSUs	15 - ENAV	1,416.79	1	37
WP4	HMI Interaction modes for ATC centre	20 - LDO	637.84	1	37
WP5	Ethics requirements	1 - DFS	N/A	1	37
<b>Total</b>			3,157.48		

### 1.3.2. WT2 list of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	WP number <sup>9</sup>	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D1.1	Project Management Plan	WP1	1 - DFS	Report	Confidential, only for members of the consortium (including the Commission Services)	3
D1.2	Progress Report 1	WP1	1 - DFS	Report	Confidential, only for members of the consortium (including the Commission Services)	11
D1.3	Progress Report 2	WP1	1 - DFS	Report	Confidential, only for members of the consortium (including the Commission Services)	23
D1.4	Final Project Report	WP1	1 - DFS	Report	Confidential, only for members of the consortium (including the Commission Services)	33
D2.1	PJ.10-W2-73 CC solution pack V2	WP2	22 - NATS	Report	Public	33
D2.2	PJ.10-W2-73 NGCV solution pack V2	WP2	22 - NATS	Report	Public	33
D2.3	PJ.10-W2-73 FCA solution pack V3	WP2	22 - NATS	Report	Public	36
D3.1	PJ.10-W2-93 solution pack V2	WP3	15 - ENAV	Report	Public	18
D3.2	PJ.10-W2-93 solution pack V3	WP3	15 - ENAV	Report	Public	35
D4.1	PJ.10-W2-96 ASR solution pack TLR6	WP4	20 - LDO	Report	Public	36
D4.2	PJ.10-W2-96 AG solution pack TLR6	WP4	20 - LDO	Report	Public	32
D4.3	PJ.10-W2-96 UPMS solution pack TLR6	WP4	20 - LDO	Report	Public	32
D5.1	POPD - Requirement No. 1	WP5	1 - DFS	Ethics	Confidential, only for members of the consortium (including the	3

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>WP number<sup>9</sup></b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
					Commission Services)	
D5.2	POPD - Requirement No. 2	WP5	1 - DFS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	4
D5.3	GEN - Requirement No. 3	WP5	1 - DFS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	4
D5.4	OEI - Requirement No. 4	WP5	1 - DFS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	13

### 1.3.3. WT3 Work package descriptions

<b>Work package number</b> <sup>9</sup>	WP1	<b>Lead beneficiary</b> <sup>10</sup>	1 - DFS
<b>Work package title</b>	Management		
<b>Start month</b>	1	<b>End month</b>	37

#### Objectives

Coordination and monitoring of project's progress to accomplish the main objectives regarding time and resources. Coordinate with SESAR 2020 programme and fulfil the administrative requirements of the grant agreement.

#### Description of work and role of partners

##### **WP1 - Management** [Months: 1-37]

##### **DFS**

Project Management and Coordination (M1-M36). Day-to-day monitoring and control of project progress with respect to project objectives, timetable and acceptance of deliverables. Responsible to carry out the main management activities at project level and the reporting process, and assure timed delivery. Meetings to be organized: Review meeting with SJU (annual), PMB, EPMB. The Project Manager (PM), together with the PMB and EPMB, will act as project steering committee. Change requests will be handled by the committee to allow flexibility.

Project Quality Management and Standardisation (M1-M36). The coordinator will ensure the quality of the project. A project management handbook has been produced by SJU to define certain processes.

Reporting and Communication with the SJU (M1-M36). In cooperation with all involved partners, the POC for Communication Activities is responsible to provide the required periodic and final reports to the SJU/EC.

Technical and Scientific Coordination (M1-M36). The Project Content Integration Leader (PCIL) will organise the technical and scientific conceptualisation of the project, the coordination of technical activities in the project, and the development of a common project understanding and vision across the timeline. He/she coordinates the PCIT (Project Content Integration Team).

Contributions to the SESAR2020 Programme Management (M1-M36). The coordinator provides input to the Programme Committee and its sub-committees meetings and supports discussions through the participating Members of the committee.

Administration of the project according to the grant agreement.

#### Participation per Partner

<b>Partner number and short name</b>	<b>WP1 effort</b>
1 - DFS	37.50
<b>Total</b>	37.50

#### List of deliverables

<b>Deliverable Number</b> <sup>14</sup>	<b>Deliverable Title</b>	<b>Lead beneficiary</b>	<b>Type</b> <sup>15</sup>	<b>Dissemination level</b> <sup>16</sup>	<b>Due Date (in months)</b> <sup>17</sup>
D1.1	Project Management Plan	1 - DFS	Report	Confidential, only for members of the consortium (including the Commission Services)	3
D1.2	Progress Report 1	1 - DFS	Report	Confidential, only for members of the	11

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
				consortium (including the Commission Services)	
D1.3	Progress Report 2	1 - DFS	Report	Confidential, only for members of the consortium (including the Commission Services)	23
D1.4	Final Project Report	1 - DFS	Report	Confidential, only for members of the consortium (including the Commission Services)	33

### Description of deliverables

This workpackage provides the following deliverables:

D1.1 : Project Management Plan [3]

Defines how the project is executed, monitored, controlled and closed.

D1.2 : Progress Report 1 [11]

Annual progress report.

D1.3 : Progress Report 2 [23]

Annual progress report.

D1.4 : Final Project Report [33]

Project achievements.

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
--------------------------------	-----------------	------------------	----------------------	-----------------------

<b>Work package number</b> <sup>9</sup>	WP2	<b>Lead beneficiary</b> <sup>10</sup>	22 - NATS
<b>Work package title</b>	Flight-centric ATC and Improved Distribution of Separation		
<b>Start month</b>	1	<b>End month</b>	37

### Objectives

- Assigning aircraft to ATCOs without references to geographical sectors, and have the aircraft controlled by that same ATCO across two or more geographical sectors.
- Validate the benefits of flight-centric ATC (all CD&R support tools that may be used in sectorized ATC shall be considered in both the reference and the solution scenarios, even if they have been developed specifically for this solution because they are considered to be a pre-requisite for flight-centric ATC).
- Research the transition aspects between flight centric and sector-based ATC, and the transition from main to fall-back systems.
- Validate the benefits of collaborative control with planned boundaries, which was researched in Wave 1 by PJ10-01c, and is also included in the scope of this solution. In this concept, sectors are retained as they are today, with aircraft being assigned to a sector according to its geographic location, and with boundaries.
- Address the challenges related to the legal responsibility for traffic separation in the collaborative control environment or flight-centric environment, which may include shared responsibility between controllers in the area and may also be linked to the performance of the support tools that support the concepts.

### Description of work and role of partners

#### **WP2 - Flight-centric ATC and Improved Distribution of Separation** [Months: 1-37]

NATS, DFS, DLR, ANS CR (B4), LFV/COOPANS, ENAIRE, ENAV, EUROCONTROL, FRQ (FSP), HC (FSP), INDRA, LDO, SKYGUIDE, THALES AIR SYS

**Solution Management (NATS):** This task will be led and facilitated by NATS reporting to the Project Leadership. NATS will be responsible as per the Solution Lead roles and responsibilities and ensure that all necessary reporting is delivered as per schedule.

#### **V2 Phase**

- CM-0309 — Sector Team Operations Adapted to Collaborative Operating Procedures involving reduced tactical co-ordination in the TMA
- CM-0310 — Sector Team Operations Adapted to Collaborative Operating Procedures involving reduced tactical co-ordination in En-Route
- SDM-0203 — Generic (non-geographical) Controller Validations

**Prepare SPR-INTEROP/OSD for V2 (NATS):** This task will be resourced and led by NATS and will cover the sub solutions Collaborative Control and Generic (non-geographical) Controller Validations only. DFS will support the Collaborative Control concept development and have an input and review role in this task. NATS will work with DFS to investigate if there are any common technical requirements applicable to Flight Centric and Collaborative Control concepts. Skyguide will work with NATS on the development and maturity of the Generic (non-geographical) Controller Validations concept. Skyguide will develop a separate thread in co-ordination with the Virtual Centres concept and NATS will develop the concept in co-ordination and applicability to the Flight Centric and Collaborative Control concepts.

**Prepare TS/IRS for V2 (INDRA):** The RTS will be built on the NATS ACE platform and no IBP will be required. However, NATS will work with INDRA to ensure that the technical requirements are suitably captured in the TS/IRS and communicated effectively as an initial activity for the V3 work.

**Prepare VALP for V2 (NATS):** NATS and Skyguide will work together to provide a suitable plan for validation of the Collaborative Control and Generic (non-geographical) Controller Validations concepts.

**Prepare VALR for V2 (NATS):** NATS and Skyguide will work together to annotate all results from validation according to Collaborative Control and Generic (non-geographical) Controller Validations concepts.

**Prepare CBA for V2 (NATS):** NATS and Skyguide will work together to provide a suitable CBA.

**Update MAT & CN & Gate Presentation (NATS):** NATS will prepare and facilitate Maturity assessment of the relevant V2 OI steps and provide a Contextual Note and Gate Presentation.

#### **V3 Phase**

- CM-0200-B — Flight-centric ATC in Non-Geographically-Constrained, Low and Medium complexity environment
  - CM-0200-C — Flight-centric ATC in Non-Geographically-Constrained, High and very High Complexity environment
- Prepare SPR-INTEROP/OSD for V3 (DFS):** DFS will lead the OSD task.

Prepare TS/IRS for V3 (INDRA): INDRA will ensure that the technical requirements are suitably captured in the TS/IRS and communicated effectively.

Prepare VALP for V3 (ENAIRES): ENAIRES will coordinate with all exercise leaders to provide a suitable plan for the validation of the Flight Centric ATC. Validation Objectives of all exercises will be integrated to provide a consistent validation path that ensures the full coverage of all aspects of the concept.

Prepare VALR for V3 (DLR (AT-One)): DLR (AT-ONE) will lead the VALR task with input from all validation exercise leads.

Prepare CBA for V3 (EUROCONTROL): EUROCONTROL will lead the CBA task with input from all other partners working on the Flight Centric ATC Concept.

Update MAT & CN & Gate Presentation (NATS): NATS will lead a Maturity assessment of the relevant V3 OI steps and provide a Contextual Note and Gate Presentation.

#### Participation per Partner

Partner number and short name	WP2 effort
1 - DFS	156.00
2 - DLR	35.80
4 - ANS CR (B4)	5.00
AFT	39.00
Integra	3.25
11 - LFV/COOPANS	5.04
14 - ENAIRES	14.70
CRIDA	67.03
INECO	25.00
15 - ENAV	4.54
TECHNO SKY	4.36
16 - EUROCONTROL	186.30
17 - FRQ (FSP)	14.91
PDTS	11.04
18 - HC (FSP)	50.20
19 - INDRA	221.00
20 - LDO	32.30
22 - NATS	137.90
23 - SKYGUIDE	5.38
24 - THALES AIR SYS	46.60
<b>Total</b>	<b>1,065.35</b>

### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D2.1	PJ.10-W2-73 CC solution pack V2	22 - NATS	Report	Public	33
D2.2	PJ.10-W2-73 NGCV solution pack V2	22 - NATS	Report	Public	33
D2.3	PJ.10-W2-73 FCA solution pack V3	22 - NATS	Report	Public	36

### Description of deliverables

This workpackage provides the following deliverables:

D2.1 : PJ.10-W2-73 CC solution pack V2 [33]

Consists of: • Safety, Performance and Operational Requirements (SPR-INTEROP/OSED) V2 • Technical Specification (TS/IRS) V2 • Validation Report (VALR) V2 • Cost Benefit Analysis (CBA) V2

D2.2 : PJ.10-W2-73 NGCV solution pack V2 [33]

Consists of: • Safety, Performance and Operational Requirements (SPR-INTEROP/OSED) V2 • Technical Specification (TS/IRS) V2 • Validation Report (VALR) V2 • Cost Benefit Analysis (CBA) V2

D2.3 : PJ.10-W2-73 FCA solution pack V3 [36]

Consists of: • Safety, Performance and Operational Requirements (SPR-INTEROP/OSED) V3 • Technical Specification (TS/IRS) V3 • Validation Report (VALR) V3 • Cost Benefit Analysis (CBA) for V3

### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	V2 Gate for Solution PJ.10-W2-73 CC	22 - NATS	34	All documents for solution pack delivered and Gate review with SJU has been passed.
MS2	V2 Gate for Solution PJ.10-W2-73 NGCV	22 - NATS	34	All documents for solution pack delivered and Gate review with SJU has been passed.
MS3	V3 Gate for Solution PJ.10-W2-73 FCA	22 - NATS	37	All documents for solution pack delivered and Gate review with SJU has been passed.

<b>Work package number</b> <sup>9</sup>	WP3	<b>Lead beneficiary</b> <sup>10</sup>	15 - ENAV
<b>Work package title</b>	Delegation of Airspace amongst ATSUs		
<b>Start month</b>	1	<b>End month</b>	37

### Objectives

- Identification and definition of the different use cases of Delegation of Airspace;
- Identification of the transition of the virtual centre services to ensure the adequate support to the implementation of the different delegation use cases,
- Develop prototypes and validation platforms to support validation of operational scenario, as Delegation of Airspace amongst ATSUs and contingency, ensuring greater flexibility and load-balancing between the ATSUs involved;
- Operational validation of the different use cases of delegation and contingency;

### Description of work and role of partners

#### **WP3 - Delegation of Airspace amongst ATSUs** [Months: 1-37]

ENAV, DFS, LPS SR (B4), ON (B4), PANSA (B4), CCL/COOPANS, LFV/COOPANS, Naviair/COOPANS, DSN, ENAIRE, EUROCONTROL, FRQ (FSP), HC (FSP), INDRA, LDO, NATS, SKYGUIDE, THALES AIR SYS

#### Description of work

This work package will be led by ENAV.

The work covers two threads, operational and technical, and a transversal validation stream:

- An operational thread, which aims at defining and validating the different types of Delegation of Airspace as described above.

The first input of this analysis of the delegation of Use cases has a strong relationship with SESAR 2020 W1 P15.09 in order to explore different use cases Delegation of Airspace amongst ATSUs in En-Route phase of flight.

The solution 93 will use the Operational Improvement (OI) already addressed in PJ15.09 at V1 maturity and will continue the analysis of the use case of delegation if airspace based on traffic / organisation needs (either static on fix-time transfer schedule (Day/Night) or dynamic e.g. when the traffic density is below/over certain level) or on contingency needs.

- A technical thread, which aims at specifying the impacts of the operational thread on the services defined in the Virtual centre concept.
- A Validation stream, that will validate the Operational context of Delegation of Airspace using Virtual Centre platforms of ad hoc platforms, with the definition of Functional and non-Functional Requirements during the production of the OSED for the definition of Use Cases. In this framework different Validation exercises are proposed in order to explore different level of maturity of the Operational Context (Complete list of the Operational use cases and assumption of the Validation context) and Technical Tread. (Infrastructure and the Virtual Centre Technology).

The list below show the main tasks assigned to each partner:

- ENAV is the Solution Leader, and will lead the validation activities of Exe No. 4 and contribute to the preparation of the corresponding OSED, VALP, VALR CBA (V2 and V3 phase). ENAV will also lead the task of CBA (V2 and V3), having the role of Contributor/Reviewer for the other exercises;
- B4 CONSORTIUM will give its contribution for validation activities of Exe No. 1 and Exe No. 5;
- COOPANS CONSORTIUM will take the lead of the Exe No. 5 (V3 phase) and will act as reviewer for the other validation activities;
- DFS will lead the OSED task (V2 and V3 phase) acting as a leader for validation activities of Exe No. 1.
- DSN will act as contributor in validation activities of exercise No. 1 giving support with ATCO and HF expertise;
- ENAIRE will take the leadership of the validation activities of exercise No. 2 (V3 phase) and the VALP task;
- EUROCONTROL will give technical support for validation activities of Exe No. 1 (V2 phase);
- FREQUENTIS will provide voice communication service during validation activities of Exe No. 1 and No. 3;
- INDRA will act as contributor for validation activities of Exe No. 1 and No. 2 giving support as ADSP – Dynamic Service.
- LEONARDO will provide technical support for validation activities of Exe No. 1 (V2 phase) and will provide HMI for Exe No. 4 (V3 phase);
- NATS will act as contributor for the validation activities of Exe No. 1 (V2 phase);
- SKYGUIDE will take the leadership of Exe No. 3 (V3 phase) VALP and VALR task; From the Exe No. 1 SKYGUIDE will lead the task of VALP and VALR

- THALES AIR SYSTEM will act as contributor in validation activities of the Exe No. 5;

#### Participation per Partner

Partner number and short name	WP3 effort
1 - DFS	24.50
5 - LPS SR (B4)	13.89
6 - ON (B4)	19.46
7 - PANSAs (B4)	43.64
9 - CCL/COOPANS	5.77
11 - LFV/COOPANS	3.56
12 - Naviair/COOPANS	9.75
13 - DSNAs	20.10
14 - ENAIRE	15.49
CRIDA	58.01
15 - ENAV	18.16
NAIS	11.06
TECHNO SKY	17.46
BIP	8.00
VMware	10.84
16 - EUROCONTROL	105.60
17 - FRQ (FSP)	15.37
PDTs	14.72
18 - HC (FSP)	37.84
19 - INDRA	359.00
20 - LDO	209.70
22 - NATS	15.60
23 - SKYGUIDE	30.07
SKYSOFT	21.10
24 - THALES AIR SYS	328.10
<b>Total</b>	<b>1,416.79</b>

#### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D3.1	PJ.10-W2-93 solution pack V2	15 - ENAV	Report	Public	18

### List of deliverables

<b>Deliverable Number<sup>14</sup></b>	<b>Deliverable Title</b>	<b>Lead beneficiary</b>	<b>Type<sup>15</sup></b>	<b>Dissemination level<sup>16</sup></b>	<b>Due Date (in months)<sup>17</sup></b>
D3.2	PJ.10-W2-93 solution pack V3	15 - ENAV	Report	Public	35

### Description of deliverables

This workpackage provides the following deliverables:

D3.1 : PJ.10-W2-93 solution pack V2 [18]

Consists of: • Safety, Performance and Operational Requirements (SPR-INTEROP/OSED) V2 • Technical Specification (TS/IRS) V2 • Validation Report (VALR) V2 • Cost Benefit Analysis (CBA) V2

D3.2 : PJ.10-W2-93 solution pack V3 [35]

Consists of: • Safety, Performance and Operational Requirements (SPR-INTEROP/OSED) V3 • Technical Specification (TS/IRS) V3 • Validation Report (VALR) V3 • Cost Benefit Analysis (CBA) for V3

### Schedule of relevant Milestones

<b>Milestone number<sup>18</sup></b>	<b>Milestone title</b>	<b>Lead beneficiary</b>	<b>Due Date (in months)</b>	<b>Means of verification</b>
MS4	V2 Gate for Solution PJ.10-W2-93	15 - ENAV	19	All documents for solution pack delivered and Gate review with SJU has been passed.
MS5	V3 Gate for Solution PJ.10-W2-93	15 - ENAV	36	All documents for solution pack delivered and Gate review with SJU has been passed.

<b>Work package number</b> <sup>9</sup>	WP4	<b>Lead beneficiary</b> <sup>10</sup>	20 - LDO
<b>Work package title</b>	HMI Interaction modes for ATC centre		
<b>Start month</b>	1	<b>End month</b>	37

### Objectives

- Integration of ASR into ATC centres to reduce controllers' workload while increasing the volume of data imputing into the ATM system – improving Human Machine Interface
- Achieve TRL 6 for ASR (Automatic Speech Recognition) integration into ATC centres
- Use Machine Learning to adapt ASR models to different ATC centres (approach areas and controller positions, e.g. feeder, pickup)
- Examine effective methods to guide the attention considering the priorities of the graphical elements to be displayed to ATCO
- Achieve TRL6 for Attention Guidance activity
- Achieve a TRL6 maturity for technologies which support ID card identification
- Improve algorithm to ensure a complete and instant personalization of work stations
- Combine ASR and AG to enhance the ATCOs' understanding of the dynamic changes in the air space configuration and how the changes affect the traffic to be controlled

### Description of work and role of partners

#### **WP4 - HMI Interaction modes for ATC centre** [Months: 1-37]

**LDO**, DLR, NLR, ANS CR (B4), LPS SR (B4), ACG/COOPANS, CCL/COOPANS, IAA/COOPANS, LFV/COOPANS, ENAIRE, HC (FSP), INDRA, SINTEF (NATMIG), NATS, SKYGUIDE, THALES AIR SYS

#### 1. Automatic Speech Recognition

The concept matured in PJ16-04 up to TRL-4, enabled the recognition and translation of spoken language into a sequence of recognized words and its transformation into the ATC commands.

#### ASR-Exe-001 (LEONARDO)

Integration of a speech recognition system in its next-gen CWP in order to achieve the following operational goals:

- Provide a coherency check between ATCO clearances issues via R/T and ATCO's input into the track label;
- Facilitate the ATCOs work by prefilling the appropriate system masks using the content of verbal communication;
- Enabling vocal preparation of clearance messages to be sent via data-link to equipped aircraft.

The rate of success of the speech recognition and the effectiveness of the adopted functionalities will be verified by conducting technical trials and technical acceptance tests with a limited sample of experienced ATCOs.

DLR (AT-ONE), COOPANS, ANS CR (B4) and Thales Air Systems will conduct the following exercises with the described tasks:

#### ASR-Exe-002a (All Partners)

- Leading exercise to quantify the benefits of a (nearly) perfect ASR system integrated in the ops room of Vienna approach (ACG/COOPANS)
- Evaluation of exercise (CCL/COOPANS)
- Preparation of KPI Data (ANS CR (B4), Integra (ANS CR LTP), COOPANS)
- Preparation of EIA (ANS CR (B4), Integra (ANS CR LTP), COOPANS)
- Recording and delivering speech data, radar data and flight plan data for engine training and testing (ACG/COOPANS, THALES Air Systems, DLR (AT-ONE))

#### ASR-Exe-002b (DLR (AT-ONE), ANS CR (B4), COOPANS)

- Leading exercise to implement MALORCA ASR engine which perform a benchmark on data from Vienna real life traffic (DLR (AT-ONE))
- Recording and delivering speech data, radar data and flight plan data for engine training and testing (ACG/COOPANS, Thales Air Systems)
- Creating and maintaining a data repository for speech and radar data (DLR (AT-ONE))
- Implementation of a MALORCA Speech Recognition Module (MALORCA Partners)
- Implementation of Speech-to-Text based on MALORCA machine learning approach (ACG/COOPANS)
- Implementation of Text-to-ATC-Commands Engine based on MALORCA machine learning approach (ACG/COOPANS) with prediction of possible commands (DLR (AT-ONE))
- Preparation of KPI Data (DLR (AT-ONE), ANS CR (B4), Integra (ANS CR LTP), COOPANS)

- Evaluation of Exercise (DLR (AT-ONE), ANS CR (B4), Integra (ANS CR LTP), COOPANS) ASR-Exe-002c (THALES AIR SYS, ANS CR (B4), COOPANS)
- Leading exercise to implement an ASR module which performs a benchmark on data from Vienna real life traffic (Thales Air Systems)
- Recording and delivering speech data, radar data and flight plan data for engine training and testing (ACG/COOPANS, Thales Air Systems)
- Implementation of Speech-to-Text Engine (Thales Air Systems, Nuance)
- Implementation of Text-to-ATC-Commands Engine (Thales Air Systems) with prediction of possible commands.
- Implementation of an ASR-Module, which includes all the necessary Engines (Speech-to-Text, Text-to-ATC-Commands, etc.)
- Optional Simulator Pre-tests for the ASR-Module (Thales Air Systems)
- Preparation of KPI Data (Thales Air Systems, ANS CR (B4), Integra (ANS CR LTP), COOPANS)
- Evaluation of Exercise (Thales Air Systems, ANS CR (B4), Integra (ANS CR LTP), COOPANS) ASR-Exe-002d (THALES AIR SYS, ANS CR (B4), COOPANS)
- Leading exercise to evaluate necessary adaptation of HMI suitable for ASR performance evaluation by ATCO (Thales Air Systems)
- Evaluation of exercise (Thales Air Systems, ANS CR (B4), Integra (ANS CR LTP), COOPANS) ASR-Exe-003 (ENAIRE)
- Mature ASR system developed in Wave 1 of PJ16-04 to reach TRL 6;
- Integrate, supported by Indra, the ASR prototype into an operational platform (i.e. into SACTA);
- Validate feasibility of ASR system and its integration into operational platform.
- ASR Exe-004 (NLR (AT-ONE))
- NLR (AT-ONE) will integrate ASR COTS into NLR (AT-ONE)'s real-time ATC simulator (NARSIM) to:
- Support the ATCO aiming to reduce workload
- Determine effect of ASR on ATCO's level of alertness and task load by e.g. eye tracking measures
- ASR-Exe-007 (SINTEF)
- Sintef will:
- augment the SIMADES CWP (developed in PJ16-04) with ASR functionality to enable faster and more predictable navigation in the 3D visualization of the air space and traffic
- conduct an exercise in cooperation with solution 44 (PJ09) to validate the effect of these enhancements
- CROCONTROL will lead HF task.
- ANS CR (B4) and Integra (ANS CR LTP), will lead the Safety tasks.

## 2. Attention Guidance

Following the recommendations, and in close collaboration with ATCOs, Skyguide, SkySoft-ATM and LFV/COOPANS will develop a prototype that will display graphical elements that are relevant for the ATCO considering the priority of the information (conflict, manual action pending, etc.).

AG-Exe-005: SINTEF will:

- augment the SIMADES CWP (developed in PJ16-04) with additional AG functionality to draw the ATCOs' attention to important changes in the traffic being controlled, including possible conflicts
- conduct an exercise in cooperation with solution 44 (PJ09) to validate the effect of these enhancements

AG-Exe-008: Leonardo will implement the AG functionality into Leonardo's next-gen CWP.

The proposed AG solution will exploit salient visual stimuli to guide the ATCO's attention to potential hotspot area (or conflict) on the radar screen, if this event is unnoticed by the controller for a given time frame.

This solution will rely on the use of eye tracker system to monitor the ATCOs eye gazes and will use peripheral cues to properly orient his/her attention to relevant hotspot area (or potential conflicts).

Leonardo will test the AG solution in technical trials in a free route environment, featured by C/DR tools (such as MTCD and STCA). The technical trials and technical acceptance tests will be conducted with a limited sample of ATCOs and a dedicated set of system metrics and indicators will be collected to estimate potential benefits in terms of controller productivity (e.g. number and RT for guided a/c; eye trackers metrics).

CROCONTROL will lead HF task.

## 3. User Profile Management Systems

UPMS-Exe-009: NATS will lead the activity and aims to create a digital 'next generation' version of the concept that was created by LPS SR (B4) as part of PJ16-04.

NATS will look to combine user profiles with other technologies such as ASR onto a common CWP. The idea is to move towards a system data-centric CWP that can measure and produce Human Performance data from system inputs. The UPMS component will demonstrate future benefits from having individual user data linked to CWPs.

LPS SR (B4) will support UPMS with the results of biometric identification technology research, if required, and with Operational, Technical and Safety expertise. CROCONTROL will lead HF task.

#### Participation per Partner

Partner number and short name	WP4 effort
2 - DLR	14.10
3 - NLR	4.60
4 - ANS CR (B4)	17.00
Integra	12.00
5 - LPS SR (B4)	18.60
8 - ACG/COOPANS	8.00
9 - CCL/COOPANS	8.49
10 - IAA/COOPANS	1.07
11 - LFV/COOPANS	2.67
14 - ENAIRE	21.98
CRIDA	14.32
18 - HC (FSP)	10.01
19 - INDRA	105.00
20 - LDO	252.00
21 - SINTEF (NATMIG)	13.00
22 - NATS	9.90
23 - SKYGUIDE	8.70
SKYSOFT	28.80
24 - THALES AIR SYS	87.60
<b>Total</b>	<b>637.84</b>

#### List of deliverables

Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D4.1	PJ.10-W2-96 ASR solution pack TLR6	20 - LDO	Report	Public	36
D4.2	PJ.10-W2-96 AG solution pack TLR6	20 - LDO	Report	Public	32
D4.3	PJ.10-W2-96 UPMS solution pack TLR6	20 - LDO	Report	Public	32

#### Description of deliverables

This workpackage provides the following deliverables:

D4.1 : PJ.10-W2-96 ASR solution pack TLR6 [36]

Consists of: • Technical Validation Report (TVALR) TRL6 • Cost Benefit Analysis tailored for the specific Technological Solution (CBAT) TRL6 • Final Technical Requirements (TS/IRS) TRL6

D4.2 : PJ.10-W2-96 AG solution pack TLR6 [32]

Consists of: • Technical Validation Report (TVALR) TRL6 • Cost Benefit Analysis tailored for the specific Technological Solution (CBAT) TRL6 • Final Technical Requirements (TS/IRS) TRL6

D4.3 : PJ.10-W2-96 UPMS solution pack TLR6 [32]

Consists of: • Technical Validation Report (TVALR) TRL6 • Cost Benefit Analysis tailored for the specific Technological Solution (CBAT) TRL6 • Final Technical Requirements (TS/IRS) TRL6

#### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS6	TLR6 Gate for Solution PJ.10-W2-96 ASR	20 - LDO	37	All documents for solution pack delivered and Gate review with SJU has been passed.
MS7	TLR6 Gate for Solution PJ.10-W2-96 AG	20 - LDO	33	All documents for solution pack delivered and Gate review with SJU has been passed.
MS8	TRL6 Gate for Solution PJ.10-W2-96 UPMS	20 - LDO	33	All documents for solution pack delivered and Gate review with SJU has been passed.

<b>Work package number</b> <sup>9</sup>	WP5	<b>Lead beneficiary</b> <sup>10</sup>	1 - DFS
<b>Work package title</b>	Ethics requirements		
<b>Start month</b>	1	<b>End month</b>	37

### Objectives

The objective is to ensure compliance with the 'ethics requirements' set out in this work package.

### Description of work and role of partners

**WP5 - Ethics requirements** [Months: 1-37]

**DFS**

This work package sets out the 'ethics requirements' that the project must comply with.

### List of deliverables

<b>Deliverable Number</b> <sup>14</sup>	<b>Deliverable Title</b>	<b>Lead beneficiary</b>	<b>Type</b> <sup>15</sup>	<b>Dissemination level</b> <sup>16</sup>	<b>Due Date (in months)</b> <sup>17</sup>
D5.1	POPD - Requirement No. 1	1 - DFS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D5.2	POPD - Requirement No. 2	1 - DFS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	4
D5.3	GEN - Requirement No. 3	1 - DFS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	4
D5.4	OEI - Requirement No. 4	1 - DFS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	13

### Description of deliverables

The 'ethics requirements' that the project must comply with are included as deliverables in this work package.

D5.1 : POPD - Requirement No. 1 [3]

2.1. The procedures and criteria that will be used to identify/recruit research participants must be submitted as a deliverable. 2.2. The informed consent procedures that will be implemented for the participation of humans must be submitted as a deliverable. 2.3. Templates of the informed consent/assent forms and information sheets (in language and terms intelligible to the participants) must be submitted as a deliverable.

D5.2 : POPD - Requirement No. 2 [4]

4.1 The beneficiary must confirm compliance with GDPR and with respective national legal framework(s). 4.2 The beneficiary must confirm that it has appointed a Data Protection Officer (DPO) and the contact details of the

DPO are made available to all data subjects involved in the research. 4.4 The beneficiary must explain how all of the data they intend to process is relevant and limited to the purposes of the research project (in accordance with the 'data minimisation' principle). This must be submitted as a deliverable. 4.6 A description of the technical and organisational measures that will be implemented to safeguard the rights and freedoms of the data subjects/research participants must be submitted as a deliverable. 4.13 In case the research involves profiling, the beneficiary must provide explanation how the data subjects will be informed of the existence of the profiling, its possible consequences and how their fundamental rights will be safeguarded. This must be submitted as a deliverable.

D5.3 : GEN - Requirement No. 3 [4]

12.2. A thorough analysis of the ethics issues raised by this project and the measures that will be taken to ensure compliance with the ethics standards of H2020 must be included in the grant agreement before signature.

D5.4 : OEI - Requirement No. 4 [13]

11.1. Other. The beneficiary must check the applicability of the ethics guidelines for trustworthy AI developed by the high level expert group on AI (issued by the EC on April 8 2019), and provide the results of the check as a deliverable.

#### Schedule of relevant Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
--------------------------------	-----------------	------------------	----------------------	-----------------------

### 1.3.4. WT4 List of milestones

Milestone number <sup>18</sup>	Milestone title	WP number <sup>9</sup>	Lead beneficiary	Due Date (in months) <sup>17</sup>	Means of verification
MS1	V2 Gate for Solution PJ.10-W2-73 CC	WP2	22 - NATS	34	All documents for solution pack delivered and Gate review with SJU has been passed.
MS2	V2 Gate for Solution PJ.10-W2-73 NGCV	WP2	22 - NATS	34	All documents for solution pack delivered and Gate review with SJU has been passed.
MS3	V3 Gate for Solution PJ.10-W2-73 FCA	WP2	22 - NATS	37	All documents for solution pack delivered and Gate review with SJU has been passed.
MS4	V2 Gate for Solution PJ.10-W2-93	WP3	15 - ENAV	19	All documents for solution pack delivered and Gate review with SJU has been passed.
MS5	V3 Gate for Solution PJ.10-W2-93	WP3	15 - ENAV	36	All documents for solution pack delivered and Gate review with SJU has been passed.
MS6	TLR6 Gate for Solution PJ.10-W2-96 ASR	WP4	20 - LDO	37	All documents for solution pack delivered and Gate review with SJU has been passed.
MS7	TLR6 Gate for Solution PJ.10-W2-96 AG	WP4	20 - LDO	33	All documents for solution pack delivered and Gate review with SJU has been passed.
MS8	TRL6 Gate for Solution PJ.10-W2-96 UPMS	WP4	20 - LDO	33	All documents for solution pack delivered and Gate review with SJU has been passed.

### 1.3.5. WT5 Critical Implementation risks and mitigation actions

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
1	Possible starting maturity for TRL6 not reached during Wave 1 by PJ16.03 Likelihood: Low	WP3	Ensure proper communication of solution 93 objectives and need to PJ16.03. Plan an assessment of the 16.03 results at the beginning of solution 93 to understand the real starting point and pending open actions. (If necessary review solution 93 objective and schedule accordingly)
2	Possible starting V1 maturity for Delegation of Airspace not reached during Wave 1 by PJ15.09 Likelihood: Low	WP3	Ensure proper communication of solution 93 objectives and need to PJ15.09. Plan an assessment of the PJ15.09 results at the beginning of solution 93 to understand the real starting point and pending open actions. (If necessary review solution 93 objective and schedule accordingly)
3	Possible delays in the V2 maturity gate, given to pending open action from 16.03 TRL6, lack of resources, difficulty in platform development Likelihood: Low	WP3	Close monitoring of the progress of the activities
4	Possible delays in the V3 maturity gate, given to the fact that four exercise are planned at Q1/Q2 2022 and delays of one or more Exercise could impact on the preparation of the V3 data pack Likelihood: Medium	WP3	Close monitoring of the progress of the activities
5	Possible starting maturity for Automatic Speech Recognition TRL4 not reached during Wave 1. Likelihood :Low	WP4	Checking Time by Time the scheduled activity in Wave 1
6	Possible starting maturity for Attention Guidance TRL4 not reached during Wave 1. Likelihood :Low	WP4	Checking Time by Time the scheduled activity in Wave 1
7	Possible starting maturity for User Profile Management Systems TRL4 not reached during Wave 1. Likelihood :Low	WP4	Checking Time by Time the scheduled activity in Wave 1
8	Missing VLD5 might require some partners to refocus their work in PJ10-W2.	WP3	Partners to propose VLD5 work for wave 3 (reduces likelihood).

### 1.3.6. WT6 Summary of project effort in person-months

	WP1	WP2	WP3	WP4	WP5	Total Person/Months per Participant
1 - DFS	37.50	156	24.50	0	✓	218
2 - DLR	0	35.80	0	14.10		49.90
3 - NLR	0	0	0	4.60		4.60
4 - ANS CR (B4)	0	5	0	17		22
· AFT	0	39	0	0		39
· Integra	0	3.25	0	12		15.25
5 - LPS SR (B4)	0	0	13.89	18.60		32.49
6 - ON (B4)	0	0	19.46	0		19.46
7 - PANSa (B4)	0	0	43.64	0		43.64
8 - ACG/COOPANS	0	0	0	8		8
9 - CCL/COOPANS	0	0	5.77	8.49		14.26
10 - IAA/COOPANS	0	0	0	1.07		1.07
11 - LFV/COOPANS	0	5.04	3.56	2.67		11.27
12 - Naviair/COOPANS	0	0	9.75	0		9.75
13 - DSNA	0	0	20.10	0		20.10
14 - ENAIRE	0	14.70	15.49	21.98		52.17
· CRIDA	0	67.03	58.01	14.32		139.36
· INECO	0	25	0	0		25
15 - ENAV	0	4.54	18.16	0		22.70
· NAIS	0	0	11.06	0		11.06
· TECHNO SKY	0	4.36	17.46	0		21.82
· BIP	0	0	8	0		8
· VMware	0	0	10.84	0		10.84
16 - EUROCONTROL	0	186.30	105.60	0		291.90

	WP1	WP2	WP3	WP4	WP5	Total Person/Months per Participant
17 - FRQ (FSP)	0	14.91	15.37	0		30.28
· PDTS	0	11.04	14.72	0		25.76
18 - HC (FSP)	0	50.20	37.84	10.01		98.05
19 - INDRA	0	221	359	105		685
20 - LDO	0	32.30	209.70	252		494
21 - SINTEF (NATMIG)	0	0	0	13		13
22 - NATS	0	137.90	15.60	9.90		163.40
23 - SKYGUIDE	0	5.38	30.07	8.70		44.15
· SKYSOFT	0	0	21.10	28.80		49.90
24 - THALES AIR SYS	0	46.60	328.10	87.60		462.30
25 - AIRBUS SAS	0	0	0	0		0
26 - ATOS (FSP)	0	0	0	0		0
27 - AIRTEL (NATMIG)	0	0	0	0		0
28 - SAAB (NATMIG)	0	0	0	0		0
<b>Total Person/Months</b>	37.50	1065.35	1416.79	637.84		3157.48

### *1.3.7. WT7 Tentative schedule of project reviews*

<b>Review number <sup>19</sup></b>	<b>Tentative timing</b>	<b>Planned venue of review</b>	<b>Comments, if any</b>
RV1	15	SJU premises	Review linked to first Reporting Period
RV2	27	SJU premises	Review linked to second Reporting Period

### 1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

### 2. Project acronym

Use the project acronym as given in the submitted proposal. It can generally not be changed. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

### 3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

### 4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry into force of the Grant Agreement (NB : entry into force = signature by the JU). Please note that if a fixed starting date is used, you will be required to provide a written justification.

### 5. Duration

Insert the duration of the project in full months.

### 6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

### 7. Abstract

### 8. Project Entry Month

The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

### 9. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

### 10. Lead beneficiary

This must be one of the beneficiaries in the grant (not a third party) - Number of the beneficiary leading the work in this work package

### 11. Person-months per work package

The total number of person-months allocated to each work package.

### 12. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

### 13. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

### 14. Deliverable number

Deliverable numbers: D1 - Dn

### 15. Type

Please indicate the type of the deliverable using one of the following codes:

R	Document, report
DEM	Demonstrator, pilot, prototype
DEC	Websites, patent filings, videos, etc.
OTHER	
ETHICS	Ethics requirement
ORDP	Open Research Data Pilot
DATA	data sets, microdata, etc.

#### 16. Dissemination level

Please indicate the dissemination level using one of the following codes:

- PU        Public
- CO        Confidential, only for members of the consortium (including the Commission Services)
- EU-RES   Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)
- EU-CON   Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC)
- EU-SEC   Classified Information: SECRET UE (Commission Decision 2005/444/EC)

#### 17. Delivery date for Deliverable

Month in which the deliverables will be available, month 1 marking the start date of the project, and all delivery dates being relative to this start date.

#### 18. Milestone number

Milestone number: MS1, MS2, ..., MSn

#### 19. Review number

Review number: RV1, RV2, ..., RVn

#### 20. Installation Number

Number progressively the installations of a same infrastructure. An installation is a part of an infrastructure that could be used independently from the rest.

#### 21. Installation country

Code of the country where the installation is located or IO if the access provider (the beneficiary or linked third party) is an international organization, an ERIC or a similar legal entity.

#### 22. Type of access

- VA        if virtual access,
- TA-uc    if trans-national access with access costs declared on the basis of unit cost,
- TA-ac    if trans-national access with access costs declared as actual costs, and
- TA-cb    if trans-national access with access costs declared as a combination of actual costs and costs on the basis of unit cost.

#### 23. Access costs

Cost of the access provided under the project. For virtual access fill only the second column. For trans-national access fill one of the two columns or both according to the way access costs are declared. Trans-national access costs on the basis of unit cost will result from the unit cost by the quantity of access to be provided.

## History of Changes

### Part A

Date	Page Section /	Nature of change and reason (if applicable)
31/07/2019	WP3 description	Removed reference to VLD 5
02/08/2019	Deliverables & Milestones	Split of PJ.10-W2-73 V2 solution pack into one for CC and one for NGCV. Therefor added new deliverable and milestone. Added abbreviations for Collaborative Control (CC), Non-geographical Controller Validations (NGCV) and Flight Centric ATC (FCA) to deliverables and milestones.
27/08/2019	Financial Information	NLR (AT-One) shifted 10k EUR from “Other direct costs” to direct “personnel costs”.
27/08/2019	General	Changed start date to 01.12.2019 whilst keeping duration of 36 months
12/09/2019	General	Changed duration from 36 to 37 months for all workpackages, increased due dates of all contractual deliverables and milestones by one month.
12/09/2019	Deliverables / section 1.3.2	Removed progress report, originally scheduled for T0+3M.
12/09/2019	WP3 DoW & role of partners / section 1.3.3	Modified WP3 description of role of partners.
12/09/2019	Critical Risks / section 1.3.5	Added risk concerning missing VLD5.
08/10/2019	Financial Information	Breakdown of ENAV budget into LTPs.
20/11/2019	Financial Information	Moved HC (FSP) cost for pseudo-pilots from “Other direct costs” to direct “personnel costs”.

### Part B

Date	Page Section /	Nature of change and reason (if applicable)
24/07/2019	All	The cover page and the list of participants were removed. Tables with the history of changes for part A & B of Annex 1 were added.  Tables 3.1a, 3.1b and 3.1c were removed from section 3.1 Tables 3.2a and 3.2b were removed from section 3.2 Table 3.4a was removed from section 3.4. A footer was added.
25/07/2019	4.1.1.20	Updated LDO company profile (All rows in table).
25/07/2019	4.2.20	Corrected information of LDO subcontracting and added description of tasks
29/07/2019	3.4	Table 3.4b breakdown of “Other direct cost” of ANS CR (B4) harmonized with Annex II “Estimated budget of the action”. The total amount has been corrected to be 64k EUR instead of 62k EUR.

Date	Page Section /	Nature of change and reason (if applicable)
29/07/2019	3.4	Added new table to present the breakdown by main cost categories per partner.
02/08/2019	3.4	Added table for breakdown and justification for “other direct cost” of HC (FSP)
02/08/2019	4.2.20	Added description of LDO subcontracting.
27/08/2019	1.3.2 b), 3.3.2 and 4	Removed references to VLD 5 and related change control board (CCB).
27/08/2019	3.2.8	Removed section on CCB.
27/08/2019	3.4	Added table for breakdown and justification for “other direct cost” of NLR (AT-One).
27/08/2019	1.3.2	Changed solution #93 exercise no.1 lead from ENAV to DFS.
27/08/2019	4.2.11	Removed reference to LFV LTP LiU.
30/08/2019	3.3.2	Corrected INDRA justification for participation.
30/08/2019	4.1.1.15	Updated ENAV company profile.
12/09/2019	3.4	Removed justification tables of ANS CR (B4) (below 15% threshold) and LPS SR (B4) (no funding requested).
12/09/2019	3.4	Added paragraphs describing implications of SJU Contribution being broken down into several instalments.
12/09/2019	5.1.3	Removed section on “Misuse”.
12/09/2019	4.2.1	Added reference to Solution PJ.10-W2-73-FCA.
12/09/2019	4.2.17	Added reference to WP2 & WP3 and related tasks.
12/09/2019	5.1 and 5.1.2	Updated reference to recent GDPR.
12/09/2019	5.1.4	Amended section with a reference to the dedicated Ethics Deliverables to be produced during execution.
13/09/2019	4.2.14	Added clarification on ENAIRE’s subcontracting of pseudo-pilots.
12/09/2019	3.4	Provided refined details on travel costs (FRQ & COOPANS).
12/09/2019	4.2.8	Added reference to related tasks.
13/09/2019	3.4	Provided refined details on travel costs (NLR & HC).
12/09/2019	1.3.1	Amended section with clarification on link between FCA and NGCV.
13/09/2019	3.4	Amended text on budget instalments.
20/09/2019	4.1.1.15	Updated ENAV company description and contribution.
20/09/2019	4.2.15	Added clarification on ENAV subcontracting of VMware.
20/09/2019	3.4	Updated COOPANS Justification of travel cost and other goods and services.
25/09/2019	3.4	Updated LFV Justification of Equipment Cost.

Date	Page Section /	Nature of change and reason (if applicable)
26/09/2019	3.4	Updated HC (FSP) Justification of Equipment Cost.
25/09/2019	4.3	Removed section 4.3 as requested by SJU to ensure consistency across projects.
25/09/2019	1.1.1	Added objective related to wide-area-communications.
02/10/2019	4.1.1.23 4.1.1.24	Adjusted Skyguide and Thales contribution description.
20/11/2019	3.4	Moved HC (FSP) cost for pseudo-pilots from “Other direct costs” to direct “personnel costs”.

# Table of Contents

<b>1</b>	<b>EXCELLENCE</b>	<b>7</b>
1.1	OBJECTIVES	7
1.1.1	<i>Solution: PJ10-W2-73</i>	7
1.1.2	<i>Solution: PJ10-W2-93</i>	8
1.1.3	<i>Solution: PJ10-W2-96</i>	9
1.2	RELATION TO THE WORK PROGRAMME (SESAR JU SINGLE PROGRAMMING DOCUMENT 2019-2021)	10
1.2.1	<i>Solution: PJ10-W2-73</i>	10
1.2.2	<i>Solution: PJ10-W2-93</i>	12
1.2.3	<i>Solution: PJ10-W2-96</i>	13
1.3	CONCEPT AND METHODOLOGY	13
1.3.1	<i>Solution: PJ10-W2-73</i>	13
a)	<i>Concept</i>	13
b)	<i>Methodology</i>	15
1.3.2	<i>Solution: PJ10-W2-93</i>	17
a)	<i>Concept</i>	17
b)	<i>Methodology</i>	18
1.3.3	<i>Solution: PJ10-W2-96</i>	22
a)	<i>Concept</i>	22
b)	<i>Methodology</i>	23
1.4	AMBITION	26
1.4.1	<i>Solution: PJ10-W2-73</i>	26
1.4.2	<i>Solution: PJ10-W2-93</i>	27
1.4.3	<i>Solution: PJ10-W2-96</i>	27
<b>2</b>	<b>IMPACT</b>	<b>29</b>
2.1	EXPECTED IMPACTS	29
2.1.1	<i>Solution: PJ10-W2-73</i>	29
a)	<i>Technical Impact</i>	29
b)	<i>Economic Impact</i>	30
c)	<i>Social Impact</i>	31
2.1.2	<i>Solution: PJ10-W2-93</i>	31
a)	<i>Technical Impact</i>	31
b)	<i>Economic Impact</i>	32
c)	<i>Social Impact</i>	32
2.1.3	<i>Solution: PJ10-W2-96</i>	32
a)	<i>Technical Impact</i>	32
b)	<i>Economic Impact</i>	33
c)	<i>Social Impact</i>	33
2.2	MEASURES TO MAXIMISE IMPACT	34
a)	<i>Dissemination and exploitation of results</i>	34
b)	<i>Communication activities</i>	35
<b>3</b>	<b>IMPLEMENTATION</b>	<b>35</b>
3.1	WORK PLAN — WORK PACKAGES, DELIVERABLES	35
3.1.1	<i>Project Structure</i>	35
3.2	MANAGEMENT STRUCTURE, MILESTONES AND PROCEDURES	38
3.2.1	<i>Project Manager (PM)</i>	38
3.2.2	<i>Project Management Board (PMB)</i>	39
3.2.3	<i>Extended Project Management Board (EPMB)</i>	39
3.2.4	<i>Solution Leader (SL)</i>	39
3.2.5	<i>Solution Team</i>	40
3.2.6	<i>Project Content Integration Lead (PCIL)</i>	40
3.2.7	<i>Project Content Integration Team (PCIT)</i>	40
3.3	CONSORTIUM AS A WHOLE	40
3.3.1	<i>Solution: PJ10-W2-73</i>	41
3.3.2	<i>Solution: PJ10-W2-93</i>	45
3.3.3	<i>Solution: PJ10-W2-96</i>	50

3.4	RESOURCES TO BE COMMITTED.....	54
<b>4</b>	<b>MEMBERS OF THE CONSORTIUM .....</b>	<b>59</b>
4.1	PARTICIPANTS (APPLICANTS) .....	59
4.1.1	<i>Companies profile .....</i>	<i>59</i>
4.1.1.1	DFS Deutsche Flugsicherung GmbH .....	59
4.1.1.2	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV .....	63
4.1.1.3	STICHTING NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM .....	65
4.1.1.4	RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK .....	67
4.1.1.5	LETOVE PREVADZKOVE SLUZBY SLOVENSKEJ REPUBLIKY, STATNY PODNIK .....	70
4.1.1.6	VALSTYBES IMONE ORO NAVIGACIJA .....	72
4.1.1.7	POLSKA AGENCJA ZEGLUGI POWIETRZNEJ .....	74
4.1.1.8	AUSTRO CONTROL OSTERREICHISCHE GESELLSCHAFT FUR ZIVILLUFTFAHRT MBH .....	76
4.1.1.9	CROATIA CONTROL, CROATIAN AIR NAVIGATION SERVICES LTD .....	78
4.1.1.10	UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY .....	80
4.1.1.11	LUFTFARTSVERKET .....	81
4.1.1.12	Naviair .....	84
4.1.1.13	DIRECTION DES SERVICES DE LA NAVIGATION AERIEENNE .....	87
4.1.1.14	ENTIDAD PUBLICA EMPRESARIAL ENAIRE .....	88
4.1.1.15	ENAV SPA .....	92
4.1.1.16	EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION .....	95
4.1.1.17	FREQUENTIS AG .....	98
4.1.1.18	HUNGAROCNTRAL MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG .....	99
4.1.1.19	INDRA SISTEMAS SA .....	101
4.1.1.20	LEONARDO - SOCIETA PER AZIONI .....	102
4.1.1.21	SINTEF AS .....	104
4.1.1.22	NATS (EN ROUTE) PUBLIC LIMITED COMPANY .....	107
4.1.1.23	SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIEENNE CIVILS ET MILITAIRES .....	110
4.1.1.24	THALES - LAS FRANCE SAS .....	116
4.1.1.25	AIRBUS SAS .....	118
4.1.1.26	ATOS BELGIUM .....	119
4.1.1.27	AIRTEL ATN LIMITED .....	120
4.1.1.28	SAAB AKTIEBOLAG .....	121
4.1.2	<i>Main profiles/CV .....</i>	<i>123</i>
4.2	THIRD PARTIES INVOLVED IN THE PROJECT (INCLUDING USE OF THIRD PARTY RESOURCES) .....	124
4.2.1	Linked to DFS – Company 1 .....	124
4.2.2	Linked to DLR (AT-One) – Company 2 .....	125
4.2.3	Linked to NLR (AT-One) – Company 3 .....	125
4.2.4	Linked to ANS CR (B4) – Company 4 .....	126
4.2.5	Linked to LPS SR (B4) – Company 5 .....	127
4.2.6	Linked to ON (B4) – Company 6 .....	128
4.2.7	Linked to PANSAs (B4) – Company 7 .....	128
4.2.8	Linked to ACG/COOPANS – Company 8 .....	129
4.2.9	Linked to CCL/COOPANS – Company 9 .....	130
4.2.10	Linked to IAA/COOPANS – Company 10 .....	130
4.2.11	Linked to LFV/COOPANS – Company 11 .....	131
4.2.12	Linked to Naviair/COOPANS – Company 12 .....	132
4.2.13	Linked to DSNAs – Company 13 .....	132
4.2.14	Linked to ENAIRE – Company 14 .....	133
4.2.15	Linked to ENAV – Company 15 .....	135
4.2.16	Linked to EUROCONTROL – Company 16 .....	139
4.2.17	Linked to FRQ (FSP) – Company 17 .....	139
4.2.18	Linked to HC (FSP) – Company 18 .....	140
4.2.19	Linked to INDRA – Company 19 .....	141
4.2.20	Linked to LDO – Company 20 .....	142
4.2.21	Linked to SINTEF (NATMIG) – Company 21 .....	142
4.2.22	Linked to NATS – Company 22 .....	143
4.2.23	Linked to SKYGUIDE – Company 23 .....	143
4.2.24	Linked to THALES AIR SYS – Company 24 .....	144
4.2.25	Linked to AIRBUS – Company 25 .....	145
4.2.26	Linked to ATOS (FSP) – Company 26 .....	145
4.2.27	Linked to AIRTEL (NATMIG) – Company 27 .....	146
4.2.28	Linked to SAAB (NATMIG) – Company 28 .....	147

<b>5</b>	<b>ETHICS AND SECURITY .....</b>	<b>148</b>
5.1	ETHICS .....	148
5.1.1	<i>Humans</i> .....	148
5.1.2	<i>Protection of Personal Data</i> .....	150
5.1.3	<i>Misuse</i> .....	152
5.1.4	<i>Other Ethics Issues</i> .....	152
5.2	SECURITY.....	153
<b>6</b>	<b>ABBREVIATIONS.....</b>	<b>153</b>

## 1 Excellence

This project is part of the SESAR JU Single Programming Document 2019-2021 (SPD). It is part of the Industrial Research & Validation phase, developed under the SJU Private Public Partnership and will address in particular the topic “PJ10 W2 Separation Management and Controller Tools” of the work programme H2020-SESAR-2019-1 IR VLD WAVE 2. The project will address the three solutions from List 1 of the SPD:

- PJ10-W2-73 Flight-centric ATC and Improved Distribution of Separation
- PJ10-W2-93 Delegation of Airspace amongst ATSUs
- PJ10-W2-96 HMI Interaction modes for ATC centre

### 1.1 Objectives

The project aims to validate and progressively mature the addressed SESAR solutions and to contribute to the SESAR2020 Programme Lifecycle. The overall objective is to provide benefits to the ATM Network in the following key areas:

- Safety
- Capacity
- Efficiency
- Flexibility
- Cost-Efficiency

The following sub-sections detail the objectives of the three SESAR solutions, which the project addresses.

#### 1.1.1 Solution: PJ10-W2-73

The three sub-solutions described in this proposal are addressed in three different sub-solutions. The major points outlined in the DoW relate to three new operational concepts, having in common a non-geographical trajectory-based approach to ATC. There may also be common user needs between the Collaborative Control and Flight Centric concepts (such as support to very short term tactical intervention, e.g. avoiding action) as well as core technical requirements (expected to be at the FDP level).

Each of the three sub-solutions will cover different elements of this research question, but the organisation of the work will have to ensure no duplication, and good common practice exists, primarily in the problem areas related to safety, regulatory changes and Human Factors.

#### Sub-solution 73A: Flight Centric ATC

Objectives:

V3 Validation of Flight Centric ATC in the En-Route environment where several flights are assigned to a controller, unconstrained by geographical location, sector or national boundaries:

- a. Validation of procedures for conflict detection and resolution, including procedures for non-standard situations (e.g. emergency, weather etc.) and also coordination procedures with adjacent sector-based ATC.
- b. Explore its applicability with different team set-ups (e.g. MSP, SPO) and consolidation of related roles and responsibilities.
- c. Quantify the expected benefits of the concept, which will include the increase of controller productivity, owing to a better balance of the demand amongst controllers, the reduction of workload due to the reduced number of coordination actions, and the increase of flight efficiency by removing the sectors entry/exit conditions.
- d. Definition of tools/procedures for demand and capacity balancing and ATFCM in a Flight-Centric ATC area and harmonisation with local, sub-regional and Regional (European) flow management.
- e. Validation of different aircraft-to-controller assignment strategies.
- f. Address the transition aspects between flight-centric and sector-based ATC, in particular, the transition from primary to fall-back systems, flight planning and airspace data (flight centric entry/exit points).

- g. To further increase the usability of the Wide Area Communication HMI for the ATCO. Contribute to the work of PJ.14 regarding the operational concept and requirements for digital voice with respect to Flight Centric operation in joint workshops.

### **Sub-solution 73B: Collaborative Control**

Objectives:

V2 Validation of Collaborative Control with planned boundaries in En-Route (Free Route) & TMA (systemized) environments, where airspace sectors are retained as they are today (although the concept would be compatible with enhancements such as dynamic sectorisation), with aircraft being assigned to sectors according to current geographic location and predicted flight profile, and with boundaries between sectors having planned coordination conditions that underlie current operations across Europe (these include procedural co-ordinations such as standing agreements).

The primary objective of the concept is to enable collaborative control operations, where ATCOs will be able to issue instructions to aircraft that involve out-of-plan (including out-of-sector) manoeuvring, without the prior coordination (e.g. of a release) required in conventional operations, i.e. a phone call, electronic dialogue etc., through the following procedures:

- a. A downstream sector “pulling” the flight into their airspace by unilaterally issuing clearances, causing the flight to perform a manoeuvre in the upstream sector that would, today, require a release to have been granted defining an envelope in which the flight may be cleared before reaching the transfer of control point into the downstream sector.
- b. An upstream sector “pushing” the flight into the downstream sector without conforming to the agreed co-ordination conditions (usually exceeding those conditions to provide a better, more efficient trajectory).
- c. Either a “pulling” or “pushing” operation being performed (by upstream or downstream sector respectively) which clears the flight to penetrate one or more additional “third-party” sectors that were previously not expected to be on the flight’s trajectory (and have no co-ordination agreement with the collaborating sector).

In all cases, the sector issuing the “collaborating clearance” makes this decision having assessed that clearance against other sectors’ traffic, and has to be supported in this assessment by a level of automated tool support to ensure the safety of the procedure – the operational needs for this support being an objective of the work.

### **Sub-solution 73C: Generic (non-geographical) Controller Validations**

Objectives:

V2 Validation of Generic (non-geographical) Controller Validations in En-Route & TMA environments where a number of flights are assigned to a controller, unconstrained by geographical location, sector or national boundaries:

- a. Enabling the Flight Centric ATC in En-Route environment concept;
- b. Enabling the Collaborative Control with planned boundaries in En-Route & TMA environments;
- c. Enabling the Virtual Centres concept;
- d. Enabling more cost efficient and flexible usage of operational staff.

#### **1.1.2 Solution: PJ10-W2-93**

Solution 93 is built as a follow up of the SESAR 2020 Wave 1 projects PJ15.09 Data centre for Virtual centre (VC) and PJ16.03 CWP HMI – Virtual Centre. The objective is to investigate and develop the Operational Uses Case of Contingency and Delegation of Airspace, considering the impacts on the services defined in the Virtual centre concept and validating the concept ensuring a realistic environment based on contingency need or on traffic / organisation needs (either static, on fix-time transfer schedule, or dynamic, when the traffic density is below/over certain level).

This solution is also covering Operational Requirements on the ATSUs that have the possibility to delegate the airspace to another ATSU while there is guarantee of the seamless ATS service provision in the delegated airspace.

This solution will address specific objectives:

1. To explore the list of Uses cases based on the Delegation /Contingency of Airspace and to describe on operational services and environment description,
2. To progress with Virtual Centre concept to support to the uses cases of static and dynamic contingency and delegation of airspace, based on En-Route, TMA and ATFCM domain. More complex architecture will also be considered with implementation options involving multiple Air traffic service providers.

The solution will provide a mean for ATSUs to be able to answer the different needs from different perspectives:

- Identification and definition of the different use cases of Delegation of Airspace. It considers the work already identified in the PJ15.09 in the context of delegation and contingency of Airspace applying the Work stream Analysis as a working method for the investigation.
- Based on the work performed in the PJ16.03 for Virtual Centre, the solution 93 aims to continue the development of the VC concept as well as a continuous development of potential virtual centre services to ensure the adequate support to the implementation of the different use cases in the context of Airspace delegation.
- Development of prototypes and validation platforms, Virtual Centre based or ad hoc platform, to support validation of operational use cases. For Virtual Centre concept implementation, a proper mapping of the technical enabler defined in the Virtual centre and the Operational needs of the delegation and contingency is needed, in order to assess the increased number of operations as well the interoperability among the systems.
- Validation of the different use cases in the Context of Delegation of Airspace covering both operational and technical aspects. Use cases to be validated will include static and dynamic (considered at predefined time either regularly or due to a specific event) bi-directional airspace delegation between two independent and geographically separated ATSU. These uses cases will be validated in the En-Route, TMA and ATFCM domain.

The target maturity level is V3.

Several aspects will be considered during the validation process based on the different Use cases to be tested. The main expected benefit is an increase in capacity due to the higher availability of ATCOs in peak periods, as well as the use of interchangeable standard services. By implementing the seamless airspace delegation for load balancing the restriction time will be shorter and the number of restrictions will be reduced.

### **1.1.3 Solution: PJ10-W2-96**

The solution 96 deals with operational and technical objectives of the Controller Working Position. It takes into account the work already performed during Wave 1 continuing to provide significant improvements thanks to advanced interaction methods with HMI. The solution will address technologies such as Speech Recognition, Attention Monitoring and Guidance and Users Profile Management Systems.

The new technologies are already studied during Wave 1 and Horizon 2020 exploratory project MALORCA. The reached results put the basis to improve concepts and to enhance developed functions. The applications of the highlighted technologies have the different targets like as the enhancement of workstation productivity following a user-centred design approach, the reduction of the workload on the controllers reporting only the useful information, a dynamic adaptation of the HMI based on the user profile authentications.

The quality criteria (presented as KPIs), which will outline results concerns the human factors, productivity improvements, capacity improvements, cost reductions and environmental impact against current interaction means, workload reduction and today's safety.

The project follows the required process objectives outlined in the PJ10-96 DoW:

- Human performance definition

**Objective 1:** The development of workstation productivity solution shall follow a user-centred design approach including *human performance assessments* collected from operational users in an operationally relevant environment.

- Controller Productivity definition

**Objective 2:** Controller Productivity and its operationalization (e.g. its quantification through the use of Human Performance measurements) shall be defined at the beginning of the project in coordination with the solution projects.

- Controller Productivity Solution HMI enablers

**Objective 3:** PJ.10-96 prototypes will take into account the work performed in PJ16-04, which reached TRL4 in Wave 1, and advance those to a TRL6 maturity level (Attention Guidance, Automatic Speech Recognition, and User Profile Management Systems).

**Objective 4:** PJ.10-96 prototypes shall be developed per selected innovative interaction technology and shall be verified in time.

- Support to SESAR 2020 ATM solution projects in order to achieve their associated OIs

**Objective 5:** PJ.10-96 prototypes will be integrated in time into validation platforms that are related to SESAR 2020 ATM solution projects TRL6 activities.

**Objective 6:** PJ.10-96 transversal enablers shall be addressed and documented including empirical evidence collected from operational users (e.g. interaction between controllers and AI/machine learners).

- Safety

**Objective 7:** PJ.10-96 prototypes will be also validated taking into account aspects related to the safety perspective, with a direct contribution of the involved controller entities.

## **1.2 Relation to the work programme (SESAR JU Single Programming Document 2019-2021)**

### **1.2.1 Solution: PJ10-W2-73**

#### **Sub-solution 73A: Flight Centric ATC**

Flight Centric ATC (FCA), where an air traffic controller is responsible for a certain number of aircraft throughout the entire flight segment within a given airspace, whereas other controllers are responsible for different aircraft within the same airspace. The mode of operation is in line with the main principles of Trajectory Based Operations and allows better distribution of ATCO workload with overall system efficiency. Since the concept allows for non-geographically based provision of ATC service, especially in higher airspace, it could contribute to the reduction of the fragmentation in ECAC airspace. The concept is also a solution for the physical limitation related to the creation of new/additional ATC sectors to cope with the demand in the highly congested airspace. Furthermore, the concept affects the frequency spectrum and addresses frequency distribution on an ECAC wide basis, as it investigates the means for air-ground communication over large areas.

The Flight Centric sub-solution will address in detail:

- Real-Time Simulation, simulating Flight Centric operations in Budapest ACC airspace above FL95 with an emphasis on automated tools usability for improved situational awareness and non-nominal situations, with substantial impact in a flight-centric environment (e.g. immediate descent due to decompression).
- Validation of transition scenarios:

- Main system - Fall-back with flight centric operations
- Flight-centric operations - Sector-based operations
- Assessment of the operational feasibility of the FCA concept implementation in a low-medium complexity operational environment as well as the evaluation of its benefits in terms of Safety, Cost-Efficiency, Fuel Efficiency and Human Performance. In particular, it will be addressing the Allocator role and the improvements of both flight-centric executive controller (FCEC) and –planning controller (FCPC) functionalities obtained during Wave 1. Non-nominal situations and transition phase from a sector-based environment to FCA will also be covered.
- Horizontal expansion of FCA in En-Route on a large scale (sub-regional and regional scale) using workload models and Dynamic Airspace Management capabilities developed for SESAR 2020 Wave 1.
- En-Route environment dynamic transition between conventional ATC and FCA operations and to the HMI, mainly situational awareness aspects specific for FCA operations.
- Use of Flight Centric ATC mode as a contingency.

### **Sub-solution 73B: Collaborative Control**

In the concept of Collaborative Control with planned boundaries airspace sectors are retained as they are today (or dynamically if such a concept has been implemented in a particular operation) with aircraft being assigned to a sector according to its geographic location and predicted flight profile, and with boundaries between sectors having planned coordination conditions like in current operations. The main objective of the concept is to enable collaborative control operations, where ATCOs will be able to issue instructions to aircraft that involve out-of-sector manoeuvring, without the coordination required in conventional operations i.e. a phone call.

Benefits include ATCO productivity owing to reduced workload deriving from reduced co-ordinations and more efficient use of controlled airspace; flight profiles are expected to be more often optimized where the workload of controllers today would restrict their ability to obtain the releases needed to make use of other sectors' airspace. Increase in Network Capacity may be a secondary benefit owing to a reduced ATCO workload and more predictable efficient aircraft profiles.

In SESAR 2020 Wave 1, a successful RTS was run in the very high complexity London TMA which showed an apparent reduction in coordination. In wave 2, the plan is to mature the concept and validate it within the UK very high complexity En-Route airspace and hence prove the benefits in both TMA and En-Route. Work will continue on Wave 2 to investigate the legal issues relating to the responsibility of controllers while an aircraft is being operated under the collaborative control procedures.

Some effort has also been assigned to investigate any common user needs between the Collaborative Control and Flight Centric concepts (such as support to very short term tactical intervention, e.g. avoiding action) as well as core technical requirements (expected to be at the FDP level).

### **Sub-solution 73C: Generic (non-geographical) Controller Validations**

Generic (non-geographical) Controller Validations (NGCV) will work to identify and validate Controller needs, which may allow for a more flexible ATCO validation regime, enabling a Controller to operate in any airspace classified as a particular type. This would mean that the ATCO would be validated on method and tools, rather than a geographically specified volume of airspace.

Problems to be addressed are:

- The barrier to a more flexible use of staff and directly addressing the shortage of ATCOs;
- Prolonged on the job training validations (cost);
- The vast amount of specific knowledge (conditions, exit/entry levels/points, local agreements/procedures, navigation aids, frequencies, geographic points etc.), that the ATCO today has to maintain in his/her knowledge and associated quality checks.

NGCV is a significant enabler for Flight Centric ATC and Collaborative Control. In order to be successful with a V2 validation, the requirements from both must be properly understood and identified. Flight Centric ATC and Collaborative Control rely on higher levels of automation and are consequently a prerequisite for NGCV.

The main benefit from NGCV will be Cost-efficiency, but also technical aspects and training will be impacted;

- Enabling Flight Centric and Collaborative Control;
- Scheduling ATCOS will be simplified (fewer endorsements);
- Enabling higher CoE for staff usage (Coefficient of Efficiency);
- Harmonised training;
- Assumption that training time will be more efficient and possibly shorter;
- Improved flexibility of staff usage ex. staff transition to other ATSU simplified.

NGCV is perceived as fundamental when introducing the Virtual Centers concept, delegation of airspace and supporting contingency and resilient services. Examples of 'light' NGCV exist today, as some ANSPs managing oceanic sectors, the need for specifics is limited and procedures are streamlined. First implementations are expected within upper airspace low, medium complexity. The operational requirements derived from Flight Centric ATC and Collaborative Control will guide the need for automation support.

Examples of information to be considered to be supported by the system and hence relieve the ATCO from the need to rely on in-depth knowledge of airspace specifics to provide ATS:

Examples of information to be considered to be supported by the system and hence relieve the ATCO from the need to rely on in-depth knowledge of airspace specifics to provide ATS:

- Conditions related to the airspace and flow of traffic;
- Agreements with users, other ATSUs;
- Frequencies.

The first implementation of the 'non-generic controller validation' part of solution 73 is expected to be in low to medium complexity airspace and as a starting point within an industry platform i.e. INDRA, THALES, etc. growing towards seamless interoperability and flexibility. In parallel, NATS will be addressing high-complexity airspace using the NATS-ACE platform.

### **1.2.2 Solution: PJ10-W2-93**

This solution will address specific challenges that will contribute to reach the performance expectation with a positive impact on the Network improving

- To provide a set of services that deliver the capability for an ATSU to act as contingency for another ATSU in a safe and efficient manner in the event of a catastrophic failure. The transfer of control should minimize the effect on traffic levels and disruption to the provision of air traffic services in the affected airspace.
- To provide a set of services that deliver the capability to delegate a volume of airspace from one ATSU to another in a safe and efficient manner that, ideally, maintains the current traffic levels without disruption to the provision of air traffic services in either ATSU.
- To provide an infrastructure usable for Virtual Centre aspects based on the operational needs of the delegation and Contingency use cases.
- To further mature the existing technical services that provide the delegation of airspace and contingency capabilities to an industrial standard that are ready for deployment by ATSUs.
- To develop new services supporting the evolution of operational needs, e.g. technical services in the NM/ATFCM domain.

- To overcome the low flexibility in managing traffic flows, Virtual Centre services will support load-balancing between ATSUs, Delegation of Airspace or manage contingency situations.
- Together with the virtualisation of the data services, the solution 93 will use specific techniques to create adequate processes and methods for the standardization of ATM services together with the necessary means and infrastructures. The virtualisation and ATM data and functions as services is a valuable transition to Virtual Centres and a common data layer allowing more flexible provision of ATM services.
- Cost reduction and flight efficiency for Air Navigation Service Providers and Airspace Users.

The solution 93 will continue to develop the operational requirements with appropriate work stream analysis for the delegation and contingency process and will define proper working methods with all Stakeholders involved in the process.

### **1.2.3 Solution: PJ10-W2-96**

The solution addresses specific challenges:

- Support air traffic controller in the future environment where more information and more complex input will be delivered demanding different management and procedures to cope with achieving the optimum efficiency, capacity and safety.
- Exploring new HMI needs and interaction modes to ease the CWP's operations and providing controllers information in the right time in an easy and intuitive way and to increase efficiency.
- Analysing the controller's productivity increase produced by the introduction of new tools and processes, especially AI and machine learning algorithms.

## **1.3 Concept and methodology**

### **1.3.1 Solution: PJ10-W2-73**

#### *a) Concept*

This new innovative approach encompasses the investigation of Flight Centric ATC in both low complexity and medium/high complexity environments. The idea is to dissolve sector boundaries and to have one controller in charge of a single flight to guide it through a large airspace. As a fundamental principle of Flight Centric ATC, a controller is no longer in charge of managing the entire traffic within a given sector. Instead, he/she is now responsible for a certain number of aircraft throughout their flight segment within a given airspace, whereas other controllers are responsible for a certain number of different aircraft within the same airspace. This way of traffic control does not change the basic responsibilities given to the controller, to ensure a conflict-free flight. This SESAR sub-solution addresses, in particular, the transition strategies from current operations to Flight Centric ATC and the assignment strategies of aircraft to controllers.

Important enablers are geographically independent voice communications, air-ground data link, accurate weather forecast and SWIM blue profile services, along with enhanced CD&R tools. These are all required to allow the controller to cope with a completely different situational awareness, where the existing special presentation of the information is replaced by the outcome of system based solutions and proposals, with the possibility of a quick check and alternative human reaction. For this new approach to situational awareness and decision making to be accepted, besides conventional HF change techniques, further moves in the definition of the system liabilities and responsibilities through regulations are required.

To validate to its full potential, the concept should be challenged on a sub-regional (Airspace equivalent to the FAB) and regional (European Network) basis, in combination with the full application of Free Route and Dynamic Airspace Configuration concepts with enhanced procedures for exchange and synchronisation of information between the Air and the ground in the context of TBO. The delegation of airspace, regardless of national boundaries and generic licensing of ATCOs are natural enablers, but also a consequence of the Flight Centric ATC concept.

The other element to be taken into account at higher validation level is the relation of the Flight Centric ATC concept and its effect on the traditional capacity planning, ATFCM regulations and Demand and Capacity Balancing processes, as well with the human resource planning, especially ATCO rostering and productive deployment. Initial maturity at the end of SESAR 1 was V0. V1 and V2 maturity were reached in Wave 1, while V3 maturity is planned for Wave 2. Outstanding R&D needs comprise among other topics assignment strategies of aircraft to controllers, the use of advanced Decision Support Tools, integration of regional and local Air Traffic Flow and Capacity Management (ATFCM) and transition aspects from current to the Flight Centric ATC environment.

The solution also consists of a concept of operation for Collaborative Control (i.e. co-ordination by exception rather than co-ordination by procedure).

New concepts such as release-on-contact, “porous” sector boundaries, sharing of airspace, flight intent and controller intent are all investigated. These concepts support:

- reduced need for co-ordination agreements (reduced workload);
- fewer boundary constraints (improved aircraft profiles);
- the application of constraints to aircraft trajectories at the point where the particular separation resolution is needed (which may be mid-sector rather than on the boundary).

Initial maturity at the end of SESAR 1 was V1. V2 maturity has been progressed in Wave 1. The validation activity on Collaborative Control with planned boundaries undertaken in SESAR 2020 Wave 1 was based in the very high complexity London TMA and focussed on OI CM-0309. In wave 2, the plan is to mature the concept and validate it within the UK very high complexity En-Route airspace. This will address OI CM-0310 (which has not as yet been progressed) but also continue to mature CM-0309. It is planned that both OI steps will be matured to full V2 maturity. Effort has been included to work with industry to ensure that the technical requirements are suitably captured in the TS/IRS and communicated effectively as an initial activity for the V3 work.

The current operation generally expects that controllers hold both a licence for a particular discipline (e.g. Area Control, Aerodrome Control etc.) and then a number of sector validations, which permit that person to exercise their license in a defined geographical volume of airspace. This solution investigates the possibility to increase staff flexibility by granting licences to controllers for more sectors. The generic controller validation assumes the need to encompass sector specific data, such as agreements, exit and entry conditions etc. will be minimized and/or harmonized. The Flight Centric ATC concept facilitates such harmonisation by putting focus on the trajectory. One early step for the ground side would be the identification of best practices, harmonisation and streamlining of procedures intra-centre and between centres with the creation of improvements in automation support i.e. better tools and increased background automation. Such developments enable both the Flight Centric ATC concept and generic ATCO validations. The impact of the NGCV concept is likely to be significant in terms of cost efficiency, considering training, conversion training and verification of competence. There are no specific CNS, MET or SWIM needs because this solution depends on enablers as defined in Wave 1, solution PJ10-02b. Initial maturity at the end of SESAR1 was V0. V1 maturity was reached in Wave 1 while V2 maturity is planned to be reached in Wave 2. Outstanding R&D needs comprise identification of the human, system and procedural needs that might allow a more flexible controller validation regime. Examples are “sector-type validations” (e.g. High level, TMA) that would allow a controller to operate in any airspace classified as a particular type. Moreover, the solution will define what additional aids (information, support in emergencies, fall-back modes of operation, etc.) are needed.

Conceptually, the solution in general address the optimisation of ATCO workload and more flexible use of ATCO workforce whereas the sub-solutions depending on the appropriate mode of operations are complementary, for example, the FCA could be an enabler for generic licencing in the upper airspace going even beyond constraints imposed by national boundaries and regulations.

In that respect, the solution addresses, in particular, the common research areas related to safety, liability and responsibility aspects, including the regulatory impacts of the area regarding the substantial change in ATC situational awareness. More consequences also exist in regards to the concepts, where two or more different ATCOs are involved in a conflict situation sharing the same airspace for the provision of the service.

It is envisaged that ATCOs will be validated for the Flight Centric area, as they are for Collaborative Control sectors. Sub-solution 73C Generic (non-geographical) Controller Validations concept will apply in the same way as for Sub-solution 73C Collaborative Control.

### b) Methodology

The validation methodology to achieve the target maturity in Wave 2 consists of many different methods, techniques and tools, which are all in line with the E-OCVM and the current maturity level. This section is structured per sub-solution and maturity level. It describes among the validation scenario also the validation platforms, organisation and dependencies to other solutions or projects.

The validation activities will be aligned with the SESAR 2020 Transition Validation Strategy, which was provided by PJ.19 during SESAR2020 Wave 1. This will ensure that the validation objectives, validation scenarios and all processes are in line with the overarching SESAR WP methodology and concept.

Legend:

Vx	Addressed Maturity Level V1, V2 or V3
OI	OI step based on ATM Master Plan - Data Set 14
Type	RTS Real Time Simulation FTS Fast Time Simulation
Prototype	Research Prototype: output of R&D development activities Industrial Prototype: output of pre-implementation activities

### Sub-solution 73A: Flight Centric ATC

Within sub-solution 73A activities with regards to the maturity cycles, V3 are foreseen. According to the current planning, all V2 related activities are expected to be completed during Wave 1. V3 maturity level is expected to be reached by the end of Wave 22. The RTS exercises will target at the validation of the concept both within low/medium and high complexity airspace. Within the RTS performed by DLR (AT-ONE), there is also a particular focus on the capability of the communication system. The RTS performed by DFS specifically looks at transition aspects (e.g. the fall-back case and the transition between sector-based and flight centric control). Finally, the FTS analyses the impact on workload and complexity measurement.

Validation platforms:

- DLR (AT-ONE) - TrafficSim
- EUROCONTROL – ESCAPE
- ANS Czech Republic – FTS platform
- DFS – Phoenix/iCAS
- ENAIRE – iTEC

Vx	OI	Type	Validation scenario/objectives	Remarks (e.g. dependencies, links outside SESAR)
V3	CM-0200-B CM-0200-C	RTS & FTS	EUROCONTROL Large scale RTS using EC ESCAPE experimental platform to address in En-Route environment dynamic transition between conventional ATC and FCA operations and to the HMI mainly situational awareness aspects are specific for FCA operations. Supported by low fidelity FTS piloted by ANS CR (B4) with ECTRL contributions to address the horizontal expansion of FCA in En-Route on a large-scale (sub-regional and regional scale) using workload models and Dynamic Airspace Management capabilities developed for SES2020 Wave 1.	Solution 53. Potential link to Non-geographical licensing sub solution as FCA ATC mode is a natural enabler for this sub-solution Cooperation with Partners DLR (AT-ONE) and Thales for the use of prototype components and their common development and enhancement for the specific FCA related tools Collaboration with LFV/COOPANS in the

Vx	OI	Type	Validation scenario/objectives	Remarks (e.g. dependencies, links outside SESAR)
			A complementary study on frequency spectrum analysis in respect of physical limitation of use of aviation communication frequencies over large geographical areas. EUROCONTROL	definition of common objectives for FCA as a potential enabler for Non-geographical licensing.
V3	CM-0200-B	Works hops/Operational simulation scenarios/Demonstrations	DFS Validation of transition scenarios: - Main system - Fallback with flight centric operations - Flight-centric operations - Sector-based operations	The evolving conceptual work with regards to flight-centric has to be carefully monitored to allow conclusions also to operational environments different from Karlsruhe upper airspace environment.
V3	CM-0200-B	RTS	ENAIRES exercise will be focused on the assessment of the operational feasibility of the FCA concept implementation in a low-medium complexity operational environment as well as the evaluation of its benefits in terms of Safety, Cost-Efficiency, Fuel Efficiency and Human Performance. In particular, it will be addressing the Allocator role and the improvements of FCEC and FCPC functionalities obtained during Wave 1. Non-nominal situations and transition phase from a sector-based environment to FCA will also be covered. This exercise will be performed using RTS validation technique.	EXE-10.1b-VP-002 performed in Wave 1
V3	CM-0200-B CM-0200-C	RTS	LR Real-Time Simulation simulating Flight-Centric operations in Budapest ACC airspace above FL95. The platform used will be DLR (AT-ONE)'s TrafficSim with Frequentis' integrated Wide Area Communication System.	None

### Sub-solution 73B: Collaborative Control

Within sub-solution 73B activities with regards to the maturity cycle V2 are foreseen. V2 maturity level is expected to be reached by the end of W2.

Validation Platform: NATS ACE Platform

Vx	OI	Type	Validation scenario/objectives	Remarks (e.g. dependencies, links outside SESAR)
V2	CM-0309 CM-0310	RTS	NATS Real Time Simulation of the Collaborative Control concept in En-Route airspace.	Solution 93 due to VC concept & solution 53 for TP development

### Sub-solution 73C: Generic (non-geographical) Controller Validations

Within sub-solution 73C activities with regards to the maturity cycle V2 are foreseen. V2 maturity level is expected to be reached by the end of W2.

Validation Platform: NATS ACE Platform (not full RTS)

Vx	OI	Type	Validation scenario/objectives	Remarks (e.g. dependencies, links outside SESAR)
V2	SDM-0203	V2 activity (non real time but controller in-the-loop)	NATS non real-time, but controller in-the-loop, V2 validation activity using the platform developed for the Collaborative Control RTS to investigate the Generic Controller Validation concept.	Solution 93 due to VC concept & solution 53 for TP development

### 1.3.2 Solution: PJ10-W2-93

#### a) Concept

The Delegation of Airspace concept applies when one ATSU delegates a portion of its airspace to another ATSU based on a particular condition. To achieve this at the operational level one or more ATCOs in the transferring ATSU must be able to communicate the current plan for managing the traffic within the sector(s) being transferred to the ATCOs in the receiving ATSU. This is the current process within the Area of Responsibility of an ATSU currently when sectors are consolidated, split or simply handed over from one controller to another during a shift change. However, no such capability exists between ATSUs due to the very limited means to transfer data and services among ATSUs that exist today. At the technical level, in case of use of the Virtual Centre concept, ATM Data Service Providers (ADSPs) can be geographically decoupled from the ATSUs also thanks to well defined service interfaces, which are part of Service Level Agreements. One ATSU may use data services from multiple ADSPs, just as an ADSP may serve multiple ATSUs.

The first discussion upon delegation has been subject to SESAR W1 PJ.15-09 and PJ.16-03 in Q3 of 2018, during the production of PJ16.03 of TRL2 Data package. The SJU started the process of PJ15.09 “Data centre of Virtual Centre” with the following scope:

*‘PJ 15-09 determines how to operationally designate airspace to each position within those centres where that information is being transferred. While the PJ16.03 is researching the technical capability to transfer data between geographically separated data service providers and ATSUs using interoperable services and (to-be) standardised service interfaces. The capability is being further developed to support the Delegation of Airspace and contingency use cases by extending the ability to exchange data between centres.’*

Therefore, a close relationship between the Operational Requirements from PJ15.09 and Technical Services from PJ16.03 has been established. Together, these two solutions will be based on an ANSP infrastructure that tackles the issues caused by the current fragmented European ATM systems and country-specific architectures, enabling Europe to move to an interoperable, cost-effective and flexible service provision infrastructure.

The Delegation of Airspace concept is potentially applicable to many operational air traffic situations. The possible use cases identified in the PJ.15-09 works represents the first set of use cases that could benefit from the solution concepts. The actual convenience of using a delegation process, or the need to use a contingency plan may vary according to the different scenarios.

In general, according to the options, Delegation of Airspace can be considered in terms of whether it is an expected and planned process, possibly scheduled on a regular basis and potentially depending on the traffic load or whether it is an unscheduled process where there is sufficient operational flexibility to take advantage of the current air traffic situation. The delegation itself may be the subject of the entire airspace (e.g. a regional airport closing for the night) or part of a larger airspace. As a general consideration delegation usually leads to a cost optimization for the ANSP, and to a capacity increase with the rationalization of resources available for European airspace.

The Contingency use case, on the other hand, is triggered by an unexpected event such as a total system failure or environmental catastrophe, independent of the traffic load and may affect all or part of the airspace. The Contingency scenario is usually led by safety and business continuity drivers, but also in this case cost optimization can play a key role, thanks to the possibility to choose between local and remote contingency platforms, sharing of resources between ATSUs and thanks to the possibility to purchase services by different providers in a competitive market environment.

Each ATSU could have different and specific systems and equipment but that will not affect the delegation, as the target of this solution is to provide the delegation service based on a Virtual Centre environment.

The delegation of Airspace Concept and Contingency is expected to allow cost savings and efficiency. In the end of W1 PJ 15.09 a first high level Cost Benefit Analysis will be performed, and it will be further assessed and investigated during solution 93, following guidelines defined by:

- “SESAR2020 Project Handbook”;
- “Guidelines for Producing Benefit and Impact Mechanisms”;
- “Methods to Assess Costs and Monetise Benefits for CBAs”.

Also a deep analysis about legal issues will be performed, to understand what kind of Standardization and Regulation the Delegation of Airspace amongst ATSU will require to be applied (e.g. Civil-Military ATSUs relation, new Operational Responsibilities definition, Security issues etc...).

#### b) Methodology

Activities will be organized in two parallel threads, one Operational and one Technical, and a transversal Validation stream.

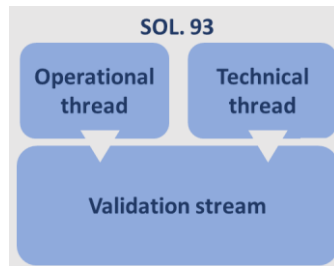


Figure 1: Threads of PJ10-W2 Solution 93

The two threads take inputs from the two SESAR2020 solutions PJ.15-09 and PJ.16-03 respectively, as indicated in the model below.

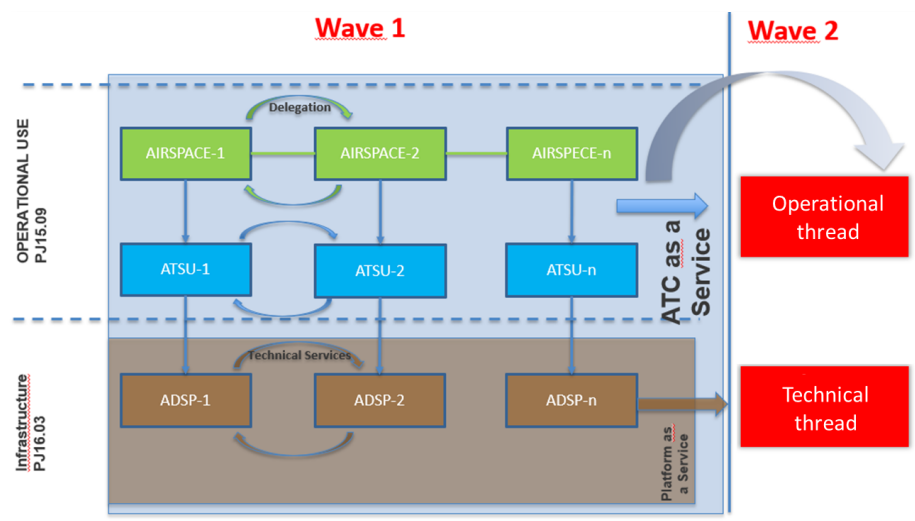


Figure 2: Transition from Wave 1 to PJ10-W2 Solution 93

The operational thread will focus on Operational Aspects that could be validated with Virtual Centre based platforms or ad-hoc platforms or combination of the 2 types. The validation scenarios include:

- The full transfer of responsibility of one of more sectors from one ATSU to another ATSU in case of contingency and delegation;
- ATSU consolidation at times of low-demand;
- A single contingency ATSU to be used to cover the contingency needs of two different ATSUs;
- Possible Use cases of delegation of airspace between TMA and En-Route and vice versa at periods of low demand, e.g. during the night.
- Dynamic ATFCM Services during dynamic airspace delegation

PJ 15.09 scope is to define the potential use cases for the delegation of airspace and contingency. Depending on the results of this on-going activity and based on the list of the Operational Requirements described in the PJ15.09 OSED, some promising Use cases will be considered during the delegation and contingency inventory analysis and will be developed in the solution 93 OSED at the V2 level then at the V3 level.

The technical thread will focus on the impacts of the use case Delegation of Airspace and contingency on the services defined in the Virtual Centre concept.

The technical thread will continue the work performed in Wave 1 by solution `PJ.16-03 that may reach TRL-6 maturity for the use case related to rationalisation of infrastructure and some deployment options. In particular, the effort in Wave 1 focused on:

- En-Route, Approach;
- Virtual Centre ATSU is provided with all ATC and Voice services consumed at the CWP (from one or several specialised ADSPs);
- Implementation options involving 1 ADSP (Data Services) and 1 ADSPs (Voice services).
- Technical validation of an initial list of services as Flight plan management and distribution, coordination & transfer and voice.

The Virtual Centre concept was originally explored in SESAR 1 B04.04, which first demonstrated its feasibility from a technical point of view. In SESAR 2020 Wave 1, PJ.16-03 solution was defined as an enabling solution to define and mature this technological concept. During the TRL2 gate, a lack of Operational definition was identified in the solution PJ.16-03, and was transferred to the solution PJ.15-09. Nevertheless, it was decided to continue PJ.16-03 as an Enabling solution to reach TRL6 Gate at the end of Wave 1.

From a specification point of view, the major deliverable of PJ.16-03 is the TS/IRS (definition of technological architecture and the functional and non-functional requirements) and the SDDs (Specification of the services).

This document is an input for PJ10-W2 solution 93 technical thread and in W2 it will be under the responsibility of PJ 10 Solution 93

#### Validation Stream:

The solution 93 will start with a V1 maturity level as output of W1 PJ15-09 activities, and is expected to reach a V3 maturity level for Q3 2022. Five exercises are anticipated to be executed. More exercises might be defined during the lifecycle of the solution and will then be described in the validation plan. The first exercise is expected to be executed from Q3 2020 to Q1 2021 to reach V2 maturity level and produce the V2 Data Pack for maturity gate. The other four exercises are expected to be executed in Q1- Q2 2022 to reach V3 maturity level and pass related maturity gate.

In order to reflect the transition of the different Maturity phase it is proposed to have an exercise to reach V2 that will consider the outcomes of the current activities of PJ16.03 and PJ15.09 for the Operational and Technical Tread in the context of the Delegation/Contingency of Airspace, as well as future development of virtual centre services. Thus V2 Validation will close with the fully achievement of V2 maturity phase.

Finally, the propose of the V3 maturity will be composed of four exercises (EXE 2,3,4 and 5) with a unique Validation Plan (VALP) and Validation Report (VALR) to report the validated number of services for the Delegation of Airspace with different Use cases validated. All the recommendations and analysis that will be considered in the Validation report will be finalized provided by the end of Wave 2 that will represent the fully V3 achievement.

The process followed to perform the validation exercise is in line with the processes defined in the handbook (in particular, chapter 2.7.11).

The validation stream, with all the exercises and their main objectives, it's been represented in the following diagram.

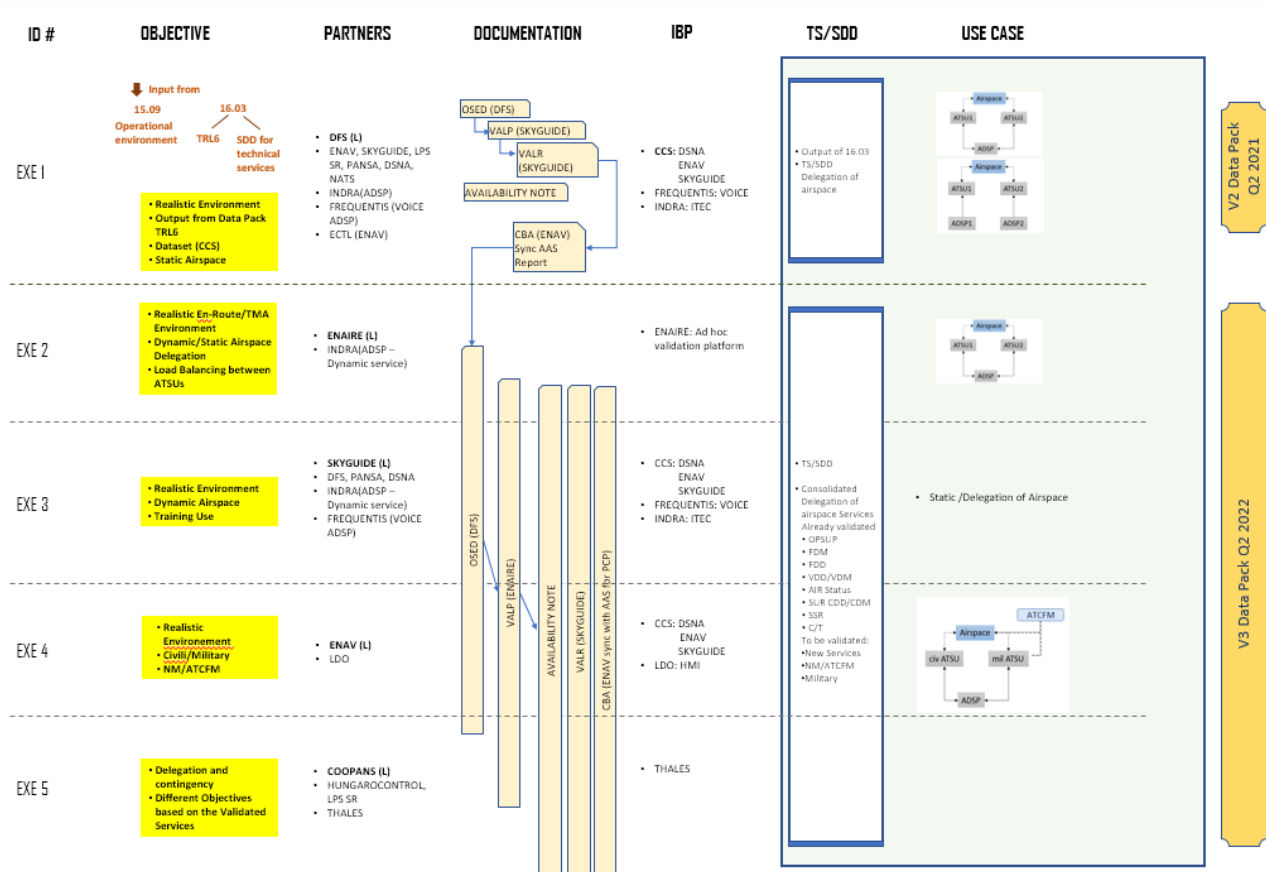


Figure 3: PJ10-W2 Solution 93 validation stream

It shows how the different exercises respond to the validation needs with respect to each maturity gate, the main use case that will be taken into consideration and how they will contribute to the preparation of the documentation and data pack, according the ambition of the solution description.

The figure provides a full picture of the validation process that will be put in place to demonstrate the feasibility of the solution and the positive impact that is expected on the Cost-Efficiency, Capacity and Flexibility, without negative impacts on HP or Safety. But it needs to be mentioned that the exercises could be slightly modified, and new exercises could be inserted, at a later stage, to ensure better alignment to the outcomes of PJ15.09 and PJ16.03 for the respectively operational and technical point of view.

To further detail the objectives of each exercise, a specific focus table with description is provided:

No	Demonstration objectives (compliant with DoW)	Interested parties (contribution/ role)	dates
01	<p>V2:</p> <ul style="list-style-type: none"> <li>Recommendations from PJ15.09 (Operational Requirements and PJ16.03 (TRL 6). Possible need of including findings from 10-06</li> <li>Feedback from Technical and Operational from TRL6</li> <li>Development of New services (SDD) for the Airspace Delegation</li> </ul>	<p><b>DFS - leadership</b></p> <ul style="list-style-type: none"> <li>ENAV: Contribution</li> <li>PANSA): Contribution</li> <li>ON (B4): Operational review</li> <li>SKYGUIDE: Contribution</li> <li>LPS SR (B4): Support with ATCOs</li> <li>DSNA: support with ATCO and HF expertise</li> <li>NATS: contribution</li> <li>INDUSTRY</li> <li>INDRA: Contribution</li> <li>LEONARDO: Technical review / Technical support</li> <li>FREQUENTIS: Voice com</li> <li>EUROCONTROL: Technical Support</li> </ul>	<p>Q3 2020 - Q1 2021</p>
02	<p>V3:</p> <ul style="list-style-type: none"> <li>To identify under which conditions (time, periods, traffic demand, static, dynamic, number of sectors), the delegation of airspace among ATSUs is feasible.</li> <li>To demonstrate that modified operational procedures necessary to mitigate lack of ATCO training or competences are feasible to tackle with the concept.</li> <li>To demonstrate that the abovementioned delegation brings benefits on: Cost-Efficiency, Capacity and Flexibility and does not have negative impacts on HP or Safety.</li> </ul> <p>Remarks:</p> <p><b>Concept under validation:</b> Delegation of airspace between different ATSUS on fix-time transfer (Day/Night) or dynamic transfer based on traffic demand with the purpose of balancing the traffic load between ATSUs and resources optimisation.</p> <p><b>Operational Scenarios:</b> Potential Scenarios TBD</p> <ul style="list-style-type: none"> <li>Delegation of Malaga Approach to Sevilla ACC or delegation of Santiago Approach to Madrid ACC – <b>example of resources organization</b></li> <li>Delegation of Sevilla ACC sectors to Madrid ACC for traffic balancing purposes. - <b>example of traffic load balancing</b></li> </ul>	<p><b>ENAIRE - leadership</b> INDRA: Contribution ON (B4): Operational review</p>	<p>Q4 2021</p>

03	<p>V3:</p> <p>Focus on delegation of airspace;</p> <ul style="list-style-type: none"> <li>• Realistic operational environment (ANSP perspective);</li> <li>• Representative users i.e. ATCOs using their usual CWP and tools</li> <li>• Development of delegation procedures and training to ATCOs</li> <li>• Possibility to delegate part of the airspace to several ANSPs</li> <li>• Supported by multi-customer ADSPs from several providers for both ATM and for Voice services (e.g. CCS provided from TLS for DSN and skyguide)</li> <li>• Several scenario operationally representative with purpose of optimizing ATCOs engagement:</li> <li>• Low / late shift with average workload</li> </ul>	<p><b>SKYGUIDE: leadership</b></p> <p>Contribution: DFS, PANSA, ON (B4), INDRA (ADSP, dynamic service), FREQUENTIS (Voice), LEONARDO, DSN</p>	Q2 2022
04	<p>V3:</p> <p>Focus on:</p> <ul style="list-style-type: none"> <li>• ATFCM domains</li> <li>• Civil/ Military ATSUs</li> </ul>	<p><b>ENAV: leadership</b> (technical and operational)</p> <p>LEONARDO: Contributor providing the HMI</p> <p>ON (B4): Operational review</p>	Q1 2022
05	<p>V3:</p> <ul style="list-style-type: none"> <li>• The exercise will validate operational requirements described in the OSED related to delegation of airspace and contingency; and possibly even comprise training and software testing UC.</li> </ul> <p>The goal is to integrate most of the services developed in PJ.16-03 during Wave 1. Even if the final details regarding environment and operational scenario is not finalized, the validation should involve CWPs and ATCOs from 4 COOPANS sites connected to an ADSP cloud service in Paris. Potentially even more partners could be added to the exercise. Delegation of airspace, contingency and cross border sectors are in the exercise scope</p>	<p><b>COOPANS: leadership</b></p> <p>THALES: Contribution</p> <p>LPS SR (B4): Support with ATCOs</p> <p>HUNGAROCNTR: contribution</p> <p><b>ON (B4): Operational review</b></p>	Q2 2022

### 1.3.3 Solution: PJ10-W2-96

#### a) Concept

The controller productivity is tied tightly to the number of interactions with data on the CWP, each controller will have several aircrafts to control. These conditions put the basis for evaluating how it will be possible to make the interaction more intuitive for controllers. Furthermore, the workstation productivity is tightly correlated to the number of information shown, which increases with the numbers of aircraft controlled for each position. New algorithms suggest having a better data organization in order to avoid information overflow on the screen not valuable in that particular moment and to automatically recognize and show/highlight the most useful information.

The solution addresses concepts under industrial research like artificial intelligence algorithms which are already applied and consolidated in other technology fields. As shown in the “Exploratory Research” Project MALORCA project, machine learning algorithms offer the opportunity to enhance the controller and workstation productivity; for these reason three different concepts to be deeply investigated are identified.

These concepts are related to new controller support modalities:

- Automatic Speech Recognition
- Attention Guidance
- User Profile Management Systems

These activities are expected to use concept results and prototypes of the projects PJ16.04 and MALORCA in order to give continuity to the study started in the past as research project and in an enabling project.

### ***b) Methodology***

Solution partners have chosen to treat the concepts in the solution as “Activities” separated from each other and to manage them independently. Starting from an assessment of maturity level reached in Wave 1, all activities will be validated towards TRL6 maturity, following the process in line with the S2020 handbook.

Before validating the technology and features, the partners will determine appropriate metrics and methods to collect controller productivity data. These will include metrics for controller performance by evaluating trial outcomes like number of aircraft guided, quality of communication, and quality of guidance. The controller workload will be assessed by objective parameters such as examination of e.g. processed cases, eye gaze measurement and subjective parameters collected e.g. by ISA (Instantaneous Self-Assessment). The acceptance of the technology should be assessed in controller interviews and by questionnaires.

#### ***Automatic Speech Recognition***

Automatic speech recognition (ASR): matured in PJ16-04 up to TRL-4, enabled the recognition and translation of spoken language into a sequence of recognized words and its transformation into the ATC concepts (commands consisting of callsign, command type, value etc.). Rules for transformation of a sequence of ATC words into ATC concepts were defined (so called ontology). This ontology will be developed further and prepared for standardization.

At the same time, in Wave 1, it was created a way of presenting the acquired data to ATCO, through the Label of each flight. These rules have been tested and approved by ATCOs.

In Wave 1 ASR was mostly used on laboratory or training data (scenarios). Now the application on real life data is addressed. This enables to benefit from training of speech recognition models with real life data, i.e. speech recordings and context data (e.g. radar and weather data) from real life traffic can be used.

Following a user-centred development approach evaluations and demonstrations will be defined and run with involvement of operational users to investigate the possible benefits of the selected implementation. This includes user workshops to identify and describe the best interaction design, and iterative human in the loop simulations with operationally relevant scenarios. The goal is the adoption of the solution by the ATM solution projects, i.e. the integration into their validation platforms in order to achieve their associated OIs especially with respect to their controller productivity objectives.

HMI prototypes need to be developed in order to present the results of the speech recognition (safety net area, highlighting of targets, user-friendly and intuitive operation etc.) in the best way to the controller.

ASR will be used to support radar label maintenance reducing head down times and manual (using computer mouse) inputs, as it was tested in Wave 1, which reduces controllers’ workload and increases safety. ASR in the ATC environment is not perfect yet, i.e. the commands recognition rate better than 85% (for the commands and information presented to ATCO via HMI) are quite ambitious. Therefore, concepts will be developed avoiding that wrong recognitions are missed by the controller and used by subsequent systems. This requires integration of artificial intelligence (AI) and machine learning algorithms for the intelligent data provision to the controllers on the application of machine learning to speech recognition (building on results from exploratory research project MALORCA). The presentation of the information to ATCOs needs to be intelligent and intuitive, providing not only the raw data, but also why it is shown and what should be done based on the information.

Currently the following validation exercises with respect to ASR are planned:

In **ASR-Exe-001** LEONARDO will integrate a speech recognition system in its next-gen CWP in order to achieve the following operational goals:

- provide a coherency check between ATCO clearances issues via R/T and ATCO's input into the track label;
- Facilitate the ATCOs work by prefilling the appropriate system masks using the content of verbal communication
- Enabling vocal preparation of clearance messages to be sent via data-link to equipped aircraft.

The first functionality is expected to positively impact the safety of operations, since the coherency check will support the controller to immediately identify possible situations of mismatches between the clearance announced via R/T and the actual values inputted via the track-label. On the other hand, the second and third functionality are expected to have a positive impact on controller productivity, since they will strengthen existing "direct manipulation" HMI features with vocal functionalities allowing a quicker execution of task associated to the communication of clearances using the standard phraseology. In order to verify the rate of success of the speech recognition and the effectiveness of the adopted functionalities, LEONARDO will conduct technical trials and technical acceptance tests with a limited sample of experienced ATCOs.

In **ASR-Exe-002a** the aim is to evaluate the human factor issues and ideal KPI values which are missing from wave 1. In this exercise the benefits of a (nearly) perfect ASR system will be quantified in the ops room. This will deliver operational quantified KPI values. Technically the executive controller will issue commands to the pilot via the Voice Communication System (VCS), but doing no mouse inputs into the system. Executive controller therefore behaves just as when he/she is supported by an Automatic Speech Recognition System (ASR System). For safety reasons mouse inputs will be done by a second controller sitting next to him/her. Big amount of data is today crucial for the training of state-of-the-art speech recognition systems therefore data recording for following EXE-002b and EXE-002c will also be conducted during this exercise. ACG/COOPANS conducts with their controller the experiment, CCL/COOPANS, THALES, ANS CR (B4), Integra and DLR (AT-ONE) evaluate the metrics, THALES will support the system configuration.

In **ASR-Exe-002b** and **ASR-Exe-002c** the usage of a full functional ASR system will be validated in an operational environment.

In **ASR-Exe-002b** first necessary data (Voice, Radar, Flight Plan) will be recorded in the operational environment of Vienna approach. All available data is used to automatically train an ASR system building on results of MALORCA project and to compare ASR performance of this trained ASR system and a conventional ASR system developed in wave1. In this exercise the ops room data will be fed into the ASR-Module and the results will deliver ASR performance of real Speech Recognizer and not of a perfect ASR system as in Exe 002a. This will enable to determine operational KPI values. ACG/COOPANS is responsible for data recording, DLR (AT-One) for command prediction and developing and maintaining the data repository ANS-CR (B4) (Integra) will evaluate the Safety impacts and CCL/COOPANS will lead the Human Performance Part.

In **ASR-Exe-002c** also the necessary data (Voice, Radar, Flight Plan) will be recorded in the operational environment of Vienna approach. All available data will there be used to train an ASR system delivered by THALES Air Systems. ASR performance of this trained ASR system can be compared to a conventional ASR system developed in wave1. ACG/COOPANS is responsible for data recording, ANS-CR (B) (Integra) will evaluate the Safety impacts and CCL/COOPANS will lead the Human Performance Part. In this exercise the ops room data will be fed into the ASR-Module and the results will deliver operational quantified KPI values. The operational KPIs will be determined either directly during the life trials in the ops room or with recorded real life data as input to the ASR system.

In **ASR-Exe-002d** Thales, COOPANS and ANS CR (B4) will evaluate HMI adaptations to an ATC System for usage with ASR Systems. (E.g. Presentations of ASR Out-/Input).

In **ASR-Exe-003** ENAIRE validates ASR to ease controller inputs, in order to reduce workload associated with maintaining the system in the future ATM environment. ENAIRE, supported by Indra, will integrate the ASR technology into an operational platform (SACTA).

In **ASR-Exe-004** NLR (AT-ONE) will integrate a speech recognition system in its NARSIM facility in order to provide the ATCO with possibility to provide system inputs via voice commands aiming to reduce the workload. Using eye tracking measures and workload measures, NLR (AT-ONE) will determine the effect of Automatic Speech Recognition on the level of alertness and task.

In **ASR-Exe-007** SINTEF (NATMIG) will explore how ASR (in combination with traditional navigation and AG techniques in 2D and 3D visualizations of the air space) can be used to enhance the ATCOs' understanding of the dynamic changes in the air space configuration (DAC), including how these changes influence the traffic the ATCOs will control. ASR will be used to enable faster and more predictable navigation in the 3D visualization of the air space and traffic, both through using bookmarks and free navigation. The exercise will be run in cooperation with solution 44 (PJ09), conducted by ENAV (through solution 44) and SINTEF (NATMIG) (through solution 44 and 96), and is a continuation of work conducted in Wave 1 (in cooperation between PJ08-01 and PJ16-04).

### ***Attention Guidance***

Following a user-centred development approach, evaluations and demonstrations will be defined and run with limited involvement of operational users in technical trials and technical acceptance tests to investigate the possible benefits of the selected implementation. The objective of the activity in this topic is to define tools and display allowing this capability to "remove" some "conflict free" flights from the display and to validate operationally the developed concept and features.

In **AG-Exe-005** Skyguide and Skysoft will test the technical development made to enable the concept and the operational validation in a high complexity environment.

As part of **AG-Exe-007** SINTEF (NATMIG) will use AG techniques to draw the ATCOs' attention to the dynamic changes in the air space configuration, as well as important changes in the traffic being controlled, including possible conflicts.

In **AG-Exe-008** Leonardo will integrate AG functionality in its next-gen CWP in order to support controller productivity.

The AG solution will exploit salient visual stimuli to guide the operator's attention to potential hotspot area (or conflict) on the radar screen, if the event is unnoticed by the controller for a given time frame. The AG solution will guide the ATCOs' attention to a potential hotspot area relaying on the use of eye tracker system. The eye tracker will monitor the ATCOs attention and will receive the trigger of the CD&R tools when a conflicting aircraft (or hotspot area) is detected. If the eye tracking system does not record ATCO fixations on the potential conflicting aircraft (or hotspot area), a visual cue (according to different level of salience) will be displayed to draw the ATCO attention toward the event.

Leonardo will test the AG solution in technical trials in a free route environment, featured by CD&R tools (such as MTCD and STCA). The technical trials and technical acceptance tests will be conducted with a limited sample of ATCOs. A dedicated set of system metrics and indicators will be collected to estimate potential benefits in terms of controller productivity (e.g. number and RT for guided a/c; eye trackers metrics).

### ***User Profile Management Systems***

In **UPMS-Exe-006** the technology, in coordination with the solution projects, shall ensure a complete and instant personalization of work stations according to ATCOs' individual operational needs, requirements and preferences so that, for instance, ATCOs will be prevented from accidentally overlooking potential misalignments of key functionalities or tools. Additionally, the UPMS shall also eliminate the currently existing risk of distraction of ATCOs' attention from operational situation due to the need for customisation.

The concept consists of two main packages: the 'Identification (authentication) system' and 'UPMS configuration system':

- Development of the 'Identification (authentication) system' will directly profit from the LPS SR (B4) and NATS long-term experience and all involved Project partners with ID card identification systems.

NATS will lead the activity and aims to create a digital ‘next generation’ version of the concept that was created by LPS SR (B4) as part of PJ16-04.

NATS will look to combine user profiles with other technologies such as ASR onto a common CWP. The idea is to move towards a system data-centric CWP that can measure and produce Human Performance data from system inputs. The UPMS component will demonstrate future benefits from having individual user data linked to CWPs.

## **1.4 Ambition**

### **1.4.1 Solution: PJ10-W2-73**

The concept of flight Centric ATC is aimed at the dedication of separation responsibility in a fully flexible way, changing the current way of controller teams being responsible in a small geographic area (sector). Different controllers will be responsible for different flights within the same airspace, thus giving full flexibility for the distribution of aircraft (i.e. workload) to controllers.

This basic principle, together with sophisticated aircraft allocation techniques and improved ATCO planning and rostering, should bring significant improvements in workload distribution, resulting in a better use of the ATCO workforce, potentially even on regional bases. Fast time validation techniques will be used to measure and illustrate the impact on the overall network system efficiency in combination with the effect in the airspace where the concept proves to be most beneficial.

In addition, the concept should further push the benefits expected by the other concepts like Free Route, and non-geographically based licensing and deployment of ATCOs, as well as increased use of enhanced air-ground information shearing and use of data link for trajectory revision. When reaching the desired status, this concept should allow for almost full flexibility of use of ATCOs for the ATC operations, primarily in medium and low complexity airspace on a large horizontal scale.

The concept of collaborative control is one thread of several concepts that will add flexibility to the operation in order to provide the highest capacity with least constraint on flight profiles that are consistent with a safe operation – collaborative control adds flexible co-ordination to concepts such as flexible sectorization, flexible use of airspace and flexible Controller validations (as described in sub-solution 73C in Non-Geographic Controller Validations). It is thought that sectorisation of airspace delivers useful benefits in terms of rostering operational staff and measuring and managing traffic demand through the airspace and distributing that demand between the available operational resources. Procedures have been developed over many years to pass traffic from Controller to Controller in this sectorised concept, but delivering an efficient and flexible service under those procedures is often onerous and leads to high inter-sector workload. Collaborative Control aims to benefit from those useful properties of a sectorised operation whilst allowing flexibility to deliver desired flight profiles without that consequential increase in workload.

The introduction of controller tools and team organisations also influences regulatory aspects. Nowadays controllers need profound knowledge about their airspace. This knowledge may be less detailed within the new environment. It is, therefore, expected, that controllers may hold their license for a much larger airspace and a higher number of sectors, thus greatly increasing staffing flexibility beyond national borders on a European level. Possibilities for such more generic controller validations will be investigated. In general industry best practices have demonstrated benefits through synergies when increasing automation, harmonization in the usage of tools, procedures and the following streamlining of services. The end result coming out from solution 73 should be an increased quality of the services and lower cost for the users.

Main benefits related to cost efficiency are due to improved scheduling and reduced cost of training. This sub solution should, by combining the concept elements and providing the necessary procedural and regulatory framework, be the major enabler for the introduction of virtual center applications in future developments.

The ambition for this solution could go even further than the standard network performance improvement and optimization, it might even positively affect areas like fragmentation and lack of competition in the provision of ATC service.

### 1.4.2 Solution: PJ10-W2-93

The ambition of this solution is to explore the concept of Delegation of Airspace. The most promising Use cases at operational level will be identified and the Operational Requirements for different ATSUs will be defined, considering the Traffic organization needs, either static or dynamic delegation of airspace. Based on the operational requirements, the technical services are matured in the TS/IRS. In this context a specific analysis will identify the operational services, considering different operational culture of the Air Navigation Service Providers involved.

A close focus must be made on the application of delegation in case of contingency: currently ANSPs have limited contingency capabilities and the airspace they oversee may suffer from long and important restrictions in case of emergency situation. By implementing airspace delegation, with appropriate Working methods during the delegation process, and technical convergence, contingency measures will be easy to set up and will reduce the number of restrictions as well as the restrictions time length. In general, the Air Traffic control service continuity will be improved.

Also from the Infrastructure Technology side, logically decoupling Air Navigation Service Providers (ANSP) from ATM Data Service Providers (ADSP) using standardized interfaces and using specific technologies and infrastructures in the context of airspace delegation, will open to new solutions that can facilitate the technical and operational interoperability of air navigation systems among ATSUs.

### 1.4.3 Solution: PJ10-W2-96

#### *Automatic Speech Recognition (ASR)*

Automatic Speech Recognition (ASR) is a very promising interaction technology for future CWP. When looking at other safety related transport domains like the automotive industry, speech recognition is already well integrated into the systems and helps the drivers to focus on driving the car, improving safety. As a result of validations/ investigations in ATM research activities already performed by project members outside of SESAR and validation in Wave1 for a target maturity level TRL4 there is still a need to develop Operational Use cases involving ASR in ATC Procedures and to develop prototype and the platform for TRL6 validation. Speech recognition shall support the controllers in their daily operational work so that controllers can focus on the traffic, release scarce mental capacities and thereby increase the overall safety.

As most input comes from the ATCO-pilot spoken dialog ASR is the appropriate technology to reduce workload by using the spoken commands instead of input to all of them manually in the system. Automatic speech recognition helps ATCO to keep the system up-to-date with almost no additional effort to one of the main tasks, giving spoken clearances to aircraft pilots. Major topics came out concern the recognition rate of the engines depends on the type of data that should be recognized. Some engines may have a good recognition rate on one type of data, and generate false recognition on others. False recognitions could be a safety critical topic. Indeed, if the ATCO is overconfident on the system, he/she may accept the data without checking its validity.

The use of speech recognition as means for updating the system while giving clearances over voice has been intensively investigated by two research projects called AcListant® and AcListant®-Strips, executed by DLR (AT-ONE). Recognition rates increased during project progress while error rate was going down. It was shown, that knowledge of the dynamic context information you integrate into the recognition of the spoken words is the key for these improvements. In addition automatic speech recognition will help the controller to identify targets earlier and it presents differences between the spoken clearance and the input made to the system.

ASR technology has made enormous progress in the ATM domain during the last decade. Therefore, both ANSPs and system providers are very interested in integrating Assistant Based Speech Recognition (ABSR) in solution projects supporting them in their tasks and integrating this controller productivity solution into their CWP equipment. Hence, nearly all decision support systems, like DMAN, SMAN and any other new system can be upgraded by assistant based ABSR.

In addition, the solution will also investigate how ASR may be used to enable faster and more predictable navigation in 3D visualizations of the air space sectorization when using dynamic air space configuration (DAC). One of the challenges that will be addressed is how to combine using speech to communicate with pilots and other ATCOs with using speech to control the 3D navigation.

### ***Attention Guidance (AG)***

HMI is the key element for generating productivity benefits from higher levels of automation. It is the central element where human meets the automation. The increased variety of information and advisories also increases the difficulty for the operator to identify the most important next actions. They need time to prioritize activities in advance while at the same time monitoring all changes on the display. Moreover, taking into account performance based operations as intended as output from Wave 1, controllers will be busier on monitoring activities in their sector of responsibility and also outside of it.

Summing up, based on automation upgrade the complexity of the HMI itself and of the area to be taken into account increases. This suggests that controller's attention reaches its limits taking into account the whole situation. The introduction of Attention Guidance to alerts and warnings is supposed to have decreased the number of incidents caused by controllers effectively.

In future scenarios described above the attention of controllers will emerge as central bottleneck in the human machine interaction. Controllers are able to care for just a limited number of events concerning their prioritization and guidance tasks simultaneously. Therefore, sophisticated concepts of Attention Guidance can become an important contribution to ATC safety and efficiency.

Regarding the fact that it is urgent to perform specific tasks in cases of emergencies and warnings first, the actual focus of controllers' attention is not relevant in the addressed situation. Current implementations of alarm concepts are limited to that use case. Instead of forcing the controller to readjust his attention, the right way to support productivity will be to permanently guide his attention gently from the actual area of interest to the most productive one. Therefore, the prior knowledge of the actual focus of the attention is crucial.

Modern gaze detection systems provide non-intrusive measurement and thus can be used for assessing and improving the attention of ATCOs without interfering with their tasks. As ATCOs' productivity is to be kept high in all cases it delivers the input for Attention Guidance concepts' implementations. Eye tracking systems can assess and guarantee the quality of controllers' attention by assessing the real-time monitoring and attention state of the human operator. Furthermore eye gaze analysis might enable single operator working conditions (for instance remote or in a virtual centre) by building a safety envelope around the HMI.

The prototype to be improved taking into account what is already done has the aims to identify loss caused by imprecise attention control in a highly automated environment. It will further increase the overall productivity of the ATM system. The key element will be a control function that actively directs the attention of controllers to the next most important task whenever necessary and appropriate. Gentle Attention Guidance based on gaze measurement is a new possibility that could be used to steer the attention of operators along a productive course of actions. It can be implemented in nearly any kind of information, assistance, or automation system in ATM supporting the safety and productivity of the underlying processes.

In addition, the solution will also investigate how AG may be exploited when using dynamic air space configuration (DAC). Although DAC is applied to level workload between controllers, introducing DAC gives at least two additional challenges for ATCOs and their attention. Firstly, the fact that the sectorization changes requires attention by the controllers. Secondly, at the time a sector change takes place, there will be a certain number of flights that "suddenly" changes sector. This requires both attention and actions from the controllers. For DAC, the solution will investigate how AG may be used to draw the ATCOs' to attention to important changes in the traffic being controlled, including possible conflicts. AG techniques will be tested both on 2D and 3D visualizations of the air space.

### ***User Profile Management Systems***

In an innovative and comprehensive way, the 'User Profile Management Systems' (UPMS) offers a fully automated solution of ATCOs Identification (Authentication) coupled with providing pre-configured user profiles, to ensure the efficient, reliable and secure logon and cater their individual needs and working preferences, which is consequently reflected in the individual customization of the CWP/HMI, regarding their roles and tasks and increasing Control Working Position productivity as SESAR 2020 requirement.

The effort to harmonize ATCOs' environment on CWP/HMI on the one hand but the complexity of HMI, caused by a continuously growing number of various functionalities, supporting tools and available settings, including the critical settings with direct impact on safety on the other hand calls for identifying and specifying

measures to avoid and mitigate risk of human error with possible impact on safety. The UPMS is thus supported by self-evident safety benefits, especially when the process of customization is conducted during an ATCO duty takeover – by reducing workload, saving time and minimizing undesired distractions or mistakes stemming from misaligned settings.

## 2 Impact

### 2.1 Expected impacts

#### 2.1.1 Solution: PJ10-W2-73

##### *a) Technical Impact*

#### **Sub-solution 73A: Flight Centric ATC**

High impact in flexibility in case of sudden demand/capacity changes because of assignment of aircraft to controller based on workload rather than geographical location of the aircraft, high increase in cost-effectiveness because of harmonised licences, no Planning Controller, more balanced “utilisation” of controller capabilities; high capacity impact due to workload reduction (e.g. no sector handovers). Frequency occupation and frequency changes will significantly drop which should enable an increase in pilot and controller performance. As only one controller is responsible for the entire trajectory (and not merely a small fraction of it as of today), it is expected that this also increases the flexibility of the airspace users.

Performance Goals	Level	Rational
Capacity	M	Increase capacity based on workload reduction; no sector handovers means a significant decrease in coordination. Coordination between controllers in the Flight Centric Area will be required, but a mechanism to support them solving conflicts will avoid an increase in the workload.
Efficiency	H	Controller’s efficiency is increased due to the workload reduction and optimisation.
Predictability	L	Changes in predictability are not expected.
Flexibility	H	Flexibility is increased because of the use of the Dynamic Allocation Strategies. In case of demand/capacity changes, the assignment of aircraft to a controller based on workload rather than the geographical location of the aircraft will allow more flexibility. The flexibility of airspace users is increased as only one controller is responsible for the entire trajectory.
Safety	L	Changes in safety are not expected. New operation modes will guarantee the same level of safety than today.
Human Performance	M	Workload reduction enables a positive impact on human performances. Frequency changes will significantly drop which should allow an increase in pilot and controller performance.
Environmental Sustainability		Environmental sustainability measures are not expected.
Interoperability	M	Impact due to different data exchange requirements especially, between FCA and conventional modes of operation.
Cost Effectiveness	H	Increase in cost-effectiveness because of harmonised licences, more balanced utilisation of controller capabilities.

#### **Sub-solution 73B: Collaborative Control**

High impact in cost-effectiveness owing to less coordination workload means more efficient use of air traffic controllers. Workload reduction also enables a positive effect on human performance. It also expected that flight efficiency would improve because of fewer co-ordination constraints at sector and/or centre boundaries. Moreover, collaborative control allows airspace to be used more freely and efficiently, which increases the flexibility of airspace users.

Performance Goals	Level	Rational
Capacity	H	Increase capacity based on workload reduction because the idea is to reduce coordination.
Efficiency	H	Flight efficiency improves because of fewer co-ordination constraints at sector boundaries.
Predictability	L	Changes in predictability are not expected.
Flexibility	H	Increase in the flexibility of the airspace users; collaborative control allows airspace to be used more freely.
Safety	L	Changes in safety are not expected. New operation modes will guarantee the same level of safety than today.
Human Performance	M	Workload reduction enables a positive impact on human performances.
Environmental Sustainability		Environmental sustainability measures are not expected.
Cost Effectiveness	H	Cost Efficiency increase because the workload reduction, based on the idea to reduce coordination, means more efficient use of air traffic controllers.

### Sub-solution 73C: Generic (non-geographical) Controller Validations

High potential in the long term because generic controller licence scheme on a European level would overcome national restrictions and would allow much more flexible employment of controllers in European Area Control Centres (ACCs). This sub-solution defines the required enablers (e.g. controller tools), and working procedures that must be in place before any regulation or legislation change process can start.

Performance Goals	Level	Rational
Flexibility	H	Flexible employment of controllers in European Area Control Centres (ACCs) because of the generic controller license.
Environmental Sustainability		Environmental sustainability measures are not expected.
Cost Effectiveness	H	Increase in cost-effectiveness because of harmonised licences, more balanced utilisation of controller capabilities.

#### *b) Economic Impact*

### Sub-solution 73A: Flight Centric ATC

Benefits are scaling with the airspace size, at least Functional Airspace Block (FAB) level envisaged; a lot of similarities with Free Route operations because both concepts need similar enablers in terms of decision support tools for large sizes of airspace.

Potential economic impact is substantial resulting mainly from system efficiency (ATCO productivity) but also from defragmentation and market liberalisation.

### Sub-solution 73B: Collaborative Control

The application of co-ordination-free transfer of control is likely to be deployed within a Centre. It may be possible at a later juncture to consider broadening the concept to encompass what are currently OLDI boundaries and enhancing the flight object to allow a similar option of coordination-free transfer at an Inter-Centre (network) level.

### Sub-solution 73C: Generic (non-geographical) Controller Validations

The application of generic ATCO validation creates the foundation for a more cost-efficient utilisation of staff. In the generic ATCO validation case, all ATCOs can deliver a service for every sector or flow of traffic. This implies that we can optimise the scheduling of staff considering the workload. Furthermore, staff not in position at a centre will be a generic resource to the whole centre. The coefficient of efficiency would then be able to improve because the slack will be easier to minimise with generic ATCO validations.

An economic impact is foreseen for following areas; training, conversion training and verification of competence.

There is also an impact on a European level regarding regulatory issues not thoroughly analysed, but primarily the generic ATCO validation will encourage a common European regulation and harmonisation between service providers. A European pan alignment would undoubtedly render a reduction in cost for the above-mentioned areas.

#### *c) Social Impact*

The solution does not have any main direct social objective but once deployed; it will have a particular social impact that can be illustrated by the following points:

- Increased flexibility in ATC labour market (due to generic licensing and possibility to work as an ATCO also in other location)
- Positive impact on human performance of particular stakeholder groups – ATCOs and pilots (due to a reduction of coordination and handovers amended by better distribution of workload over time)

The concept itself also brings partial social challenges, especially concerning ATCO stakeholder group (acceptance of the concept, new training needs, further distribution of liabilities etc.). The challenges will be addressed within the project primarily through active ATCOs involvement and continuous work with this group. Therefore, the overall social impact of the solution should be positive.

### 2.1.2 Solution: PJ10-W2-93

#### *a) Technical Impact*

The following performance objectives are expected with the assumption that at the right infrastructure is in place:

Performance Goals	Level	Rational
Efficiency	M	<p>Increased capability to organise contingency plans, both on the ATSUs operational side and on the ATM Data provision side, using interchangeable standard services.</p> <p>When traffic demand is low, full transfer of responsibility of one of more sectors from one ATSU to another ATSU will improve the Cost-Efficiency as the number of ATCOs on duty might decrease.</p> <p>ANSPs will have possibility to purchase services from various providers. The technical certified “plug-in” capabilities are expected to increase competitive market thus reducing costs for ANSPs and airspace users.</p> <p>Double training and further contingency exercises are required, because of the involvement of an additional ADSP.</p>
Capacity	H	<p>In those cases of lack of capacity in a sector or more sectors of an ATSU due to resource limitations, full transfer of responsibility of any of these sectors to a less overloaded ATSU will improve the use of spare capacity and therefore the throughput will increase.</p> <p>The capacity could increase due to potential higher availability of ATCOs in peak periods.</p>

Performance Goals	Level	Rational
		Contingency plans ready to assume the control of an ATSU under degradation, would improve the capacity shortfall due to the degradation of the ATSU service By implementing the seamless airspace delegation for load balancing the restriction time will be shorter and the number of restrictions will be reduced.
Flexibility	M	The ATFCM delays will be reduced on those cases where regulations are potential mitigations to solve capacity problems due to resource limitations meaning that airspace configurations with more sectors can be opened. The transfer of responsibility of one or more overloaded sectors to a different ATSU with spare capacity will avoid the application of regulations and therefore the imposition of delays.
Human performance	M	The Delegation of Airspace among ATSUs might imply ATCOs trained to control in different sectors of different ATSUS implying an increase of training times and costs to keep the competences and licences.
Interoperability	H	Synchronised application of standards and common principles between different ATUS together with common technical and operational solutions will ensure the technical and operational interoperability of air navigation systems among ATSUs.
Safety	L	The Delegation of Airspace among ATSUs may imply a loss of Situational Awareness for the ATCO assuming new responsibilities when absorbing new sectors. This situation may imply risks to be mitigated impacting Safety negatively.

The Virtual Centre concept could be implemented in a Geographical environment with a distributed platform and in this case operational transparency for Airspaces users and neighbouring FIRs will be realized. If this concept is used in a networking and connected environment (the ATM grid), the services Design for Airspace Delegation, has to be carefully studied but it has to be transparent for Airspace users.

#### ***b) Economic Impact***

Delegation can produce cost savings for ANSPs thanks to the possibility to transfer responsibilities between ATSUs, thus allowing to better manage and balance capacity and human resources in particular situation, for example when the capacity demand is very high or very low. For the technical perspective, a service-oriented approach allows to purchase services from various providers, opening to a competitive market that would, in the end, reduce costs for ANSPs and airspace users.

#### ***c) Social Impact***

By having coherent, accurate Working methods using the Airspace Delegation and Contingency and early information on the process, the different ATM actors are able to better warrant the flight schedules and minimize delays as well the impact of Workload. A potential social impact could also be the sharing of operational culture and a more enhanced level of coordination with adjacent control areas/sectors for the Delegation of Airspace.

### **2.1.3 Solution: PJ10-W2-96**

#### ***a) Technical Impact***

The following performance objectives are expected.

Performance Goals	Level	Rational
Capacity	M	Increased time is available to controllers' due to increased productivity. Could choose to use a portion of this additional "headroom" to increase Capacity if required.
Efficiency	M	Efficiency is increased due to fewer controller actions required to achieve the same result.
Predictability	M	Predictability of outcome is increased due to standardisation of input devices and procedures.
Flexibility	M	Faster, more reliable and secure controller logon and configuration increases flexibility of allocation of roles to CWP's, hence flexibility of staffing in operations.
Safety	H	Safety gains are made due to decreased controller workload (fewer instances of overload), increased reliability of controller input and potential new safety nets based on new input data available for cross-checking.
Human Performance	H	Controller performance will be enhanced in a clear, measurable way verifying the increase in the number of effectively managed flights per year.
Environmental Sustainability	M	Better interaction with trajectories and more efficient selection of routes facilitates environmental gains promised by other SESAR projects.
Interoperability	M	Interoperability will be increased by tailoring interaction modalities to the controller tasks, best practices are supposed to get standard at corresponding CWP's.
Cost Effectiveness	H	The interaction methods under trial are mature technologies and relatively cheap. The potential benefits in terms of capacity, performance and safety enhancements are conversely quite large.

### ***b) Economic Impact***

Previous Projects involved in Automatic Speech Recognition like PJ.16-04, MALORCA and AcListant showed improvements in wide areas like economy (cost saving), capacity, environmental and safety impact. The validations done in Simulations for TMA in these previous projects showed for airlines 50 to 65 € cost savings of kerosene per flight in medium traffic situations. The Environmental impact showed savings of about 130 kg of CO<sub>2</sub> per flight (A320). On the landing rate in TMA there was an increase of 2.1 movements per hour with ASR support. And the Distance Flown showed on Director Position an average reduction of 5.0 NM with ASR support (-6.5%)

The validations in Solution 96 are conducted to show the correctness of these values with Real-Time Data in Real-Life OPS-Rooms. ASR has several use cases to support controllers in the expedite and efficient execution of their tasks, e.g. the update of the system with the controllers commands, the better understanding of a new dynamic sectorisation, etc.

Time of HMI arrangement by ATCOs will be reduced and workload will decrease during shift take-over/ re-sectorisation / change of role with UPMS support.

### ***c) Social Impact***

Previous validations showed that Controllers in Approach Areas will have 15% - 20% less workload with ASR support. The reduction of controller's workload thanks to the introduction of ABSR allows the controller to concentrate in key information highlighted by AG HMI. On top of that, the crosscheck of controller's voice commands with their inputs in the CWP's provides a new safety layer to the system. In Approach Units there are 8% more correct values in the aircraft label with ASR support.

The integration of ASR into the ATM system allows automatic input of all data, which currently flows only between the controller and the pilot, into the ATM system. Both, the ATM system and the ATCO, will therefore

work with a very similar data structure, allowing further development of supporting tools, including the Safety nets. Without automatic input of the data into the ATM system, such development is hardly feasible.

UPMS will increase Safety by automatic activation of important customized functions which leads to decreased risk of overlooking of some functions activated by ATCO.

The introduction of a UPMS could easily be combined with a security lock or biometric device that could increase the difficulty to misuse the CWP by unauthorised agents.

Moreover, the introduction of these new technologies in the field of Human/Machine interaction will most probably lead to the adjustment of European and local legislations in order to make sure the ATCOs and other stakeholders' responsibility in these new scenarios is clearly determined.

## **2.2 Measures to maximise impact**

### ***a) Dissemination and exploitation of results***

In addition to the common principles, it is foreseen to communicate largely on the contents of the work to be performed in the frame of this project.

The main means for dissemination will be:

- participation in international conferences, presenting project results and achievements,
- meetings, digital newsletters, organisation of workshops and tutorials or other common events,
- publications to high-profile journals (e.g. IEEE Journals), participating ANSP and industry websites.

It is expected that the consortium will submit technical papers to international conferences on the separation management topics covered by this project, thus allowing the project to be presented. In addition, 'Open Days' will be conducted after a significant validation has taken place. Stakeholders are invited to see the developed tools and procedures being applied in a realistic target environment, and also allowing the attendees to put 'hands-on' and have a first-sight experience of the achieved project results. This in turn also allows the project partners to get important feedback from people not directly being involved.

Furthermore, it is planned to link the dissemination activities of project results to already existing events. As soon as the project is released and initial results or progress can be reported, it is intended to propagate the achievements through events such as the ATM EUROCONTROL-FAA Seminars. Specific events can also be used for such propagation (e.g. the Digital Avionics Systems Conference/DASC, the International Conference on Research in Air Transportation/ICRA or the International Council of the Aeronautical Sciences Congress/ICAS). Ideally, a common approach with existing conferences with SJU presence should be planned, an active role in the ATC-Global or World ATM congress conferences would be a very good showcase.

The target audience for the dissemination would be ATM leaders and airspace users. Changes in the scope of the advanced team organisations and controller decision support tools need to be disclosed at all levels, from top management to end-users, to allow full buy-in in the new concepts. Also specific stakeholder groups will be addressed, e.g. through presentations at the IFATCA and IFATSEA annual meetings (as part of a social dialogue).

In solution PJ.16-04 of wave 1 the partners including ANSPS, Research Institutes, ATM supplier industry and ATM consultancy have agreed on common rules for extracting the semantics of controller utterances, i.e. an ontology for command annotation. The ontology enables comparison of the different ASR implementation, as they are planned in the four different exercises with respect to ASR. Furthermore the ontology enables not only the exchange of test data, but also the exchange of training data. MALORCA project showed that speech recognition model requires huge training data sets. The next step is to standardize the ontology and especially to use ontology as basis for standardization of interfaces between the new functional block speech recognition and the (traditional) functional blocks for voice communication, aircraft state information (e.g. radar data), and weather data on the one hand and the integration of ASR output into the ATCO's HMIs (e.g. radar screen) on the other hand.

### ***b) Communication activities***

Most of the project participants are members of several international organisations, associations and forums. In this way, they will be able to present project's results to a large ATM community, through for instance workshops, conferences, and seminars. Another opportunity to communicate project's results will be through presentations to the European Commission or at specific meetings organised by European bodies (e.g. EASA) in Air Transport.

The appointed communication manager co-ordinates all activities in this area. It is envisaged that DFS as project manager takes responsibility for communication.

As an internal communication channel the SESAR STELLAR extranet is already established. Furthermore, it is planned to build up a database on STELLAR containing all relevant documents produced in PJ10. At least all programme documentation will be stored in order to have full electronic access to documentation.

The second step, will be the creation of a project's website for PJ10 external communication. The external accessible website will inform about all public objectives and goals of the project, the consortium members with contact data, it will provide short descriptions of work packages and co-operation activities between partners. In the course of project, a newsletter with current project status and planned meetings will be the means of a regular flow of information about the project's general progress.

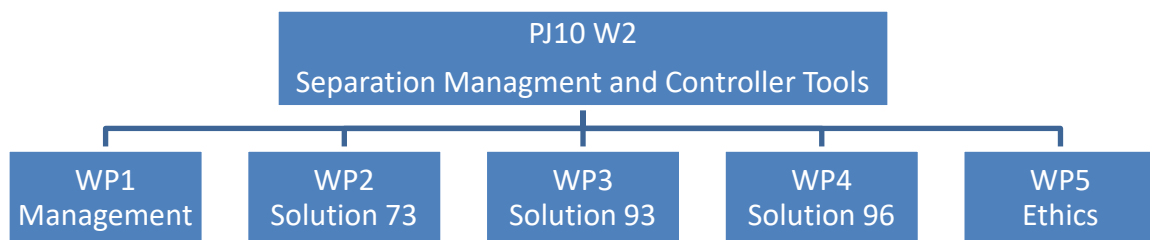
Great attention will be paid to the quality of communication with the European Commission, and to the quality of the reporting. For allowing such precise reporting, the consortium has defined a number of deliverables which will ensure a tight follow-up of the works being carried on. These deliverables have been designed as successive milestones for both the partners and the consortium.

## **3 Implementation**

### **3.1 Work plan — Work packages, deliverables**

#### **3.1.1 Project Structure**

The project is divided into three different solutions; each split into a certain number of activities and to a certain extent, coordinated independently by its SL. The project structure is displayed in Figure 5.



**Figure 4: PJ10-W2 Work Break Down Structure**

In order to ensure the appropriate coordination and performance of the activities related to transversal activities, two additional roles are proposed at project level: The Project Content Integration Team (PCIT) which will be a subset of the ATM focal points led by the Project Content Integration Leader (PCIL). The PCIT will have in addition to the responsibilities as an ATM focal point, other duties related to the coordination with the transversal projects in order to ensure the suitability of the contributions generated by the different solutions. See more details of the responsibilities in section 3.2.

A detailed work package description follows in chapter 3.4.

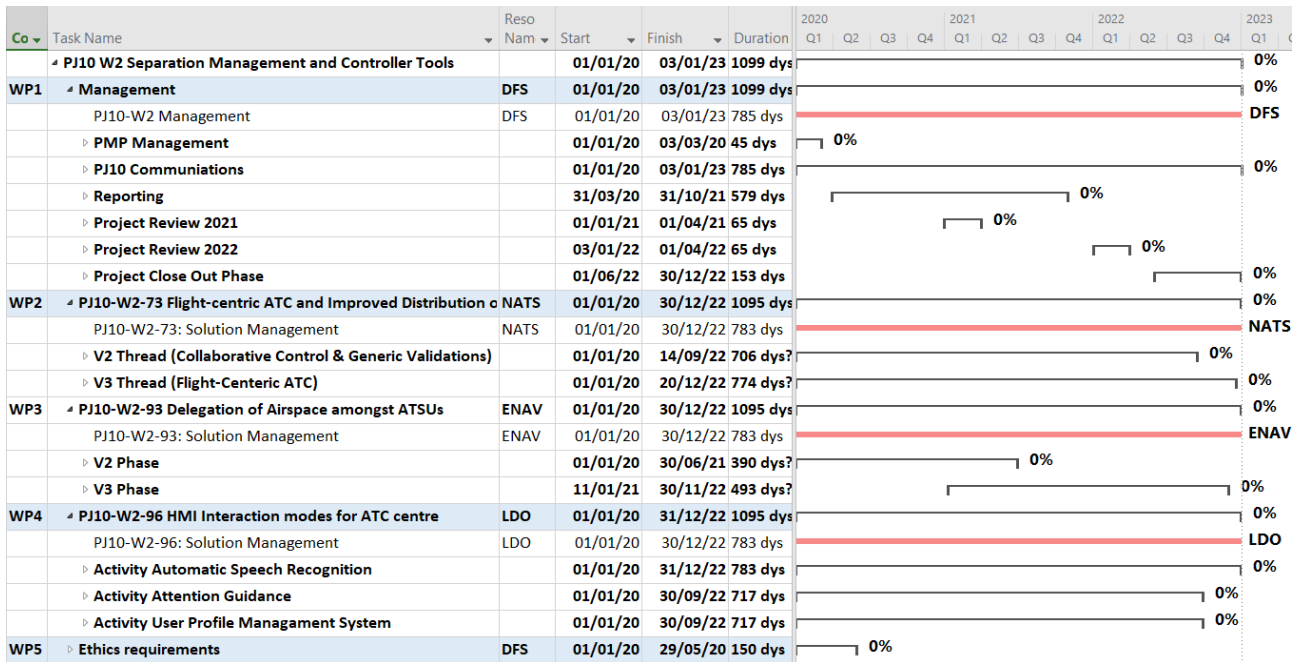


Figure 5: Project PJ10-W2 Gantt chart

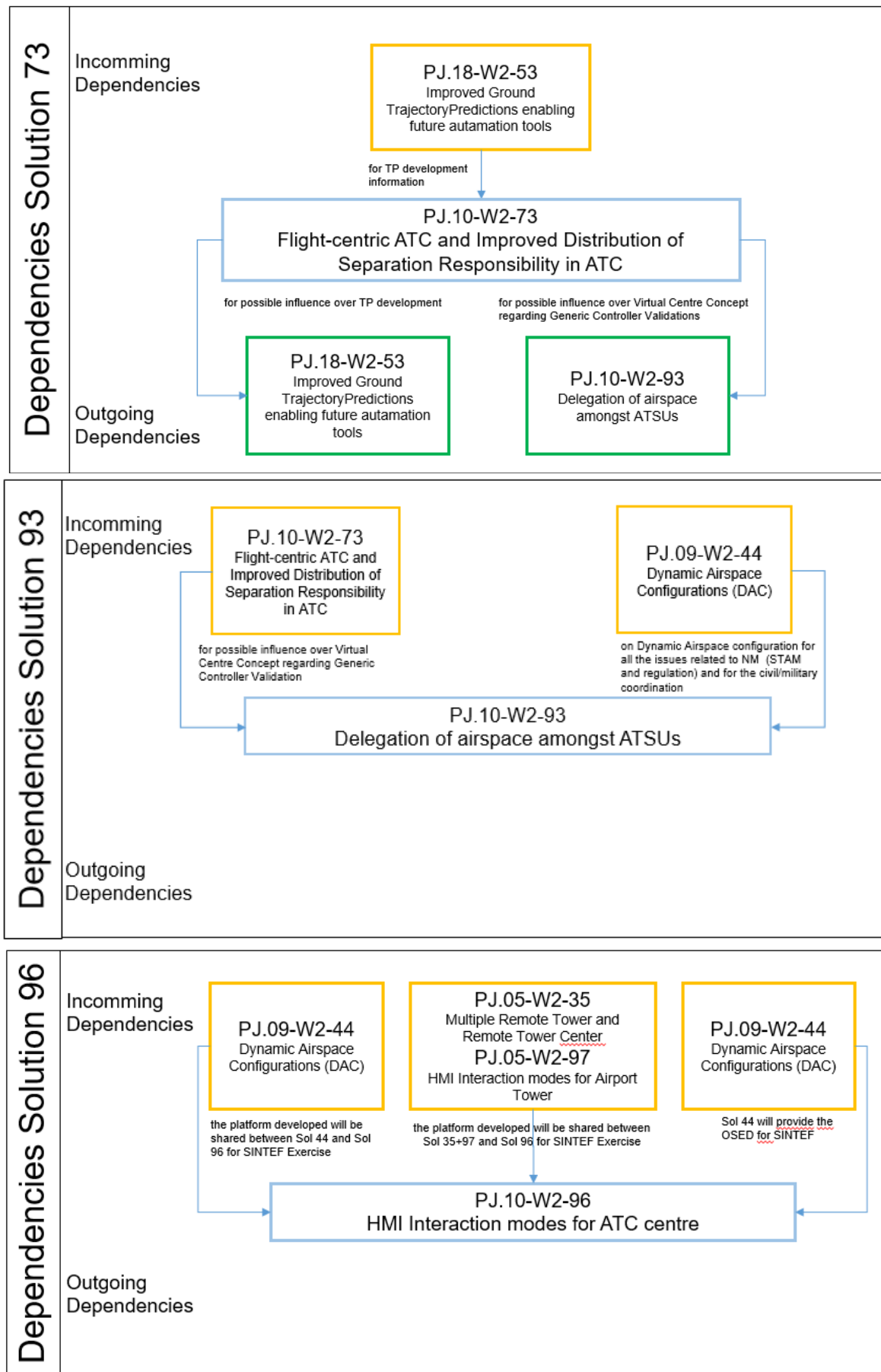
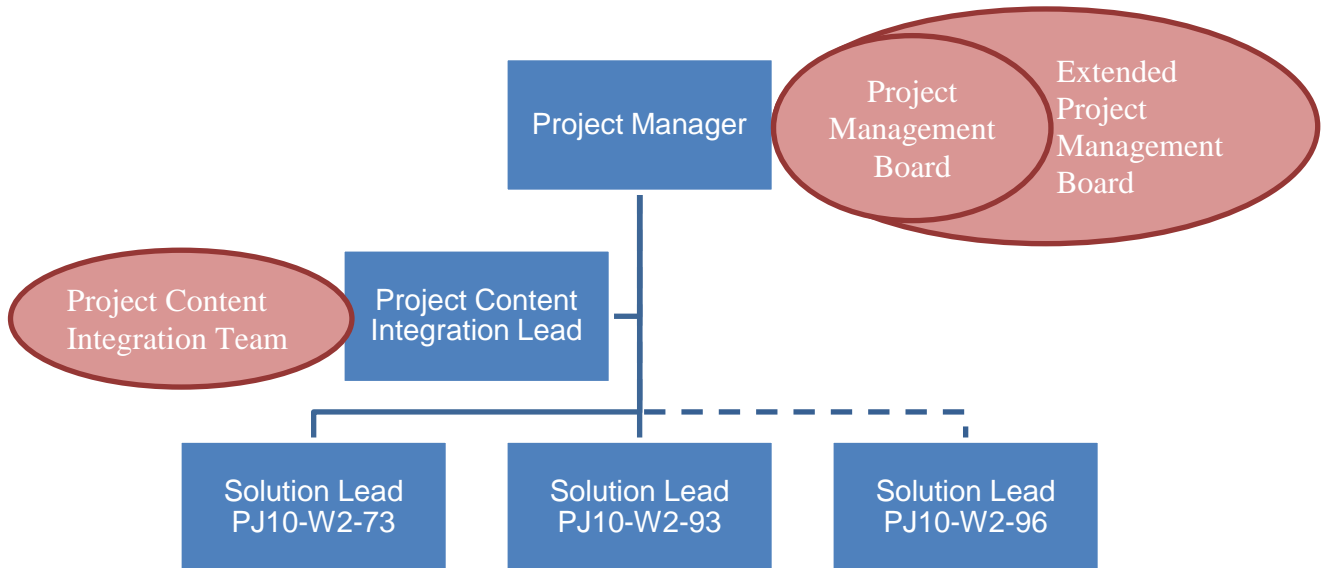


Figure 6: Project Pert Diagrams

### 3.2 Management structure, milestones and procedures

A lean and efficient management structure will be applied that allows for fast decision making to ensure that the pursued objectives are met. The SESAR2020 Membership Agreement (SMA) specifies management rules that govern the project's workflow as well as all responsibilities and duties of the partners during the course of the project. The administrative and organisational management activities are hosted in WP01. This approach will allow an effective and efficient assignment of partner contributions, while facilitating separation of research and technology tasks from the administrative work necessary to carry out the project.

The project management structure is composed of two main levels that are presented in Figure 7.



**Figure 7: Project Structure for Solution Project**

The combined legislative-executive level is composed of the Project Manager (PM) and a set of dedicated panels. The PM, as a central point of reference, participates in the Project Management Board, ensuring the overall coordination and follow-up of Project activities. The PM reports to the SESAR Joint Undertaking (SJU) on behalf of the project partners. The Project Content Integration Lead (PCIL) ensures that the project content information is consistent across solutions. At the implementation level Solution Leaders (SLs) manage the execution of technical development and control implementation steps.

#### 3.2.1 Project Manager (PM)

The **Project Manager** acts as the Specific Grant Agreement point of contact (SGA Coordinator) with the SJU for all contractual matters, and is responsible for:

- checking the quality of the deliverables and verifying their completeness and correctness;
- submitting the deliverables and reports on behalf of the SGA beneficiaries;
- the escalation of issues relevant to the Grant Agreement or to the overall SESAR Programme and management of changes to the Grant Agreement;
- preparing and contributing to the formal contractual closure of the activity.

In addition, the **Project Manager** is responsible of:

- the timely delivery of the SESAR solutions or technological solutions and enablers for IRs projects;
- the timely execution of SESAR solution validation activities for IRs projects;
- the preparation, execution and maintenance of a Project Management plan;
- the application of common methods, as defined within the Programme Management Plan (e.g. progress reporting, corrective action implementation, project control gates);
- the provision of a comprehensive oversight of the Project and management of the operational relationship between the Members involved at the Project level;

- ensuring with partners the engagement of 3rd parties (such as but not limited to airspace users, staff associations, etc.), where applicable;
- escalation of issues internal to the Project that cannot be resolved by the PMB to the contribution managers of the Project Partners;
- proper and timely communication of information, within and outside of the Project; and
- an appropriate preparation and contribution to the operational closure of the Project.

### **3.2.2 Project Management Board (PMB)**

The Project Management Board will ensure a constant exchange of information between Project Manager, Solution Leads and the SJU. It will be used to monitor the application and to constantly improve the common methods as defined in the PMP.

The Project Management Board should meet periodically (e.g. weekly WebEx and quarterly Face to Face as required) to:

- review progress of the solutions;
- review solution risks and associated mitigation actions;
- review solution schedule
- review communication and dissemination activities.

The Project Management Board will be composed of:

- Project Manager (chairman)
- Solution Leaders (WP leaders)

SJU may be invited for specific agenda items.

### **3.2.3 Extended Project Management Board (EPMB)**

An Extended Project Management Board meeting including all contributors of the project will convene on a regular basis, typically 3-4 times per year. SJU may be invited for specific agenda items.

The Extended Project Management Board will ensure that all key management decisions of the project are taken with the full support of contributors of the projects. Decision will be made by consensus of all partners involved in a given solution or work package, or in the project if the decision applies to the whole project. In case of disagreement, the escalation process foreseen in Appendix F of the SJU Membership Agreement will apply.

The Extended Project Management Board will meet periodically (preferably Face to Face) to:

- review progress of the project as a whole;
- decide corrective actions;
- review project risks and associated mitigation actions;
- review any potential Change Request to the SGA when necessary.

In addition, in case of significant changes to the project, the Extended Project Management Board shall be asked for approval by correspondence, e.g. for:

- critical deliverables of the project:
  - Initial PMP and updates
  - CBAs (approved by contributors to the solution)
  - V Data Pack
- Change Request to the SGA.

### **3.2.4 Solution Leader (SL)**

The Solution Leader is the person responsible for the operational and technical leading of the solution. He/She is responsible for the SESAR solution refinement, the overall management of related validation activities and timely delivery of the solution deliverables. In particular, the Solution Leader will:

- organise and coordinate the activities of the Solution Team;

- report to the Project Manager on progresses and issues;
- make proposal for update and amendments of the validation roadmap, to be agreed at project level;
- ensure consistency within the solution and in particular of the different deliverables in support of the different maturity evolution/levels (V1, V2 and V3);
- prepare and represent the solution at the maturity gate, notably responsible for producing the Maturity Report;
- participate to the PMB/EPMB.

### **3.2.5 Solution Team**

The main role of the Solution Team is to:

- Define, validate the SESAR solution and produce the associated deliverables and prototypes. A project validation roadmap will be agreed at project level. The Solution Team will conduct validations according to the agreed roadmap.
- Identify and initiate required changes to the SESAR solution, including the validation roadmap.
- Contribute, under the coordination of the Project Content Integration Lead, to update the relevant sections of Transversal Projects deliverables.
- The Solution Team is composed of all contributors to the work of a given solution.

### **3.2.6 Project Content Integration Lead (PCIL)**

The Project Content Integration Lead will be a role assumed by the Project Manager:

- coordinates the work of the Project Content Integration Team;
- acts as a focal point for interaction with the Transversal Projects, supported by the Project Content Integration Team;
- is in particular the focal point for the project's change requests to the project content information.

The effort of the PCIL is allocated to WP1.

### **3.2.7 Project Content Integration Team (PCIT)**

The Project Content Integration Team is a virtual team composed of the ATM Focal Points and relevant experts from the Solution Teams.

- The role of the Project Content Integration Team is to ensure the technical and operational consistency between the different solutions developed in one project, consistency with dependant solutions in other Projects and to coordinate interactions with Transversal activities. It ensures that the outputs provided by the projects are compliant with the guidance material provided by Transversal Projects. It shall identify and seek for solutions for any gaps or conflicting choices between the solutions of the project in order to ensure the project fulfils its objectives. It also supports the Project Manager for the organisation of the technical gates, and for the communication of project results.
- For each focal area, the three solutions will name a single point of contact for the PCIL.

## **3.3 Consortium as a whole**

The members of the SESAR Joint Undertaking PPP work and cooperate together to the best of their abilities with a view of implementing SESAR 2020 in a correct, efficient, open and timely manner and of attaining the objectives and the deliverables as envisaged by the ATM Master Plan. The consortium involves key stakeholders of the Airborne Systems, Ground ATM Systems, Service Provision and EUROCONTROL hence providing a wide range of expertise covering all aspects of EUROPEAN ATM.

At the time of submitting this proposal, this consortium comprises 24 active organisations from 17 member states of the European Union, and 2 organisations from 2 nations beyond the EU. The consortium was carefully selected according to the skills and experiences required to accomplish the proposed work. The operational

expertise, which is crucial for the conceptualisation and implementation phase of the project, is found in the strong representation of end-user organisations in the consortium. The work is structured in a very collaborative way throughout all work packages and will ensure the transfer of knowledge and know-how between all participants.

### **3.3.1 Solution: PJ10-W2-73**

#### **Airbus justification for participation:**

AIRBUS SAS will contribute to solution 73, through ad-hoc consultations, in order to assess the feasibility of the potential evolutions in the airborne communications functions and systems, which might be required for Flight-Centric ATC, such as:

- the extension of the current analogue VHF system over wider geographical areas
- definition and implementation of VHF frequencies assignment plans
- future digital voice systems

#### **ANS CR (B4) justification for participation:**

Thanks to active participation in current FCA solution (PJ10-1b), there is a lot of experience not only with the FCA topic itself, but also with the preparation of VAL EXE, contribution to deliverables etc. There are also lessons learnt from current cooperation on the FCA VAL EXE. All this experience will be used as a basis for the cooperation in solution 73. Apart of that, the range of subjects closely cooperating together (common VAL EXE) stays almost the same which allows to use the already established communication and other mechanisms to facilitate the progress. The main benefits are:

- ANS CR (B4), INTEGRA and AgentFly Technologies are all involved in current FCA solution and have enough experience and expert skills in the FCA field
- ANS CR (B4) and AgentFly Technologies already developed a FTS platform for the FCA environment enabling comparison of conventional and FCA operations. This platform can be further developed to accommodate new requirements. The use of the already proven platform will save a lot of effort and can bring substantial benefits
- ANS CR (B4), INTEGRA and AgentFly will continue in their expert contribution based on their FCA experience that will make their contribution more effective

ANS CR (B4) intends to contribute to following activities:

- development and participation in FTS to address horizontal expansion of FCA in En-Route (a joint EXE with EUROCONTROL led by EUROCONTROL)
- contribution to VALP/VALR and CBA regarding the FTS
- expert review of deliverables using the experience from current PJ10-1b solution (SAF and HP particularly)
- support to inputs of deliverables into SE-DMF (inputs relevant to the FTS)

ANS CR (B4) will contribute in cooperation with its LTP AgentFly and INTEGRA (concrete tasks and experience are described below):

- AgentFly Technologies (ANS CR (B4) LTP):

AgentFly Technologies was established in 2010 to commercialize outcomes of research projects carried out at the Czech Technical University in Prague since 2005. Initial research sponsored by U.S Air Force, U.S Army and U.S Navy focused on simulation of UAS teams. In 2009, acquisition of hardware platforms (both fixed wing and rotary) and deployment of AgentFly to these platforms have been started. Air traffic simulation branch has been initiated under sponsorship of FAA in 2008 and extended by participation in SESAR 2020 and cooperation with Czech ANSP.

AgentFly Technologies will participate in following activities:

- development and participation in FTS

- contribution to VALP/VALR and CBA regarding the FTS

- **INTEGRA (ANS CR (B4) LTP):**

Integra is a privately owned consultant company with close to 30 years of experience providing consultancy services to the aviation and defence industries. Within aviation, Integra is specialized in the fields of Air Traffic Management (ATM), airports as well as regulatory and oversight functions. Integra has performed more than 500 consultancy projects for aviation organisations such as ANSPs, airports, national authorities and defence organisations in more than 30 different countries on five continents, as well as for a long list of international organisations like NATO, European Commission, EUROCONTROL, ICAO, World Bank and European Bank for Reconstruction and Development.

INTEGRA will participate in following activities for solution 73:

- expert review of deliverables using the experience from current PJ10-1b solution (SAF and HP particularly)

**COOPANS justification for participation:**

Operational expertise in developing the OSED. Evaluate the Concept development and validation from FTS to RTS. Specific skills within Human Performance, Safety and Risk Assessment and operational experience from medium to low complexity. Competences from Linköping University.

**DFS justification for participation:**

Special emphasis will be put on the transition aspect both between flight centric and sector-based ATC and the transition from main to fallback system. As it is not clear at the moment whether the flight centric ATC may be operated 24h or a switchback to sector-based operations is required from time to time, the approach may be subject to change during the project (i.e. if H24 operations are possible than this transition only needs to be addressed in less detail). For the transition a stable communication infrastructure will be assumed. Non-nominal cases regarding communication are not within the scope. As fallback system the DFS operational fallback system Phoenix will be used. Controller tools are essential also for the fallback case in order to safely handle the high traffic levels within the FCA. Therefore the Phoenix system will be enriched with appropriate conflict detection, resolution advisory and flight path monitoring tools. Partners will be involved within the concept development of the operational procedures in order to suit the needs of different operational environments.

**DLR (AT-One) justification for participation:**

DLR (AT-ONE) intends to conduct an exercise together with Hungarocontrol and Frequentis which will show benefits in workload for both ATCOs and (to a lesser degree) pilots, ATCO productivity and capacity. Flight-Centric operations 24/7 in whole Budapest ACC above FL95 (exact lower boundary to be determined during exercise) will be simulated. ATCOs work in sort of Single-Person Operations, fulfilling duties of Planning and Executive Controller on the flights allocated to them. Investigation of feasibility of concept under non-nominal situations (emergencies, severe weather). Contribution to refined performance assessment of concept in V3. Clarification of feasibility of Flight-Centric ATC under non-nominal conditions, further refinement of performance assessment of Flight-Centric concept. Simulation Platform and Radar Display to be provided by DLR (AT-ONE) for this exercise.

DLR (AT-ONE) has worked together successfully in Wave 1 in a V2 exercise simulating together with Hungarocontrol Budapest ACC on DLR (AT-ONE)'s TrafficSim platform with Wide Area Communication System from Frequentis integrated as well. However, only nominal situations were investigated in the Wave 1 exercise. Further previous work of AT-One (DLR) Institute of Flight Guidance in this field:

- LRM2020 study (2008-2009): Joint study between DFS Deutsche Flugsicherung GmbH and Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) (commissioned by DFS) to investigate feasibility of sectorless ATM on principle.
- TeFiS (Technologie für Flugverkehrsmanagement in großen Strukturen) LuFo project (2014-2016): Subcontractor of DFS to investigate details of sectorless ATM.

**ENAIRES justification for participation:**

ENAIRES is highly interested in the improvement of provided air navigation service in En-Route and TMA phase, especially in terms of capacity and quality of service and cost-effectiveness. ENAIRES will be deeply involved in the validation of new concepts that imply a change in the paradigm of the ATC control such as the Flight Centric ATC. ENAIRES intends to carry out a validation exercise in this solution, participating also in the development of the concept. In order to perform this exercise, ENAIRES will collaborate with INDRA as platform provider for the FCEC and FCPC CWP which will include the improvements of the functionalities obtained during Wave 1. ENAIRES will complement the functionalities of the Industrial-based platform with their own developments to support the Allocator tasks dealing with the implementation of flight allocation criteria.

#### **ENAV justification for participation:**

ENAV intends to contribute to the validation of transition scenarios between flight centric and sector-based operations. ENAV will participate to the validation activities led by DFS, providing with operational personnel supporting the exercise execution via suitable validation techniques.

Moreover, ENAV in cooperation with its LTP Techno Sky intends to support and to review the development of operational concept/ATC procedures related to Flight-centric ATC operations defined in the OSED.

#### **EUROCONTROL justification for participation:**

EUROCONTROL will participate in the project actions without requesting funding. EUROCONTROL will, however, fully engage in the project and in particular is committed to providing the effort, contributions to deliverables and to other activities as set out in this tender and in the accompanying administrative forms.

Main reasons for EUROCONTROL participation in this solutions are:

- Need to research the Impact of the sub-solution on NM provision responsibility, having in mind that the solution could have direct and substantial impact on NM operations in terms of capacity planning in all phases.
- Validation capabilities and infrastructure for high fidelity FTS and RTS Data availability and statistics on regional bases which is going to cover the regional aspects of the CBA for the solution.
- Proven expertise in all required research aspects for this solution (operational, safety, technical, specific expertise related to planning, organization and conduct of validation).
- Capability to provide Frequency spectrum analyses of the FCA impact on regional level.

#### **FRQ (FSP) justification for participation:**

Frequentis AG will support the project with expert staff with knowledge and capabilities in the following areas:

- Air Traffic Control Radio Communications
- Digital Signal Processing skills in Algorithm Design, Simulation
- ATC Voice and Data Communication know how

Frequentis additionally proposes to contribute to the RTS exercises of EUROCONTROL and DFS. The Wide Area Communication concept developed in Wave 1 will be assumed. In practice the A/G communications will be emulated and no further prototype development or integration of the existing FREQUENTIS prototype in the RTS platforms is foreseen.

#### **HungaroControl justification for participation:**

HungaroControl intends to conduct an exercise together with DLR and Frequentis which will show benefits in workload for both ATCOs and (to a lesser degree) pilots, ATCO productivity and capacity. Flight-Centric operations 24/7 in whole Budapest ACC above FL95 (exact lower boundary to be determined during exercise) will be simulated. ATCOs work in sort of Single-Person Operations, fulfilling duties of Planning and Executive Controller on the flights allocated to them. Investigation of feasibility of concept under non-nominal situations (emergencies, severe weather). Contribution to refined performance assessment of concept in V3. Clarification of feasibility of Flight-Centric ATC under non-nominal conditions, further refinement of performance assessment of Flight-Centric concept. HungaroControl will support the project with expert staff with knowledge and capabilities in the following areas:

- Air Traffic Controllers for validation, concept development and system test
- Airspace designers
- Voice communication expert
- ATM system experts
- Human Factors expertise

#### **Indra justification for participation:**

Indra's expertise covers a wide variety of areas of knowledge shared and improved through its participation under the SESAR Programme.

Indra's experience obtained during SESAR 2020 in the project PJ.10-01b, focuses to assess the benefits of the FCA to optimize the controllers' productivity maintaining the same safety level and to assess the feasibility of different team organizations defining roles and responsibilities and assessing different allocation strategies.

#### **Leonardo justification for participation:**

Leonardo will support the exercise evaluating new functions which allow the ATCOs to exchange the information with the controlled aircraft when flying across different sectors. The investigation will be concentrate on the functions able to skip frequency sectors automatically and cable to guarantee continuity in communication between the ATCO which has in charge the flight and the pilot. The feasibility will be investigate taking into account Multi Sector Planner feature.

#### **NATS justification for participation:**

NATS plan to continue developing the concept of Collaborative Control with planned boundaries, a continuation of the work carried out in SESAR 2020 Wave 1 by PJ10-01c. In this concept, airspace sectors are retained as they are today, with aircraft being assigned to a sector according to its geographic location, and with boundaries between sectors having planned coordination conditions like in current operations. The main objective of the concept is to enable collaborative control operations, where ATCOs will be able to issue instructions to aircraft that involve out-of-sector manoeuvring, without the coordination required in conventional operations i.e. a phone call.

The NATS validation activity undertaken in SESAR 2020 Wave 1 was based in the very high complexity London TMA and focussed on OI CM-0309. In Wave 2, the plan is to mature the concept and validate it within the UK very high complexity En-Route airspace. This will address OI CM-0310 (which has not as yet been progressed) but also continue to mature CM-0309. It is planned that both OI steps will be matured to full V2 maturity. As the work is primarily targeting V2, the RTS will be built on the NATS ACE platform and no IBP will be required. However, effort has been included to work with INDRA to ensure that the technical requirements are suitably captured in the TS/IRS and communicated effectively as an initial activity for the V3 work.

NATS also plan to continue developing the work undertaken in SESAR 2020 Wave 1 PJ10-06 on Non Geographical Controller Validations. This concept investigates the possibility of moving away from the current operating method of controllers holding sector based validations to one in which controllers hold a validation entitling them to work a particular type of airspace (yet to be defined but likely to be based on complexity, type and level of traffic). This work was matured to V1 in Wave 1 and it is hoped to mature it to V2 in Wave 2 through further concept development and a V2 activity (non real-time but controller in-the-loop) using the platform developed for the Collaborative Control RTS.

Effort has also been assigned for NATS to work with DFS to investigate if there are any common technical requirements applicable to Flight Centric and Collaborative Control concepts.

NATS propose to lead the solution 73 VALR and contribute to other deliverables within the solution.

#### **Skyguide justification for participation:**

Skyguide participation is fully justified even if it belongs to a non EU country. Skyguide is the civil and military ANSP of Switzerland – we are therefore able to provide front-end expertise of a dynamic ANSP located in the middle of the European ATM Network, dealing with the highest density and complexity airspace of Europe and are also able to provide innovative approaches to new technology in the domains of ATC HMIs, centralised

ATC data processing engines with various levels of automation and boosting the performance to manage this complex airspace of the European ATM Network core-area.

Within the SESAR 1, B04.04 Project, Skyguide played a key role as simulation coordinator for all planned sessions. The B04.04 showed the capabilities that a dynamic entity such as Skyguide.

Skyguide was core-member of the FASTI programme as from 2005 and declared as a FASTI pioneer, at the time already making use of our fully electronic environment. Our operations are fully equipped with CPDLC capability and make use on a daily basis of 4d Trajectory based ATC Support tools (conflict detection and conflict resolution tools, monitoring aids, inter-sector coordination tools).

In addition Skyguide has set up an advanced R&D platform equipped with new functionalities such as “what-if” and “what-else” functions, 4D trajectory management etc. In the context of the changing ATM environment, we intend also to migrate to a Multi-Sector Planner configuration, some initial validations have been performed in the frame of FASTI, in collaboration with ENAV.

Skyguide has a dedicated SESAR platform available that offers 16 positions. The platform is the result of our excellent collaboration between the ATM and ATM solution provider.

Skyguide has a competitive advantage in the field of virtualisation. We have not only concluded the conceptual work around the Virtual centre concept, but has also taken the first major steps in the technical implementation of the baseline solution that will allow us to operate in a fully Service based environment. Our technical infrastructure will be adapted in the same timeframe as the SESAR 2020 programme will be conducted. We see our contribution in the programme as a possible key enabler to identify constraints and also opportunities to progress on the first major overhaul of the ATM System. By progressing in parallel with the evolution of the PJ, we can also show early advantages and report initial successes from our experience back into the PJ and make both developments to be synchronised.

As for NATS, skyguide also plans to continue developing the work undertaken in SESAR 2020 Wave 1 PJ10-06 on Non Geographical Controller Validations. We intend continuing investigating the concept of the possibility of moving away from the current operating method of controllers holding sector based validations to one in which controllers hold a validation entitling them to work a particular type of airspace (yet to be defined but likely to be based on complexity, type and level of traffic). This work was matured to V1 in Wave 1 and it is hoped to mature it to V2 in Wave 2 through further concept development and a V2 activity.

#### **Thales Air Systems justification for participation:**

With its strong technical expertise in ATM systems development, Thales AIR SYS will support the flight centric concept by providing ATC controller tools (TCT, CDR ...) to be integrated in IBP to support a validation exercise led by ECTRL.

Thales AIR SYS also plans to contribute to the technical specification and to provide its technical expertise support for other solution deliverables and review them.

### **3.3.2 Solution: PJ10-W2-93**

#### **Thales Air Systems justification for participation**

For the operational point of view, Thales Air Systems is an active partner of the Wave 1 solution PJ.15-09 by participating of all workshops and providing expertise on the operational Use Case. For the technical point of view, Thales Air Systems is the solution leader of the Wave 1 PJ.16-03 which is in charge of the TS/IRS of the Virtual Centre. During Wave 1, 2 successful TRL4 exercises were conducted with partners and 2 TRL6 exercises are planned in Q3 2019. In wave 2, the objective is both operational and technical to progress with our partners.

#### **B4 Consortium justification for participation**

LPS SR (B4) has a vast expertise in ATM operational and technical domains, performance management and analysis, business case, information management and ATM projects, based on know-how of Operational, Technical and Safety experts. LPS SR (B4) also has an expertise in design and implementation of innovative technologies, especially related to the Controller Working Position productivity and Safety.

LPS SR (B4) will use its knowledge gained in SESAR 2020 Wave 1 PJ.16-03 and will support and contribute to numerous activities in PJ.10 solution 93, but will mostly work as an active reviewer. Despite the lack of having a dedicated in-house validation platform, LPS SR (B4) will support validation exercises with their ATCOs on the platforms of PJ.10-93 partners.

PANSA (B4) provides air traffic management services, communication, navigation and surveillance services as well as aeronautical information services in the airspace over Poland and a designated area of the Baltic Sea. PANSA (B4) is involved in the iTEC Collaboration project (part of the DFS System Group). PANSA (B4) gathered experience in Wave 1 of SESAR2020 - participating in, among others, PJ10.02a (Improved Performance in the Provision of Separation), a project aimed at researching improved separation tools for ATCOs, in cooperation with ICM (University of Warsaw) and INDRA.

PANSA (B4) will contribute to solution 93, providing its operational expertise for the support of the operational concept of the Delegation of Airspace among ATSUs. PANSA (B4) will provide the iTEC validation platform to support validation exercises.

ON (B4) is a state-owned enterprise providing Air Navigation Services, including Air Traffic Management Services, Communication, Navigation and Surveillance Services, Aeronautical Information Services, as well as Search and Rescue, in the airspace of Republic of Lithuania and over the part of Baltic Sea. ON (B4) is a Member of Baltic FAB, a part of B4 Consortium composed of four ANSPs from Central and Eastern European countries and a Member of SESAR Joint Undertaking. Being a member of SESAR Joint Undertaking via B4 Consortium, ON actively participates in the industrial and transversal projects by SESAR 2020 Programme while participation in SESAR Deployment Programme allows to implement several projects. In 2017, ON officially joined the European iTEC (Interoperability Through European Collaboration) alliance developing a high-end air traffic management system for busy and complex airspace.

ON (B4) will contribute to solution 93, providing its operational expertise for the support of the operational concept of the Delegation of Airspace among ATSUs.

#### **ACG, CCL, IAA, LFV and Naviair – the COOPANS consortium justification for participation**

COOPANS consortium is a good example in cooperation between ANSP's and a system supplier, and is leading actor in the development and delivery of new ATM requirements. COOPANS partners have particular expertise in the development of common operational solutions, the development of ATC support tools, and future concepts of operation. The virtual centre supported by appropriate concept of operations offers the opportunity to develop a solution that will deliver performance and flexibility in operations. COOPANS Topsky system already has CWP's geographically separated from the FDP (used in the Dublin Control Centre for a period of time to provide the Shannon Approach Service) and see potential benefits in further exploration of VC capabilities. The members of COOPANS have previous experience from SESAR 1 WP 05.09, 16.01.02, 16.04.01 and 16.06.01b.

COOPANS partners intends to run validations in PJ.16 (with Thales Air Systems), investigating Delegation of Airspace as well as business continuity (through VC capabilities) and training environment (based on VC) even if the exact scope of the validation still needs to be clarified. COOPANS partners will bring in operational and system experts with experience from trajectory management and a highly automated ATM system.

#### **DSNA justification for participation**

DSNA has developed significant experiences within the previous and current SESAR solutions linked to the service oriented architecture, by demonstrating a strong involvement in projects B04.04 (as a leader) and PJ16.03 (leader of the service definition, contributor to exercises with the use of the Coflight Cloud Services platforms), that will have a direct link with solution 93.

In continuation with its current activities, DSNA intends to pursue its strong involvement on the concept of virtual centre to demonstrate the viability of the concepts:

- While ensuring the follow up of the Services defined in PJ16.03 and the feedbacks consistent with the running of and solution 93.

In addition to the solid background in SOA and virtualization, DSNA intends to build upon the following experiences and skills:

- DSN has worked in the SESAR1 7.5.4 and SESAR2020 Wave 1 PJ08 projects, addressing the operational concept of Dynamic Airspace Configuration. DSN has led validation exercises assessing Dynamic Sector Configuration with a huge range of possibilities enabled by a very modular airspace (simulations and shadow mode).
- With the implementation program of the new ATC system 4Flight, DSN is currently working on the contingency plans and needs, studying in particular Safety risk assessment and Human Factors aspects. This strong expertise will be used in the project.

### **ENAIRE justification for participation**

As service provider ENAIRE is currently enhancing its internal network architecture, by moving from a situation where the En-Route and TMA centres encompasses both, main servers and control working positions, to a more efficient architecture based on centralising the servers in one/two locations and keeping in most of control centres just the CWP. Similar improvements are being addressed regarding the service provision on Control Towers of Spanish airports.

As previous experiences on SESAR activities, apart from its participation in projects dealing with CWP improvements (SESAR 1, projects 05.09 and 06.09.02) and virtualisation (SESAR 1 contingency remote tower, 06.08.04), it has to be mentioned also the activities performed on SESAR Wave 2 projects, by contributing to the development of the SPR/INTEROP/OSD (V1) for contingency and delegation of Airspace (PJ15-09) and contributing to the definition and modelling of the operational and technical concept of the Virtual Centre, refining the initial set of services up to an operational and ready to standardise maturity level, refining and modelling of the high level architecture (PJ16-03).

### **ENAV justification for participation**

ENAV has an outstanding expertise in Air Traffic Management operations and services, in the development and validation of concepts also in the SESAR Programme. ENAV idea is to evaluate the potentiality of new technologies and approaches exploring the possible impact on ATCO workload, situation awareness and safety. In addition during this activities performance and system efficiency will be monitored.

The role taken by ENAV as leader of W2 solution 93 has to be seen as follow-up of its involvement in SESAR 1 and SESAR 2020 W1 projects into the both En-Route and TMA domain for technical and operational aspects. In particular, the leadership of PJ 15.09, whose objective is to reach V1 maturity for the concept of Airspace delegation, and contribution to PJ16.03 on Virtual Centre, has to be considered as an added value for the participation of SESAR 2020 W2 solution 93 activities.

ENAV is leading national and international programs in the complete evolution of its infrastructures and platforms, looking forward to an entire transformational chain into the ATM service-chain. ENAV is structurally collaborating with major industries in IT and ATM domains.

### **NATS justification for participation**

NATS is the national air navigation services provider in the United Kingdom. NATS has been actively involved in the SESAR programme for many years and has been involved in the development of the Virtual Centre concept from the very beginning including full involvement in B04.04 and PJ16-03 projects. Within these projects NATS has contributed to the development of the VC concept, acted as lead for the development of several of the services and service interfaces, has lead the development of the functional and non-functional requirements of all the services and participated in several validation exercises as both a service provider (ADSP) and service consumer (VC ATSU).

Furthermore, NATS is currently in the process of replacing its existing flight data and CWP systems with new trajectory based technology using service oriented architecture employing remote data centres supplying two ATSUs in Swanwick and Prestwick. Initially these will be deployed for upper airspace and military controllers but will be extended to lower airspace in the near future.

NATS will use this experience to provide:

- Expert knowledge of the Virtual Centre services developed in B04.04 and PJ16-03 leading to the design and development of new services to support the Delegation of Airspace and Contingency use cases.
- Expertise in developing large scale scenarios for training new controllers, training licensed controllers to use new tools and technology and validating new controller tools and concepts.
- Experience in utilising real live traffic data to validate new systems in a realistic operational environment with realistic traffic levels and complexity.
- Expertise in integrating systems and systems interfaces with more recent experience in developing and integrating service based systems in an operational environment.

NATS will continue its involvement in the realisation of the VC concept as it moves towards its introduction to operational service. NATS intends to be a major contributor in terms of developing the services and participating fully in the validation exercises.

### **SKYGUIDE justification for participation**

Skyguide participation is fully justified even if it belongs to a non EU country. Skyguide is the civil and military ANSP of Switzerland – we are therefore able to provide front-end expertise of a dynamic ANSP located in the middle of the European ATM Network, dealing with the highest density and complexity airspace of Europe and are also able to provide innovative approaches to new technology in the domains of ATC HMIs, centralised ATC data processing engines with various levels of automation and boosting the performance to manage this complex airspace of the European ATM Network core-area.

In the realisation projects running in skyguide, we are currently creating and migrating towards a Service Oriented Architecture (SOA). The skyguide internal project and the realisations performed in the Wave 1 of SESAR 2020 are running in parallel, allowing for an optimum cross-validation and sharing of concepts.

Within the SESAR 1, B04.04 Project and in the PJ.16-03 skyguide played a key role as simulation coordinator for all planned sessions.

In Wave 1, skyguide made good use of its advanced R&D platform equipped with new functionalities such as “what-if” and “what-else” functions, 4D trajectory management etc.... This platform available offers 16 positions and is the result of our excellent collaboration between the ATM and ATM solution provider.

### **EUROCONTROL (incl. MUAC) justification for participation**

EUROCONTROL will participate in the project actions without requesting funding. EUROCONTROL will, however, fully engage in the project and in particular is committed to providing the effort, contributions to deliverables and to other activities as set out in this tender and in the accompanying administrative forms.

EUROCONTROL has

- Deep knowledge of the Virtual Centre services developed successively by B04.04 and PJ16-03
- Complete expertise in the ATFCM domain and in the Network Manager systems
- Strong and recognised Architecture expertise: SESAR PJ19 (Lexicon, EATMA, System lead), including also set-up and opening up of MEGA Db;
- Strong and recognised expertise in modelling techniques of ATM operations, systems and services with associated methodologies;
- Strong and recognised expertise in Cost-Benefits Analysis and in Safety & Human Factors;
- Strong and recognised expertise in ATM simulation and validation, including multi systems and ANSPs.

EUROCONTROL will provide expertise in ATM architecture and service modelling, in particular from its experience gained in B04.04/PJ16-03 projects. EUROCONTROL will also provide technical prototyping and simulation platforms/facilities (i.e. ESCAPE, eDEP) to support the exercises and contribute to a relevant coverage of the validation scenarios. EUROCONTROL will also review the operational concept to identify impact and gaps related to ATFCM operations.

### **Frequentis SESAR Partners justification for participation**

Frequentis and Hungarocontrol work together within Frequentis SESAR Partners (FSP) and will contribute together in this solution. Frequentis SESAR Partners is in an excellent position to contribute to this very large scale demonstration, by bringing in:

- Experience and deep knowledge of previous work done in the context of Virtual centre within PJ16-03, PJ15-09 and B.04.04.
- The expertise in voice communication solutions (being the world market leader in ATC voice communication) and infrastructure aspects.
- Operational experience from Hungarocontrol in planning, development, implementation process and operation of remote ATS (Air Traffic Service) provision in third country (KFOR sector – Kosovo).

The technical know-how and deep operational experience within Frequentis SESAR Partners consortium will be of great benefit for further workout of concept, operational concept and definitions of:

- technical specification processes taking the relevant commission regulations and standards into account
- development of test procedures from operational point of view/test and validation activity
- further development of new operational procedures
- development of safety assessment procedures

For the validation, evaluation and optimization activities Frequentis SESAR Partners can create and use the environment and ensures the availability of all the essential parts of the voice communication and infrastructure necessary for test, validation and demonstration activities to complete the overall setup of the SESAR Partners.

#### **Indra justification for participation**

Indra's expertise covers a wide variety of areas of knowledge shared and improved through its participation under the SESAR Programme.

Indra's experience obtained during SESAR 2020 in the project PJ.16-03, were it had a large contribution in the design of the Virtual Centre services, in the different validations and in the definition of requirement. Furthermore, it participate in B.04.04 Modelling and Demonstration Phases and in the transversal participation in the domains of En Route, Approach and Tower projects in SESAR 1 supports the Virtual Centre concept and its technical means. More specific works under the SESAR Programme such as collaboration in the Information Service Reference Model and ATM Information Reference Model or strong implication in SWIM TI related projects are relevant to the ability of the virtual centre to support the required operational performance with the required deployment of underlying systems and services.

#### **Leonardo justification for participation**

LEONARDO with its technical experience and knowledge of previous work done in Wave 1 will provide support to enhance the concept of delegation of airspace consolidating the services already studied and provide in Wave 1 and where necessary defining new services to support the validation at V3 maturity level. LEONARDO will provide its HMI prototype with all the features required to support the new services and the concept of delegation.

#### **DFS justification for participation**

The DFS has the technical as well as the operational expertise to contribute to all activities of solution 93. In addition, DFS has the necessary infrastructure to participate in validation exercise, as already done in SESAR 1 B.04.04 and SESAR 2020 Wave 1 PJ.16-03.

In continuation of the work already done in SESAR 1 B.04.04 and SESAR 2020 Wave 1 PJ.16-03, DFS, as an ANSP, provides operational and technical expertise including system and services development, operating of IBPs and security. In solution PJ.16-03 DFS intends to contribute to:

- Concept definition
- Service definition

- Prototype implementation
- Technical demonstrations
- Security risk assessments

The developed concepts and services will be implemented and verified in technical demonstrations which will involve several industry partners and service providers.

### **3.3.3 Solution: PJ10-W2-96**

#### **THALES AIR SYS justification for participation**

For HMI innovative interaction, Thales Air Systems is particularly involved in the future of ATM and innovation through the different Innovation Lab (France, Australia, Singapore, US). Developed in these labs, the Shape platform is an immersive control system integrating new technologies such as multi-touch, ASR (Automated Voice Recognition), eye tracking, paredown HMI. This platform has already received a lot of acclamations (WAC in Madrid, ATCA in Washington, Paris Air Show, Thales InnovDays, ...) and during the TRL4 exercises in Wave 1 PJ.16-04 solution.

The TRL4 exercises have been performed in the SkyCentre in Rungis which provides ATC platforms and debriefing capabilities and where a dedicated Human Factors team and a dedicated innovation development team are present. To help during the TRL6 exercises, Thales Air Systems will bring tools like Topsky HF (Human Factors) which increases the efficiency of real time simulation and will help measuring the benefits on human performances brought by the new HMI.

#### **B4 Consortium justification for participation**

In solution 96, LPS SR (B4) will support the whole consortium in the research and specification activities with know-how from Wave 1 and UPMS activities and expert capacity of its in-house software development team as well as with the results of biometric identification technology research, if required, and Operational, Technical and Safety expertise, while delivering detailed specification of operational needs for UPMS based on exact task issues, operational requirements, as well as the rationale behind. LPS SR (B4) is not intending to develop a platform but able to support with expertise.

ANS CR (B4) will participate at ASR part, together with COOPANS (ACG, CCL), Thales, DLR (AT-ONE) and Integra (LTP of ANS CR (B4)). ANS CR (B4) has experience and knowledge from previous Automatic Speech Recognition Projects – AcListant, MALORCA and PJ.16-04. The ANS CR (B4) will support the ACG/COOPANS on whose validation platform the tests will take place. The main task of ANS CR (B4) will be management of the exercise, expert review of procedures and rules developed by ACG/COOPANS and CWP/HMI.

Integra (ANS CR LTP) is a privately owned consultant company with close to 30 years of experience providing consultancy services to the aviation and defence industries. Within aviation, Integra is specialized in the fields of Air Traffic Management (ATM), airports as well as regulatory and oversight functions. Integra will lead the Safety parts in ASR Activity and contribute to the evaluation of the results (VALP and VALR).

#### **ACG, CCL, IAA, LFV and Naviair – the COOPANS consortium justification for participation**

COOPANS consortium is a good example in cooperation between ANSP's and a system supplier and is leading actor in the development and delivery of new ATM requirements. COOPANS partners have expertise in the development of common operational solutions, the development of ATC support tools, and future concepts of operation. The virtual centre supported by appropriate concept of operations offers the opportunity to develop a solution that will deliver performance and flexibility in operations. COOPANS partners would like to investigate the potential of new CWP/HMI technologies, e.g. Automatic Speech Recognition, and explore possible impact on ATCO performance, capacity and system efficiency

The members of COOPANS have previous experience from SESAR 1 WP 16.04 in the area of Automatic Speech Recognition ACG/COOPANS and LFV/COOPANS can build on previous experience, e.g. from SESAR exploratory research, dealing with the foundation of speech recognition for ATCOs not yet integrated

into an ATM environment. ACG/COOPANS has experience and knowledge from previous Automatic Speech Recognition Projects like MALORCA.

COOPANS partners intends to run validations in PJ.10 (with Thales Air Systems), investigating Basis will be a cooperation with Thales Air Systems and DLR (AT-One) who are planning to assess the operational benefits of Automatic Speech Recognition. COOPANS partners will bring in operational experts with experience in Automatic Speech Recognition, as well as Human Performance experts.

### **ENAIRe justification for participation**

As service provider, ENAIRe is constantly enhancing their controller working positions, CWP, to increase safety and increase productivity. Within these internal activities ENAIRe has contributed in the development of several FOCUCS and VICTOR versions (CWPs of the Spanish Air Navigation System developed jointly with Indra) and participates in the working groups defining iTEC CWP requirements (iTEC means interoperability Through European Collaboration, the Air Navigation System under development between ENAIRe, INDRA, NATS, DFS, LVNL, AVINOR, ORO NAVIGACIJA and PANSA).

ENAIRe has participated in SESAR2020 PJ16, developing (ENAIRe own its own ASR system called VOICE) and analysing the potential benefits of introducing the Automatic Speech Recognition technology in the CWP. This work develops the first steps performed within SESAR 1, in the contingency tower (06.08.04), En-Route (05.09) and Tower (06.09.02) CWP projects, and in ENAIRe internal projects analysing the use of Automatic Speech Recognition (ASR).

### **NATS justification for participation**

NATS has significant experience and capability in developing advanced controller tools and HMI for its common workstation. NATS has adopted a service based approach to its operations and intends to adopt an architecture supporting the principles of any controller, any airspace, and any position at any Centre. The CWP/HMI project provides the foundation for this and creates a capability allowing any working position to be located independently from its supporting data centre.

Our considerable experience in the development of the Controller Working Position and the Human Machine Interface derives from the initial development of the London Area Control system with Lockheed Martin ATM. Our later development of the CWP platform to introduce MTCD tools (iFACTS) significantly added to the company's experience. Our current work in this area is focussed on the development of our future CWP with Indra in support of NATS' Deploying SESAR programme.

NATS' strategy is to adopt a Service Oriented Architecture with a service catalogue defining ATM operations as a set of operational services. NATS have embarked on a transformation programme that incorporates improved controller tools to deliver the benefits of improved controller workload and human performance to meet the demands of increasing traffic levels and improved safety targets. This solution is thus fully aligned with NATS' current investment programme and therefore the company can bring significant experience in evaluating the new controller tools in an operational environment based on the Service Oriented Architecture.

### **AT-One justification for participation**

AT-One is the European ATM research alliance. It combines the strength of DLR's Institute of Flight Guidance and NLR (AT-ONE)'s Air Transport Division. Both deliver innovative and independent Air Traffic Management research and implementation support. Several AT-One divisions stand for expertise in ergonomic design, human performance assessment, and evaluation of HMI concepts. In this research area AT-One worked in projects like VINTECH I & II, EMMA I & II, FLYSAFE, CAATS II, HILAS, and MAN4GEN. Additionally, DLR (AT-One) contributed to the SESAR 1 WP 10.10.02 CWP Human Factors Design, e.g. by executing human performance assessments including ergonomic and new technology screening studies with focus on multi touch technology. In SESAR 1 WP 5.9 the members decided to use a DLR (AT-One) CWP implementation as basis for the SESAR HMI demonstrator as a common core for airports, TMA, and En-Route domains.

Within the projects AcListant® and AcListant® Strips, co-financed by Helmholtz Validation Fund, DLR (AT-One) investigated with promising results to what extent automatic speech recognition (ASR) is improving the usability of future CWPs. The German air navigation service provider DFS and Austro Control were acting as consultant and supported the project with their expertise. Within PJ16-04 Wave 1 DLR (AT-ONE) led the development of an ontology, i.e. unique rules, for command transcription and annotation. This will ease the

exchange of training data between different partners for speech recognition model improvement and comparison of speech recognition performance of different speech recognition components, used in the different exercises.

Within AcListant® and AcListant®-Strips projects DLR (AT-ONE) has validated that Assistant Based Speech Recognition (ABSR) integrating a conventional speech recognizer with an assistant system can provide acceptable recognition rates so that runway throughput can be increased and controller workload can be reduced. The following EC H2020 MALORCA project (Machine Learning of Speech Recognition Models for Controller Assistance), also led by DLR (AT-ONE), has developed new machine learning algorithms significantly reducing development and maintenance costs while exploiting new automatically transcribed speech corpora.

Furthermore, DLR (AT-One) has developed a variety of decision and negotiation support tools with their corresponding HMIs.

### **HC (FSP) justification for participation:**

HC (FSP) is in an excellent position to contribute, providing operational experience in planning, development, implementation process and operation of remote ATS (Air Traffic Service) provision in third country (KFOR sector – Kosovo). The operational experience of HC (FSP) will be of great benefit for workout of concept, operational concept and definitions of:

- technical specification processes taking the relevant Commission Regulations and standards into account
- development of test procedures from operational point of view/test and validation activity
- development of new operational procedures
- development of safety assessment procedures

For the validation, evaluation and optimization activities HC (FSP) can create and use the environment and ensure the availability of all the essential system and sub-system necessary for test, validation and demonstration activities, also providing data of live operation to any validation activity.

### **INDRA justification for participation**

Indra's expertise covers a wide variety of areas of knowledge shared and improved through its participation under the SESAR Programme.

Indra's experience obtained during SESAR 2020 in the project PJ.16-04, focuses on the Human Machine Interface of the CWP, contributing to different validations and in the definition of requirements and guidelines could be used to improve the usability and performance of the CWP interactions. Furthermore, the CWP gain prominence as Indra focuses on their final users.

### **LEONARDO justification for participation**

LEONARDO is particularly interested in innovative interaction with HMI. The intention are analysis and definition of possible technologies to be integrated on the CWP.

### **SKYGUIDE justification for participation**

Skyguide participation is fully justified even if it belongs to a non EU country. Skyguide is the civil and military ANSP of Switzerland – we are therefore able to provide front-end expertise of a dynamic ANSP located in the middle of the European ATM Network, dealing with the highest density and complexity airspace of Europe and are also able to provide innovative approaches to new technology in the domains of ATC HMIs, centralised ATC data processing engines with various levels of automation and boosting the performance to manage this complex airspace of the European ATM Network core-area.

Within the SESAR 1, B04.04 Project, Skyguide played a key role as simulation coordinator for all planned sessions. The B04.04 showed the capabilities that a dynamic entity such as Skyguide.

Skyguide was core-member of the FASTI programme as from 2005 and declared as a FASTI pioneer, at the time already making use of our fully electronic environment. Our operations are fully equipped with CPDLC

capability and make use on a daily basis of 4d Trajectory based ATC Support tools (conflict detection and conflict resolution tools, monitoring aids, inter-sector coordination tools).

In addition Skyguide has set up an advanced R&D platform equipped with new functionalities such as “what-if” and “what-else” functions, 4D trajectory management etc. In the context of the changing ATM environment, we intend also to migrate to a Multi-Sector Planner configuration, some initial validations have been performed in the frame of FASTI, in collaboration with ENAV.

Skyguide has a dedicated SESAR platform available that offers 16 positions. The platform is the result of our excellent collaboration between the ATM and ATM solution provider.

Skyguide has a competitive advantage in the field of virtualisation. We have not only concluded the conceptual work around the Virtual centre concept, but has also taken the first major steps in the technical implementation of the baseline solution that will allow us to operate in a fully Service based environment. Our technical infrastructure will be adapted in the same timeframe as the SESAR 2020 programme will be conducted. We see our contribution in the programme as a possible key enabler to identify constraints and also opportunities to progress on the first major overhaul of the ATM System. By progressing in parallel with the evolution of the PJ, we can also show early advantages and report initial successes from our experience back into the PJ and make both developments to be synchronised.

### **SKYSOFT justification for participation**

SkySoft-ATM is the provider of high-end modern ATM solutions and is in a position to adapt the CWP and associated HMI functionalities on the simulation platform. In the framework of solution 96, Skyguide needs to entrust to Skysoft-ATM as LTP for the elaboration and the provision of the simulation platform and the development the necessary functionalities.

SkySoft-ATM has already provided a large simulation platform based on skyguide’s operational systems for S2020 Wave 1 projects: PJ02-08, PJ06-01, PJ10-01a, PJ10-02a, PJ16-03, PJ16-04, PJ18-02a and PJ18-02c.

More specifically, in the field of Attention Guidance Skysoft has participated in PJ16-04 with the development of prototype for the “Enhancement of ATCO Awareness by display of uncertainty” and solution 96 developments will be a continuation of this activity.

### **SINTEF (NATMIG) justification for participation**

Although SINTEF DIGITAL has gained competence in state-of-the-art ATM research for several decades, the increased focus through the SESAR 1 (32 projects) and SESAR 2020 involvement has substantially improved our technology and aligned it further to the needs of the aviation industry and airspace users.

The HCI group which will participate in PJ10 participated in SESAR 1 project with Human Performance Management (16.04), Human Performance in Automation Support (16.05) and with Human Performance support and coordination (16.06.05). In SESAR2020 Wave 1, the HCI group participated in PJ08-01, PJ.16-03 and PJ.16-04. A major outcome of this work was the development of the SIMADES ATC-CWP prototype, which in addition to traditional functionality for CWPs also includes mechanisms for notifying when and how the air space configuration is to change when dynamic air space configuration (DAC) is used. The functionality in the SIMADES ATC-CWP includes both 2D radar view and a 3D visualization of the air space. It was validated in an exercise conducted in cooperation with ENAV.

In solution 96, SINTEF (NATMIG) will use findings from the Wave 1 exercise to further develop the CWP to enhance the ATCOs' understanding of the changes in the air space, particularly the layout of neighboring sectors, as well as how the sectorization changes influence the traffic to be controlled by different ATCOs. This work will be performed in cooperation with solution 44 (PJ09). The focus in the solution 96 part of the work will be on introducing ASR and enhancing the AG in the SIMADES ATC-CWP.

## Participation of non-EU organisations Skyguide from Switzerland and SINTEF (NATMIG) from Norway

Both Switzerland and Norway are Associated Countries to EC. Association to Horizon 2020 is governed by Article 7 of the Horizon 2020 Regulation. Legal entities from Associated Countries can participate under the same conditions as legal entities from the Member States. Association to Horizon 2020 takes place through the conclusion of an International Agreement.

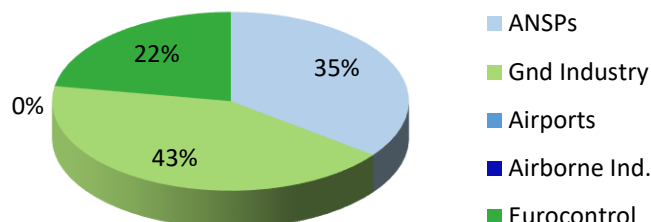


Figure 8: Budget share between stakeholder groups

### 3.4 Resources to be committed

As per Sections 2.4 and 2.5 of the SJU Single Programming Document 2019-2021, “It is also envisaged that the same grant budget amendment procedure used for Wave 1 projects will be applied for Wave 2 projects in 2020”.

Therefore, the SJU contribution to the Action shall be broken down into several instalments.

The first instalment (“First SJU Contribution” of the Action), corresponding to the initial “maximum grant amount” as per Article 5.1 of the Grant Agreement, will be calculated in proportion of:

- the maximum grant amount after evaluation for the Action,
- the number of grants awarded under the IR call, and
- the 95 M€ SJU budget available.

On the basis of the First SJU Contribution for this Action established at a maximum grant amount of 12,943,562.65 EUR it is clarified that as a consequence, at the date of signature of the Grant Agreement and without prejudice to the total amount of the budget agreed for this Action, notwithstanding the activities described in the Annex 1, the work to be performed under the First SJU Contribution as per Article 5.1 of the Grant Agreement is limited as summarized below:

- D1.1 Project Management Plan
- D1.2 Progress Report 1
- D5.1 POPD - Requirement No. 1
- D5.2 POPD - Requirement No. 2
- D5.3 GEN - Requirement No. 3
- D5.4 OEI - Requirement No. 4

Any further SJU contribution resulting from further budget availability, will be implemented through a Grant Amendment as per Sections 2.4 and 2.5 of the SJU Single Programming Document 2019-2021, and will result in an update of the Maximum Grant amount in Article 5.1 of the Grant Agreement.

The Grant Amendment shall also modify article 21 of the Grant Agreement with an update of the pre-financing payment for the Action. The level of SJU contributions and pre-financing of the grant amendments will be established in accordance with the SJU Single Programming Document (SPD) as approved by the Administrative Board.

In the event of unavailability of further SJU Budget, beneficiaries may terminate their participation in the action as per article 50.2 and this shall not be regarded as a case of improper termination.

Acronym	Title	Coordinating organisation	Total eligible costs	Requested EU contribution	Recommended EU contribution	1st Instalment	Prefinancing
PJ10-W2 PROSA	Separation Management and Controller Tools	DFS DEUTSCHE FLUGSICHERUNG GMBH	37.382.510,50 €	20.057.736,17 €	20.057.736,17 €	12.043.562,65 €	7.706.137,50 €

**Table: Budget breakdown by main cost categories per partner**

Beneficiary	direct personnel costs	other direct cost / direct personnel cost ratio	other direct costs			
			total	travel	equipment	other goods & services
1 / DFS	2,363,773	6.46%	152,640			
2 / DLR (AT-One)	431,428	13.91%	60,000			
3 / NLR (AT-One)	47,143	21.17%	10,000	5,000	0	5,000
4 / ANS CR (B4)	656,000	9.76%	64,000	62,000	2,000	0
5 / LPS SR (B4)	179,727	29.16%	52,400	32,400	20,000	0
6 / ON (B4)	139,150	14.98%	20,850			
7 / PANSA (B4)	208,816	14.77%	30,840			
8 / ACG/COOPANS	109,440	20.55%	22,485	16,416	0	9,069
9 / CCL/COOPANS	49,800	60.64%	30,200	27,710	0	2,490
10 / IAA/COOPANS	14,164	34.16%	4,838	4,000	0	838
11 / LFV/COOPANS	145,600	37.65%	54,818	46,418	1,000	7,400
12 / Naviair/COOPANS	133,285	20.04%	26,715	20,000	0	6,715
13 / DSNA	216,000	0.00%	0			
14 / ENAIRE	1,680,748	7.64%	128,400			
15 / ENAV	684,000	11.11%	76,000			
16 / EUROCONTROL	5,748,753	1.57%	90,000			
17 / FRQ (FSP)	342,682	19.39%	66,440	31,200	35,240	0
18 / HC (FSP)	456,676	27.09%	123,700	59,800	55,900	8,000
19 / INDRA	2,842,234	5.26%	149,591			
20 / LDO	2,378,746	14.96%	355,821			
21 / SINTEF (NATMIG)	149,517	9.36%	14,000			
22 / NATS	1,385,860	6.79%	94,140			
23 / SKYGUIDE	1,400,084	14.29%	200,012			
24 / THALES AIR SYS	4,402,541	4.00%	176,101			
25 / AIRBUS	0	n/a	0			
26 / ATOS (FSP)	0	n/a	0			
27 / AIRTEL (NATMIG)	0	n/a	0			
28 / SAAB (NATMIG)	0	n/a	0			

**Table 3.4b: ‘Other direct cost’ items (travel, equipment, other goods and services, large research infrastructure)**

NLR (AT-One)	Cost (€)	Justification
<b>Travel</b>	5 000	Estimate for travel costs based on prospected number of meetings and activities in other countries as well as experience from previous SESAR-2020 work for coordinating and carrying out validation work. Estimated number of travels is 4.
<b>Equipment</b>	0	N/A
<b>Other goods and services</b>	5 000	Use of NARSIM as development and real-time simulation platform for testing and validation of voice recognition software. This includes costs for computing. The numbers are based on previous experience from SESAR-2020.
<b>Total</b>	<b>10 000</b>	

ACG/COOPANS	Cost (€)	Justification
<b>Travel</b>	16416	Estimate for travel costs based on prospected number of meetings and activities in other countries as well as experience from previous SESAR-2020 work for coordinating and carrying out validation work. Estimated number of travels is 16.
<b>Equipment</b>	-	
<b>Other goods and services</b>	6069	H2020 “Certificate on Financial Statements”, catering for meetings at ACG/COOPANS premises with external guests
<b>Total</b>	<b>22485</b>	

CCL/COOPANS	Cost (€)	Justification
<b>Travel</b>	27710	Estimate for travel costs based on prospected number of meetings and activities in other countries as well as experience from previous SESAR-2020 work for coordinating and carrying out validation work. Estimated number of travels is 27.
<b>Equipment</b>	-	
<b>Other goods and services</b>	2490	H2020“Certificate on Financial Statements”
<b>Total</b>	<b>30200</b>	

IAA/COOPANS	Cost (€)	Justification
<b>Travel</b>	4000	Estimate for travel costs based on prospected number of meetings and activities in other countries as well as experience from previous SESAR-2020 work for coordinating and carrying out validation work. Estimated number of travels is 4.
<b>Equipment</b>	-	
<b>Other goods and services</b>	838	H2020 “Certificate on Financial Statements”
<b>Total</b>	<b>4838</b>	

LFV/COOPANS	Cost (€)	Justification
<b>Travel</b>	46418	Estimate for travel costs based on prospected number of meetings and activities in other countries as well as experience from previous SESAR-2020 work for coordinating and carrying out validation work. Estimated number of travels is 30.
<b>Equipment</b>	1000	Cost of low value assets e.g. equipment used during validations.
<b>Other goods and services</b>	7400	H2020 “Certificate on Financial Statements”, catering for meetings at LFV/COOPANS premises with external guests.
<b>Total</b>	54818	

Naviar/COOPANS	Cost (€)	Justification
<b>Travel</b>	20000	Estimate for travel costs based on prospected number of meetings and activities in other countries as well as experience from previous SESAR-2020 work for coordinating and carrying out validation work. Estimated number of travels is 20.
<b>Equipment</b>	-	
<b>Other goods and services</b>	6715	H2020 “Certificate on Financial Statements”, catering for meetings at Naviar/COOPANS premises with external guests
<b>Total</b>	26715	

FRQ (FSP)	Cost (€)	Justification
<b>Travel</b>	31200	<p>Travels for PJ10-73 and PJ10-93</p> <ul style="list-style-type: none"> <li>- Preparation for validation exercises, like site survey.</li> <li>- Execution of validation exercises at operational site</li> <li>- Project meetings</li> <li>- Workshop and coordination meetings with the validation team</li> </ul> <p>PJ10-73: The travel cost cover 10 trips for an average of EUR 1500 within Europe to attend KOM, EPMB, validation preparation and validation attendance and open day.</p> <p>PJ10-93: The travel cost cover 9 trips for an average EUR 1800 within Europe to attend KOM, EPMB, validation preparation and validation attendance and open day.</p>
<b>Equipment</b>	35240	<ul style="list-style-type: none"> <li>- CWP rental</li> <li>- IT rental for VM Server and PC</li> </ul>
<b>Other goods and services</b>	-	
<b>Total</b>	66440	

HC (FSP)	Cost (€)	Justification
<b>Travel</b>	59800	Travel costs are based on HC (FSP)'s participation at validation activities, project or solution meetings, coordination meetings, integration work, tests and preparation work at non-HC (FSP) site. Trips for PJ10-W2 includes an average of 8 travels/year for 2-3 person, on the approximated cost of €1400 per travel and person.
<b>Equipment</b>	55900	Depreciation cost of: <ul style="list-style-type: none"> <li>- 4K screens, ATCO workload measuring software</li> <li>- Network connection, cabling and hardware support</li> </ul>
<b>Other goods and services</b>	8000	Marketing and representation: <ul style="list-style-type: none"> <li>- Publicity for the results of the solution (electronic press, social media etc.)</li> <li>- Catering for meetings at HC (FSP) premises</li> </ul>
<b>Total</b>	123700	

## 4 Members of the consortium

### 4.1 Participants (applicants)

#### 4.1.1 Companies profile

##### 4.1.1.1 DFS Deutsche Flugsicherung GmbH

Organisation	1 DFS	Service Provider
Description	<p>DFS DEUTSCHE FLUGSICHERUNG GMBH (DFS) is responsible for air traffic control in Germany and is headquartered in the town of Langen, near Frankfurt. It is a company organised under private law and is wholly owned by the Federal Republic of Germany.</p> <p>The main business of air navigation services provided by DFS is defined by the tasks set out in Section 27c of the German Aviation Act (LuftVG). DFS provides air traffic services as a sovereign function, coordinates the air traffic flow and manages airspace utilisation (as a company entrusted with State functions). For this purpose, it develops and operates air traffic service systems as well as communications, surveillance and navigation systems. DFS operates control centres in Langen, Bremen, Karlsruhe and Munich as well as 16 control towers at Germany's designated international airports. With its approximately 5,400 operational and administrative staff, DFS ensures that approximately three million flights under instrument flight rules (IFR) reach their destinations safely and on time each year.</p>	
Previous experience	<p><b>Selected Publications:</b></p> <p>SECTORLESS ATM – Analysis and Simulation Results, 23.09.2010, Bernd Korn, Christiane Edinger, Sebastian Tittel (DLR), Thomas Pütz, Bernd Mohrhard (DFS), 27. ICAS-Konferenz (International Council of the Aeronautical Sciences)</p> <p>Increasing Capacity or Productivity with Controller Assistance Tools in High Complexity Airspace, 13.09.2015, Katharina Reinhardt, Dr. Matthias Poppe, Stephan Herr, 34th Digital Avionics Systems Conference, Prague</p> <p>The Usability of ADS-C EPP Data for Air Traffic Control Applications, 13.09.2015, Eliana Haugg, Matthias Poppe, Stephan Herr, Thomas Pütz (DFS); Jiří Svoboda, Róbert Šošovička (Honeywell), 34th Digital Avionics Systems Conference, Prague</p> <p>Optimal Control – A new Approach to Automation in Air Traffic Control, 08.07.2013, Dr. Matthias Poppe, Markus Hochstrasser, Leif Walter, Jutta Heinz Interdisciplinary Science for Innovative Air Traffic Management (ISIATM), 8.-10. Juli 2013</p> <p>Evaluation of Conceptual Changes in Air Traffic Control using Task-Based Workload Models, 23.09.2010, Stephan Herr, 27. ICAS-Konferenz (International Council of the Aeronautical Sciences)</p>	

Task-based workload models for the evaluation of conceptual changes in air traffic control, 09.10.2009, Stephan Herr, 8. Berliner Werkstatt Mensch-Maschine-Systeme

SECTORLESS ATM – A Concept to increase En-Route Efficiency, 09.09.2009, Bernd Korn, Christiane Edinger, Sebastian Tittel, Dirk Kügler (DLR), Thomas Pütz, Oliver Hassa, Bernd Mohrhard (DFS), Deutscher Luft- und Raumfahrtkongress 2009 der DGLR

Towards SESAR Performance Targets – The Super-Highway Approach, 11.12.2008, Dr. Matthias Poppe, Thomas Hellbach, AIAA Aviation Technology, Integration, and Operations Conference (ATIO 2008)

Development and Validation in Air Traffic Control by Means of Real-Time Simulations, 02.07.2008, Stephan Herr, Michael Teichmann, Tim Gesekus, Conference-for-Systemics-Informatics-and-Cybernetics

DFS DEUTSCHE FLUGSICHERUNG GMBH aligning their Research & Development Needs for the SINGLE EUROPEAN SKY AIR TRAFFIC MANAGEMENT RESEARCH PROGRAMME (SESAR), 05.07.2007, Dr. Thomas Bierwagen, CEAS European Air and Space Conference and Deutscher Luft- und Raumfahrt Kongress 2007

Automation in Air Traffic Control, 07.11.2006, Dr. Thomas Bierwagen, Dr. Andreas Tautz, Dr. Michael Poppe, Deutscher Luft- und Raumfahrt Kongress 2006, 6.-9.11.2006, Braunschweig

Introduction of a New Methodology to Assess the Capacity of Air Traffic Management Systems, 21.07.2006, Dr. Thomas Bierwagen, Dr. Andreas Tautz, 3rd International Conference on Cybernetics and Information Technologies, Systems and Applications

AUTOMATION in Air Traffic Management, 26.06.2006, Dr. Andreas Tautz, Dr. Matthias Poppe, 3rd International Conference on Cybernetics and Information Technologies, Systems and Applications

The DFS ADAM methodology assessing capacity benefits of ATM systems, 26.06.2006, Dr. Thomas Bierwagen, Dr. Andreas Tautz, 2nd International Conference on Research in Air Transportation

**Previous projects:**

EPISODE 3, Single European Sky implementation support through validation, FP6, 2004-2010, Key Performance Targets for the future ATM system

TORCH, Technical, economical and operational assessment of an ATM concept for the year 2005, FP4, 1999-2000, consolidated operational concept including benefit assessment

MAEVA, A Master ATM European Validation Plan, FP5, 2000-2003, developing validation strategy

AVENUE, An ATM validation environment for use towards EATMS, FP4, 1998-2000, provision of a validation platform capable of supporting large scale demonstration and validation

S-WAKE, Assessment of wake vortex safety, FP5, 2000-2003, development of tools for assessing appropriate (safe) wake vortex separation distance

C-ATM, Co-operative Air Traffic Management - phase 1, FP6, 2004-2006, among other: Advanced tools to support Separation Management, Flight Data processing and Flow Management Gate-to-Gate, Validation of a European ATM gate to gate operational concept for 2005 – 2010, FP5, 2002-2005, Operational concept development and validation

WAKENET2 Europe, European thematic network for aircraft wake turbulence, FP5, 2003-2006, wake turbulence phenomena (safety, capacity and operations)

DFS has contributed within the frame of SESAR 1 to the following separation management related projects:

- Project 4.2 Consolidation of operational concept definition and validation including operating mode and air-ground task sharing
- Project 4.7.2 Separation Task in En Route Trajectory based environment
- Project 4.8.1 Enhanced safety nets for en-route & TMA operations

Within these projects DFS was responsible for the conduct of the following V2 and V3 validation exercises: VP-066, VP-171, VP-594, VP-175, VP-332.

Within SESAR phase 1 has built or increased its expertise in the fields of:

- operational concept development,
- both research and industrial prototype development and verification validation planning, execution and evaluation

DFS has contributed within SESAR Wave 1 to PJ10:

- PJ10 Project Lead
- PJ10-01b  
Contribution to OSED/SPR/Interop, Validation Plan, Validation Report in the V1 phase  
Conduct of several workshops and demonstrations in the V1 phase for the flight centric concept within lower airspace  
Contribution to V2 OSED/SPR/interop, Validation Plan, Validation Report in the V2 phase
- PJ10-02a  
Contribution to OSED/SPR/Interop, Validation Plan, Validation Report in the V2 phase  
Conduct of a cross-validation of TCT (originally V3 validated in the frame SESAR 1 04.07.02 VP-175) together with Naviair / COOPANS within Danish airspace
- PJ10-02b  
Contribution to OSED/SPR/Interop, Validation Plan, Validation Report in the V1 phase

	<p>Conduct of several workshops and demonstrations in the V1 phase for further automation steps beyond Conflict Detection &amp; Resolution Advisory</p> <p>DFS has contributed to project B.4.4 “Workstation, Service Interface Definition” of SESAR1, being involved in conceptual work, service definition, prototype implementation and technical demonstration activities.</p> <p>Furthermore, DFS contributed to PJ.16-03 “CWP/HMI” of SESAR 2020 Wave 1. Being involved in technical, operational and validation activities. DFS led a pan-European technical validation exercise of the TRL4 phase including 7 partners from ANSPs and industry. During the final TRL6 phase of PJ.16-03, DFS is co-leading a pan-European technical validation exercise including 11 partners from ANSPs and industry. This technical validation exercise will deliver the technical basis for further validation exercises in Solution 93.</p>
Entity Profile matching the task	<p>Air Navigation Service provider (ANSP), including job profiles of air traffic controllers, Air Traffic Management (ATM) specialists in the fields of safety, human factors, software engineering, validation specialists.</p> <p>The DFS has the technical as well as the operational expertise to contribute to all activities of Solution 93. In addition, DFS has the necessary infrastructure to participate in validation exercise, as already done in SESAR 1 B.04.04 and SESAR 2020 Wave 1 PJ.16-03.</p>
Contribution	<p>DFS will assume the role of PJ10-W2 project coordinator and thus will lead WP1 and WP5.</p> <p><b>Solution 73</b> In continuation of the work already done in SESAR 1 04.07.02 and SESAR 2020 Wave 1 PJ.10-01b, DFS, as an ANSP, provides operational and technical expertise including system and services development, operating of IBPs and security. In solution 73 “Flight-Centric” DFS intends to lead the OSED/SPR/Interop and to contribute to the Validation Plan and the Validation Report. Furthermore DFS will conduct a validation thread to assess transition scenarios from the main system to the fallback system and potentially the transition from flight-centric operations to sector-based operations.</p> <p><b>Solution 93</b> In continuation of the work already done in SESAR 1 B.04.04 and SESAR 2020 Wave 1 PJ.16-03, DFS, as an ANSP, provides operational and technical expertise including system and services development, operating of IBPs and security. In solution PJ.16-03 DFS intends to contribute to:</p> <ul style="list-style-type: none"> <li>· Concept definition</li> <li>· Service definition</li> <li>· Prototype implementation</li> <li>· Technical demonstrations</li> </ul>

- Security risk assessments
- The developed concepts and services will be implemented and verified in technical demonstrations which will involve several industry partners and service providers.

#### 4.1.1.2 DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV

Organisation	2 DLR (AT-One)	Airborne Industry, Ground Industry, Service Provider
Description	<p>The German Aerospace Center (DLR) is the national aeronautics and space research centre of the Federal Republic of Germany. Its extensive research and development work in aeronautics, space, energy, transport, digitalisation and security is integrated into national and international cooperative ventures. In addition to its own research, as Germany's space agency, DLR has been given responsibility by the federal government for the planning and implementation of the German space programme. DLR is also the umbrella organisation for one of Germany's largest project management agencies. DLR has approximately 8000 employees at 20 locations in Germany.</p> <p>Several DLR research institutes are participating in SESAR which are shortly introduced in the following:</p> <p>DLR Institute of Flight Guidance develops innovative air traffic concepts – from the idea towards the implementation. The goal is to ensure an air transport system that is safe, efficient, environmentally friendly and reliable. In the field of air traffic management (ATM) and airports, the institute acts as a supplier of know-how and ideas while balancing the conflicting interests between fundamental research and applied science. As the largest German research facility for flight guidance, it strives to validate and deliver solutions to one of the greatest challenges in aviation – how to increase the efficiency and capacity of air transport in a safe and green way. Key tasks of the institute are to explore how the interplay of flight guidance on board and on the ground is optimized and how the complex interdependencies between the increasingly optimized aviation systems can be handled in a robust and resilient manner.</p> <p>DLR Institute of Communications and Navigation develops and investigates new systems and methods for radio transmission and positioning. Its work in aviation focusses on enabling technologies for air-traffic management. The Institute has a profound expertise in communications, navigation, and surveillance (CNS) technologies. It actively performs research and development in air-ground, air-air, and</p>	

	<p>satellite communications as well as on the networking concept for the future communications infrastructure. In navigation, the Institute has largely contributed to the development of GBAS as well as future ARAIM. It has developed means to protect navigation systems from harmful interference, spoofing and space weather effects and conceptualized integrity monitoring standards for all phases of flight.</p> <p>The DLR Institute of Atmospheric Physics focusses on the research of the physical and chemical processes of the atmosphere and meteorological applications. On both regional and global scales, the relevant processes and changes of the state of the atmosphere are quantified and systematically investigated using remote sensing, research aircraft and computational models. The knowledge of dynamical, cloud physical, and chemical processes constitute the basis for many aeronautical applications.</p> <p>DLR Institute of Flight Systems is active in the topics of flight mechanics and measurement and system technology of all flying systems. The Institute has extensive knowledge in wake turbulence and aviation flight safety, originating from numerous wake-vortex related research projects.</p> <p>AT-One Consortium is composed of its two members Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) and Netherlands Aerospace Centre (NLR)</p>
Previous experience	<p>Publications:</p> <p>M. Kleinert, H. Helmke, G. Siol, H. Ehr, A. Cerna, C. Kern, D. Klakow, P. Motlicek, et al., "Semi-supervised Adaptation of Assistant Based Speech Recognition Models for different Approach Areas", in IEEE/AIAA 37<sup>th</sup> Digital Avionics Systems Conference (DASC). London, England, 2018.</p> <p>M. Kleinert, H. Helmke, H. Ehr, Chr. Kern, D. Klakow, P. Motlicek, M. Singh, and G. Siol, "Building Blocks of Assistant Based Speech Recognition for Air Traffic Management Applications". 8<sup>th</sup> SESAR Innovation Days, Salzburg, 2018</p> <p>H. Helmke, O. Ohneiser, J. Buxbaum, and Chr. Kern, "Increasing ATM efficiency with assistant-based speech recognition", in 12<sup>th</sup> USA/Europe Air Traffic Management Research and Development Seminar (ATM2017). Seattle, Washington, 2017.</p> <p>Previous projects:</p> <p>SESAR 2020 W1 PJ.10-01b</p> <p>LRM2020 study (2008-2009): Joint study between DFS Deutsche Flugsicherung and Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) (commissioned by DFS) to investigate feasibility of sectorless ATM on principle.</p> <p>TeFiS (Technologie für Flugverkehrsmanagement in großen Strukturen)</p> <p>LuFo project (2014-2016): Subcontractor of DFS to investigate details of sectorless ATM</p> <p>AcListant® project: DLR has validated that Assistant Based Speech Recognition (ABSR) integrating a conventional speech recognizer with an assistant system can provide acceptable recognition rates so that</p>

	<p>runway throughput can be increased and controller workload can be reduced.</p> <p>MALORCA: Research Project which automatically learns speech recognition models from recorded controller-pilot communication and the associated radar data. The new machine learning algorithms significantly reduce development and maintenance costs while exploiting new automatically transcribed speech corpora.</p> <p>PJ-16.04: wave 1 project for development of a controller working position which integrates Automatic Speech Recognition, Multi Touch, Attention Guidance, User Profile Management System. PJ-16-04 will be continued in sol 96 (WP4).</p>
Entity Profile matching the task	Job profiles of researchers and scientists specialized on flight-centric air traffic control, air traffic management, safety, human factors. Software engineering, validation specialists.
Contribution	<p>DLR in #73 (WP2) intends to conduct together with Hungarocontrol and Frequentis (both FSP) a V3 real-time simulation of flight-centric operations in Budapest airspace specifically investigating non-nominal situations. DLR will provide the simulation platform and concept expertise and lead the exercise.</p> <p>DLR supports in #96 (WP4) recording of speech data and radar data for ASR model training and testing. DLR maintains the corresponding data repository and develops the command prediction within the Text-to-ATC-Commands Engine based on MALORCA machine learning approach. Furthermore supports in data preparation for exercise and KPI evaluation.</p>

#### 4.1.1.3 STICHTING NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM

Organisation	3 NLR (AT-ONE)	<b>Airborne Industry Ground Industry Service Provider</b>
Description	<p>NLR is the Netherlands Aerospace Centre for identifying, developing and applying advanced technological knowledge in the area of aerospace. NLR activities are relevant to society. They are market-oriented and carried out on a non-profit basis. NLR strengthens the innovativeness, competitiveness and effectiveness of government and business.</p> <p>The mission of NLR is to increase the sustainability, safety and efficiency of air transport. NLR is renowned for its leading expertise, professional approach and independent consultancy. NLR moreover possesses an impressive array of high quality research facilities. The activities of NLR span the full spectrum of Research Development Test &amp; Evaluation. NLR thereby bridges the gap between research and</p>	

	<p>practical applications, while working for both government and industry. Founded in 1919, and employing some 650 people.</p> <p>NLR is participating with two divisions in SESAR which are shortly introduced in the following:</p> <p>The division Aerospace Operations of NLR supports its customers – worldwide- with the realization of an excellent operation. With our extensive expertise and unique simulation facilities we contribute to the sustainable performance of air traffic: futureproof, safer, more efficient and more environmentally friendly. Through consultancy and R&amp;D our flexible and state-of-the-art activities find their way to customers such as airlines, air traffic control, airports, ATM industry and governments. We find our customers both in The Netherlands and beyond its borders and also contribute to European programmes such as SESAR and CleanSky. From the integration of drones in civil airspace to new airport concepts, with our passion for aerospace and our excellence and extensive knowledge of air traffic we always strive for the best result for the customer.</p> <p>The division Aerospace Systems of NLR is active in several domains: avionics technology, definition and flight testing of aircraft systems, application and testing of military systems, and application of space systems. Experts are active in the recent developments of RPAS technology, their certification and integration into non-segregated airspace. Furthermore the division is active in defining and facilitating experimental flight testing. The division has wide expertise in the certification of civil and military aircraft and systems. In the field of navigation NLR has deep expertise in GNSS.</p> <p>AT-One Consortium is composed of its two members Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) and Netherlands Aerospace Centre (NLR).</p>
Previous experience	<p>Previous projects:</p> <p>SESAR 2020 Wave1:</p> <ul style="list-style-type: none"> <li>• PJ01 Airborne Spacing Flight Deck Interval Management</li> <li>• PJ02</li> <li>• PJ03a Enhanced Guidance Assistance to Aircraft and Vehicles on the Airport Surface Combined with Routing</li> <li>• PJ03b Enhanced Airport Safety Nets</li> <li>• PJ04 Enhanced Collaborative Airport Performance</li> <li>• PJ05 Multiple Remote Tower</li> <li>• PJ14 CNS</li> <li>• PJ17 SWIM</li> </ul> <p>SESAR 1:</p> <ul style="list-style-type: none"> <li>• 04.03.00 Integrated and pre-operational validation &amp; cross-validation</li> <li>• 12.03.01 Improved Surveillance for Surface Management</li> <li>• 16.1.3 Develop techniques for Dynamic Risk Modelling</li> <li>• 16.6.3 Environment and coordination function</li> <li>• 06.08.04 Coupled AMAN-DMAN</li> </ul>

	<ul style="list-style-type: none"> <li>• 04.03.00 Integrated and pre-operational validation &amp; cross-validation of: En-route and TMA integration</li> <li>• 4.10 General Aviation and Rotorcraft</li> <li>• 05.02.00 Consolidation of Operational Concept Definition and Validation</li> <li>• 05.05.01 Trajectory Management Framework in TMA</li> <li>• 05.06.01 QM1 – Ground and Airborne Capabilities to Implement Sequence</li> <li>• 05.06.04 QM4 - Tactical TMA and En-route Queue Management</li> <li>• 05.06.06 QM6 – ASAS Sequencing and Merging (TMA-8)</li> <li>• 06.07.03 A-SMGCS Guidance Function</li> <li>• 06.08.07 Improved weather resilience – re-classify criteria for Low Visibility Procedures (LVP)</li> <li>• 06.08.08 Enhanced arrival procedures enabled by GBAS</li> <li>• 16.06.01b Resilience</li> </ul>
Entity Profile matching the task	NLR has ATM Operational experts, ATM System experts, Safety experts and Human Factor experts who could participate in this project.
Contribution	<p>Solution 96</p> <p>NLR will integrate ASR COTS into NARISM to :</p> <ul style="list-style-type: none"> <li>• Support clearance conflict detection, radar label maintenance, transfer of control</li> </ul> <p>Determine effect of ASR on ATCO's the level of alertness and task load by e.g. eye tracking measures</p>

#### 4.1.1.4 RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK

Organisation	4 ANS CR (B4)	Service provider
Description	<p>Air Navigation Services of the Czech Republic (ANS CR) is a progressive provider of safe and cost-effective air traffic services designated by Czech Ministry of Transport. Its task is to provide services to airspace users within the Czech airspace and at 4 international airports - Prague, Brno, Ostrava and Karlovy Vary. Covering rather small but very complex airspace, the company handled more than 850.000 flights in 2017, reaching to 900.000 flights in 2018, with minimal level of delay. Operating fleet of jet and propeller calibration aircraft, ANS CR offers wide range of flight inspection services. In addition, ANS CR provides specialized aviation training. The portfolio includes ATC training, pilot and other aviation staff training using its own facilities including ATC and aircraft simulators. The above-mentioned activities together with ATM consultancy services are provided to international customers on commercial basis by subsidiary companies CANI (Czech Air Navigation Institute) and CATC (Czech Aviation Training Centre).</p> <p>Being member of SESAR Joint Undertaking via B4 Consortium, ANS CR actively contributes to SESAR 2020 Programme. Participation in SESAR Deployment Programme is ensured by involvement in several implementation projects. Together with other central European countries</p>	

	<p>the Functional Airspace Block Central Europe (FAB CE) was formally established. All such activities contribute to implementation of the Single European Sky (SES) legislation.</p>
Previous experience	<p>Previous EU/SESAR projects with ANS CR participation:</p> <ul style="list-style-type: none"> <li>- BETA project, 2000-2002, Fifth RTD Framework Programme (EC)</li> <li>- EMMA project, 2004-2006, Sixth Framework Programme (EC),</li> <li>- EMMA2 project, 2006-2009, Sixth Framework Programme (EC),</li> <li>- INSuRE project, 2013-2015, SESAR 1 Demonstration Activities,</li> <li>- AAL project, 2015-2016, SESAR 1 Demonstration Activities (SES Award '17),</li> <li>- MALORCA project, 2016-2017, Horizon 2020 (EU Research and Innovation programme).</li> </ul> <p>General SESAR experience:</p> <p>ANS CR is actively involved in SESAR 2020 Wave 1 Solutions and has a lot of experience not only with the SESAR requirements and methodology, but also with various research and development topics being content of SESAR. Currently, ANS CR is actively involved in following solutions:</p> <p>PJ.01-02, PJ.01-3b, PJ.03a, PJ.03b, PJ.07-03, PJ.10-1b, PJ.10-2a, PJ.10-2b, PJ.16-03, PJ.16-04, PJ.18-06 and PJ.28.</p> <p>ANS CR has experience with contribution and development of all main project deliverables and also with a preparation of big validation exercises. ANS CR has a skilled internal team to coordinate the SESAR projects/contribution of ANS CR to the SESAR projects. ANS CR has also internal team of experts and well developed network of cooperating LTPs. This experience will be utilised in the Wave 2.</p> <p>Experience specific to the content of SOL 73:</p> <p>ANS CR together with its LTPs INTEGRA and AgentFly Technologies is part of the team of SOL PJ10-1b (Flight Centric ATC). AgentFly developed a progressive tool for Fast Time Simulations (FTS) for both conventional and flightcentric environment. The FTS is based on the real traffic supported by the operational expertise of ANS CR. Two validation EXEs - FTSs (lead by EUROCONTROL) are being realised. INTEGRA actively provides expert comments/review for project deliverables (especially in its main domain - HP and Safety). ANS CR and both its LTP have therefore enough experience with the topic and can contribute with its experience in this respective field.</p> <p>Experience specific to the content of SOL 96:</p> <p>ANS CR together with its LTPs INTEGRA are part of the team of SOL PJ16-04 (Workstation, Controller Productivity):</p> <ul style="list-style-type: none"> <li>- Project sponsored by Horizon 2020, 28 partners in different Activities, 2016-2019</li> </ul>

	<ul style="list-style-type: none"> <li>- ANS CR participate in the Activities – MTI (Multiple Touch Input device), UPMS (User Profile Management System) and ASR (Automatic Speech Recognition)</li> <li>- ASR activity – ANS CR participate in Exercise 220, together with Thales Air Systems, DLR, AustroControl and Integra (LTP of ANS CR)</li> <li>- ASR activity – ANS CR is responsible for Operational Concept, Requirements specification, preparation of validation scenarios, plans and trials.</li> <li>- Integra (LTP of ANS CR) is responsible for all Safety assessments and participate on HF assessments.</li> </ul>
Entity Profile matching the task	<p>Thanks to active participation in current FCA SOL (PJ10-1b), there is a lot of experience not only with the FCA topic itself, but also with the preparation of VAL EXE, contribution to deliverables etc. There are also lessons learnt from current cooperation on the FCA VAL EXE. All this experience will be used as a basis for the cooperation in SOL 73. Apart of that, the range of subjects closely cooperating together (common VAL EXE) stays almost the same which allows to use the already established communication and other mechanisms to facilitate the progress. The main benefits are:</p> <ul style="list-style-type: none"> <li>▪ ANS CR, INTEGRA and AgentFly Technologies are all involved in current FCA SOL and have enough experience and expert skills in the FCA field</li> <li>▪ ANS CR and AgentFly Technologies already developed a FTS platform for the FCA environment enabling comparison of conventional and FCA operations. This platform can be further developed to accommodate new requirements. The use of the</li> <li>▪ ANS CR, INTEGRA and AgentFly will continue in their expert contribution based on their FCA experience that will make their contribution more effective</li> </ul> <p>ANS CR has a vast expertise in ATM operational and technical domains, performance management and analysis, business case, information management and ATM projects, based on know-how of Operational, Technical and Safety experts.</p> <p>Experience relevant to Solution 96 includes ATM Operational services, development, prototyping and operation of specific tools, Project and Quality management, prototype and operational validation, ATM Safety assessment (provided by LTP Integra).</p> <p>Additional to the abovementioned expertise and experience ANS CR can support Project PJ.10-W2 by its knowledge in the areas of preparation of ATM Operational Concepts and Requirements. From previous ASM projects ANS CR has a lot of experiences with implementation this technology into the ATM systems.</p>
Contribution	<p>SOL 73:</p> <p>ANS CR (B4) intends to contribute to following activities:</p> <ul style="list-style-type: none"> <li>▪ development and participation in FTS to address horizontal expansion of FCA in En-Route (a joint EXE with EUROCONTROL led by EUROCONTROL)</li> </ul>

- contribution to VALP/VALR and CBA regarding the FTS
- expert review of deliverables using the experience from current PJ10-1b Solution (SAF and HP particularly)
- support to inputs of deliverables into SE-DMF (inputs relevant to the FTS)

ANS CR will contribute in cooperation with its LTP AgentFly and INTEGRA. ANS CR will coordinate its contribution with EUROCONTROL (EXE lead) and other partners participating at the same activities. ANS CR and EUROCONTROL have already experience in mutual cooperation as both organisations have common EXEs in current FCA SOL PJ10-1b. Therefore, the best practices are already established and will be used also in SOL 73.

SOL 96:

ANS CR intends to contribute to following activities:

- project management and corresponding documents
- contribution to VALP / VALR and CBA
- expert review of the system requirements using the experience from ATC operations and previous ASR projects
- expert review of all documents and deliverables
- leading of Safety Assessment and preparation of corresponding Documents (mainly via LTP Integra)

ANS CR will contribute in cooperation with its LTP Integra.

ANS CR will coordinate its contribution with Project manager and other partners participating at the same activities.

ANS CR has already experience in cooperation with the all partners from previous ASR projects – AcListant, MALORCA and PJ.16-04\_ASR. Therefore, the best practices are already established and will be used also in Solution 96.

#### 4.1.1.5 LETOVE PREVADZKOVE SLUZBY SLOVENSKEJ REPUBLIKY, STATNY PODNIK

Organisation	5 LPS SR (B4)	Service provider
Description	<p>Founded by the Ministry of Transport, Construction and Regional Development of the Slovak Republic in January 2000, LPS SR (Letové prevádzkové služby Slovenskej republiky, štátny podnik) is a state enterprise providing Air Navigation Services, including Air Traffic Services, Aeronautical Telecommunication Services, Aeronautical Information Services, as well as Search and Rescue, in the Slovak Republic.</p> <p>With a total staff of 500 (including 118 ATCOs) and altogether nine Operational units, among them one ACC (Bratislava), two APPs (Bratislava, Košice), five TWRs (Bratislava, Košice, Piešťany, Poprad, Žilina) and Central ATS Reporting Office (Bratislava), LPS SR controls the Slovak airspace (Bratislava FIR) of the total size of 48,800 km<sup>2</sup> and provides ATC services at five designated Slovak international airports as well as within small parts of the Hungarian airspace.</p>	

	<p>In 2017, compared to the previous year, an increase in traffic was seen in the FIR Bratislava, namely from 505,155 to 522,353 movements, i.e. by 3.4%. August 5 was the day with the highest number of movements; on that day LPS SR provided air navigation services to record-breaking 2,163 flights. The European-wide increase in air traffic is also reflected in the evolution seen in the Slovak airspace in the last decade when the total number of movements increased by 59%.</p> <p>As far as provision of air traffic control is concerned, there were no delays which would exceed the determined limit of 0.5 minute per 1 flight. The average delay was only 0.039 minutes per flight.</p> <p>LPS SR is a part of B4 Consortium, Member of SESAR Joint Undertaking.</p> <p>LPS SR is a Member of the FAB CE and a founding member of the Gate One, a regional platform of Central and Eastern European ANSPs.</p>
Previous experience	<p>Aside from continuous technological and operational improvements and upgrades realised through execution of in-house projects and/or projects in cooperation with domestic and/or international partners financed from user charges and in line with the company's investment plan (such as the RIMCAS project – development of a new surveillance surface movement system focusing on small and regional airports, the E2000 system upgrade, or the AIM systems development and operation), LPS SR has been also involved in implementation of projects co-financed with the EU funds.</p> <p>These include both the R&amp;D as well as the deployment kind of actions, where co-funding has been provided under the following instruments or institutions:</p> <ul style="list-style-type: none"> <li>• European GNSS Agency:             <ul style="list-style-type: none"> <li>○ ACCEPTA</li> <li>○ IMPROWE</li> </ul> </li> <li>• SESAR 2020:             <ul style="list-style-type: none"> <li>○ PJ.03b Airport Safety Nets</li> <li>○ PJ.04 Total Airport Management</li> <li>○ PJ.05 Remote Tower for Multiple Airports</li> <li>○ PJ.14 Essential and Efficient Communication Navigation and Surveillance Integrated System</li> <li>○ PJ.16 Controller Working Position / Human Machine Interface - CWP/HMI</li> <li>○ PJ.17 SWIM Technical Infrastructure</li> <li>○ PJ.18 4D Trajectory Management</li> </ul> </li> <li>• Connecting Europe Facility:             <ul style="list-style-type: none"> <li>○ 2014 CEF Transport:                 <ul style="list-style-type: none"> <li>▪ Free Route Airspace from the Black Forrest to the Black Sea</li> </ul> </li> <li>○ 2015 CEF Transport (MAP Cohesion Call):                 <ul style="list-style-type: none"> <li>▪ NewPENS</li> <li>▪ AMAN LOWW initial</li> <li>▪ Synchronised Performance Based Navigation Implementation Cohesion Europe (SPICE)</li> </ul> </li> <li>○ 2016 CEF Transport Call (MAP General Call)                 <ul style="list-style-type: none"> <li>▪ Deploy SWIM Governance</li> </ul> </li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>▪ DLS Implementation – Path 2</li> <li>○ 2016 CEF Transport Call (MAP Cohesion Call) <ul style="list-style-type: none"> <li>▪ FAB CE Wide Implementation of DAM and STAM Study</li> </ul> </li> <li>○ 2017 CEF Transport MAP SESAR Call: <ul style="list-style-type: none"> <li>▪ SWIM Common PKI and policies &amp; procedures for establishing a Trust framework</li> </ul> </li> </ul> <p>PRISME (PBN Regional Implementation and Sustained Monitoring of EGNOS Performance)</p>
Entity Profile matching the task	<p>LPS SR has a vast expertise in ATM operational and technical domains, performance management and analysis, business case, information management and ATM projects, based on know-how of Operational, Technical and Safety experts. LPS SR also has an expertise in design and implementation of innovative technologies, especially related to the Controller Working Position productivity and Safety supported by the use of the Development and Test Platform developed by the company's in-house SW development unit.</p> <p>LPS SR also has experience in the area of identification (authentication) system as it is good assumption and baseline to cover all the required Operational and Validation Procedures, even related to the UPMS (User Profile Management System) solution.</p> <p>Additional to the abovementioned expertise and experience, LPS SR can support Project PJ.10 by its knowledge in the areas of ATM Operational Concept, ATC and SESAR Programme objectives knowledge specific to the project. The validated results and experience gained from Wave 1 should be beneficial for input to solution #93 and #96 where LPS SR plans to participate in Wave 2.</p>
Contribution	<p>LPS SR will support numerous activities in project SESAR 2020 PJ.10-W2 Solution #93, but will mostly work as an active reviewer. We will take part in validation exercises during V1 and V3 and therefore will contribute to preparation of documents necessary to pass the maturity gate.</p> <p>In Solution #96 LPS SR will provide significant contribution to the User Profile Management Systems concept. On the grounds of research from Wave 1 we are entitled to deliver the results of UPMS OSED founding. In case of combination/full set of Wave 1 SESAR 2020 PJ.16-04 Activities UPMS could be extended/adapted to fulfil all partners' requirements/needs. LPS SR can contribute to the concept with vast technical expertise.</p>

#### 4.1.1.6 VALSTYBES IMONE ORO NAVIGACIJA

Organisation	6 ON (B4)	Service provider
Description	<p>Founded by the Ministry of Transport and Communications of the Republic of Lithuania in 1995, valstybes imone Oro navigacija (ON) is a state-owned enterprise providing Air Navigation Services, including Air Traffic Management Services, Communication, Navigation and</p>	

	<p>Surveillance Services, Aeronautical Information Services, as well as Search and Rescue, in the airspace of Republic of Lithuania and over the part of Baltic Sea.</p> <p>With a total staff of 290 (including 90 ATCOs) and altogether five operational units, among them one ACC (Vilnius), three APPs (Vilnius, Kaunas, Palanga), one TWR (Siauliai), ON controls the airspace of Republic of Lithuania and over the part of Baltic Sea (Vilnius FIR) of the total size of 76 126 km<sup>2</sup> and provides ATC services at four designated Lithuanian international airports.</p> <p>In 2018, compared to the previous year, an increase in air traffic was seen in the Vilnius FIR, namely from 243,022 to 265,919 IFR movements, i.e. by 9.4 %. The European-wide increase in air traffic is also reflected in the evolution seen in the airspace of Republic of Lithuania in the last decade when the total number of IFR movements increased by 47%. Each year providing safe and efficient air traffic control services to more than 250 thousand flights ON continues to maintain zero delays level and to meet users' expectations.</p> <p>ON is a Member of Baltic FAB, a part of B4 Consortium composed of four ANSPs from Central and Eastern European countries and a Member of SESAR Joint Undertaking. Being a member of SESAR Joint Undertaking via B4 Consortium, ON actively participates in the industrial and transversal projects by SESAR 2020 Programme while participation in SESAR Deployment Programme allows to implement several projects. In 2017, ON officially joined the European iTEC (Interoperability Through European Collaboration) alliance developing a high-end air traffic management system for busy and complex airspace.</p>
Previous experience	<p>ON participates in 6 projects and 8 solutions (Workpackages (WPs)) under SESAR 2020 Programme in Wave 1 within the framework of Horizon 2020 Programme (EU Research and Innovation Programme). Currently, ON actively participates in the following SESAR 2020 Wave 1 projects:</p> <ul style="list-style-type: none"> <li>• PJ.05: Remote Tower for Multiple Airports</li> <li>• PJ.06: Trajectory based Free Routing</li> <li>• PJ.14: Essential and Efficient Communication Navigation and Surveillance Integrated System</li> <li>• PJ.19: Content Integration</li> <li>• PJ.20: Master Plan Maintenance</li> <li>• PJ.22: Validation and Demonstration Engineering and solutions (workpackages (WPs)):</li> <li>• PJ.05-02: Remotely Provided Air Traffic Service for Multiple Aerodromes</li> <li>• PJ.05-03: Remotely Provided Air Traffic Services from a Remote Tower Centre with a Flexible Allocation of Aerodromes to Remote Tower Modules</li> <li>• PJ.06-02: Management of Performance Based Free Routing in Lower Airspace</li> </ul>

	<ul style="list-style-type: none"> <li>• PJ.14-01: CNS Environment Evolution</li> <li>• PJ.19-04: Performance Management</li> <li>• PJ.20-02: Master Plan Maintenance</li> <li>• PJ.22-03: Maintenance of the Platform Development Methodology</li> <li>• PJ.22-04: Communalization of Validation Tools and Interoperability Solutions</li> </ul> <p>ON has experience in contribution and development of all main projects deliverables and performing solutions validation exercises. ON has a SESAR 2020 Programme Management team and an internal team of experts specializing in different ATM related fields.</p>
Entity Profile matching the task	ON has ATM Operational experts, ATM System experts, Air Traffic Controllers, Safety experts.
Contribution	<p>ON intends to contribute to the following activities related to Solution 93 (Delegation of airspace amongst ATSUs):</p> <ul style="list-style-type: none"> <li>• Contribution to project management and corresponding documents</li> <li>• Contribution to description the required operational services and environment description, including the conditions under which the delegation of airspace would be activated</li> <li>• Contribution to description the operational transition from nominal control to delegation of airspace, and vice versa</li> </ul> <p>Expert review of all documents and deliverables</p>

#### 4.1.1.7 POLSKA AGENCJA ZEGLUGI POWIETRZNEJ

Organisation	7 PANSa (B4)	Service provider
Description	<p>PANSa (Polish Air Navigation Services Agency) is the national entity acting pursuant to the Act on the Polish Air Navigation Services Agency (2006) to provide air navigation services in Poland. PANSa provides air traffic management services, communication, navigation and surveillance services as well as an aeronautical information services in the Polish airspace and in airspace over the part of Baltic Sea. It operates one combined En-route/TMA control centre at Warsaw, 3 independent TMA control centres (Gdańsk, Kraków, Poznań) and 14 tower units at Polish international airports. Each year PANSa, being one of the biggest ANSPs in the Central and Eastern part of Europe, provides safe, effective and highly efficient air traffic control services.</p> <p>In 2018 PANSa handled over 830 thousands movements (IFR traffic). PANSa is constituent entity of B4 Consortium, composed of four ANSPs from Central and Eastern part of Europe and their Linked Third Parties. B4 Consortium is a member of A6+ on SESAR 2020 Programme content.</p> <p>PANSa is a Member of the Baltic FAB and Gate One, a regional platform of Central and Eastern European ANSPs.</p>	

	<p>PANSA is also a founding member of the SESAR Deployment Alliance that was mandated by the European Commission to perform functions of the SESAR Deployment Manager that is responsible for synchronisation and coordination of PCP-related implementation projects.</p>
Previous experience	<p>Previous projects:</p> <ul style="list-style-type: none"> <li>▪ GIANT (GNSS INTRODUCTION IN THE AVIATION SECTOR) – project researching possibility of usage of EGNOS and Galileo systems for approach procedures. 2005-2011</li> <li>▪ HEDGE (Helicopters Deploy GNSS in Europe) – project aimed on deployment of EGNOS system among helicopters and GA. In Poland there was introduced first time LPV approach procedure in Katowice and Mielec airports. Partners: REGA, Aeroclub de Sabadell, Pildo Labs, TAF Helicopters, Capital High Tech, Helileo, Polish Air Navigation Services, Royal Star. 2009-2011</li> <li>▪ SHERPA (Support ad-Hoc to Eastern Region Pre-operational Actions in GNSS) – regional project aiming on harmonization and acceleration of GNSS deployment among Central and Eastern Europe. Partners: BULATSA, PLD, ESSP, HCAA, PANSA, SUT (Silesia University of Technology), DHMI. 2009-</li> <li>▪ MeteoFlight – national R&amp;I program project in cooperation with Polish Institute of Meteorology and Water Management aiming at development of decision supporting tool which with use of meteo data helps to avoid areas of adverse weather in ATM. 2009-2014</li> <li>▪ SESAR 2020 Wave 1 Solution PJ.10.02a (Improved Performance in the Provision of Separation) – Project aimed in researching improved separation tools for ATCOs. PANSA Partners: Interdisciplinary Centre for Mathematical and Computational Modelling, University of Warsaw (ICM), INDRA, Participation in iTEC Collaboration (part of the iTEC DFS System Group)</li> </ul>
Entity Profile matching the task	<p>Air Navigation Service Providers including the profiles:</p> <ul style="list-style-type: none"> <li>▪ ATM Operational expertise,</li> <li>▪ ATM System expertise,</li> <li>▪ En-Route and Approach Air Traffic Controllers,</li> <li>▪ Human Factors expertise,</li> <li>▪ Safety expertise</li> </ul> <p>Experience relevant to the project PJ.10 includes ATM Operational services (En-Route, TMA), development of ATM Systems functionalities and other specific technical tools supporting ATCOs in air traffic management tasks.</p>
Contribution	<p>PANSA under SESAR 2020 Solution 93 will participate in activities related to Virtual Centres, additionally Transfer of Responsibility, in particular with the Area Control Domain, as well as the full transfer of responsibility of one of more sectors from one ATSU to another ATSU in case of contingency. All activities will be performed on iTEC Validation Platform in cooperation with our iTEC Partners.</p>

#### 4.1.1.8 **AUSTRO CONTROL OSTERREICHISCHE GESELLSCHAFT FUR ZIVILLUFTFAHRT MBH**

Organisation	8 ACG/COOPANS	Service provider
Description	<p>Austro Control is a state-owned limited liability company.  Location: The headquarter is located in Vienna and subdivisions are situated in Linz, Salzburg, Klagenfurt, Graz and Innsbruck.  Organizational setup: Two main divisions - Air Navigation Services (operational functions) comprising Air Traffic Management, Engineering Services, Meteorological Services and Aviation Agency (regulatory matters) supported by corporate services</p> <p>Governance structure: A Supervisory Board and a Management Board are responsible for the corporate governance. An audit committee is also established.</p> <p>The primary business of the ANS part of Austro Control is the provision of air navigation services, pursuing the basic principle of a high level of air traffic safety in compliance with Single European Sky framework</p> <p>Austro Control is a member of COOPANS Consortium consisting of 5 Air Navigation Service Providers: Austro Control (ACG), Croatia Control (CCL), Irish Aviation Authority (IAA), Naviair and Luftfartsverket (LFV). All five Air Navigation Service Providers have already for a long time been working under a common framework agreement together with Thales in COOPANS. COOPANS is a joint program based on the incremental development of a common ATM platform. The overarching goal for COOPANS is to enable each individual ANSP to achieve financial savings through cost, resource, and competence sharing and to meet the EU objective of harmonizing ATM systems. This work is now expanded to Research &amp; Innovation by the establishment of the COOPANS Consortium.</p> <p>Austro Control has many years of experience in the delivery of Air Traffic Services, the design of concepts and in development, validation and implementation of Air Traffic Management tools.  The enterprise is certified according to ISO 9001.</p>	
Previous experience	<p>Austro Control has participated in SESAR via NORACON consortium in the following WPs:</p> <p>WP00 SESAR2020 preparation: 00.15</p> <p>WP3 Validation infrastructure adaptation and integration: 03.03.02, 03.03.03</p> <p>WP5 TMA Operations: 05.03.00, 05.06.02, 05.06.04, 05.06.07, 05.07.02, 05.09</p> <p>WP6 Airport Operations: 06.05.05, 06.06.01, 06.07.01, 06.08.08, 06.09.03</p> <p>WP7 Network Operations: 07.05.04</p> <p>WP8 Information Management: 08.01.01, 08.01.06, 08.03.03, 08.03.06, 08.03.10</p>	

	<p>WP10 En-Route &amp; Approach ATM Systems: 10.02.01, 10.02.03, 10.03.01, 10.03.08, 10.07.01, 10.10.03</p> <p>WP12 Airport Systems : 12.02.01, 12.06.03</p> <p>WP13 Network Information Management Systems: 13.02.02</p> <p>WP14 SWIM Technical Architecture: 14.02.03, 14.04</p> <p>WP16 R&amp;D Transversal Areas: 16.01.01, 16.06.01, 16.06.01.b</p> <p>WP B Target Concept and Architecture Maintenance: B.04.05</p> <p>WP C: Master Plan Maintenance C.02, C.03</p> <p>Austro Control has participated in SESAR 2 Wave 1 in the following Projects, Solutions or VLDs:</p> <p>PJ.01-01</p> <p>PJ.02-01</p> <p>PJ.03a-01</p> <p>PJ.04-02</p> <p>PJ.05-02</p> <p>PJ.05-03</p> <p>PJ.06-01</p> <p>PJ.09-02</p> <p>PJ.10-02A</p> <p>PJ.10-02B</p> <p>PJ.16-03</p> <p>PJ.16-04</p> <p>PJ.17-08</p> <p>PJ.18.02</p> <p>PJ.18.04</p> <p>PJ.19-CI01</p> <p>PJ.19-CI02</p> <p>PJ.20</p> <p>PJ.24</p> <p>PJ.27</p>
Entity Profile matching the task	<p>During the exploratory research project MALORCA and the work in PJ.16 in Wave 1 Austro Control has gained substantial experience in Automatic Speech Recognition, which shall now be taken to the next level by integrating the capability into the operational environment. Specific expertise relevant for the project:</p> <ul style="list-style-type: none"> <li>• Development and supervision of operational concepts</li> <li>• Safety concepts &amp; Safety Assessments</li> <li>• Automatic Speech Recognition</li> <li>• Validation and Integration</li> <li>• Participation in European deployment activities (IDSG &amp; SDM)</li> </ul> <p>Human Performance Assessment</p>
Contribution	<p>Austro Control will contribute to the project by providing ATM subject matter experts emphasizing on operational work, mainly providing input to the operational concepts and supporting the validations with the goal to:</p> <ul style="list-style-type: none"> <li>• Alleviate ATCOs of tedious and error-prone manual tasks thus reducing AC workload</li> <li>• Improving the safety due to automation</li> </ul>

#### 4.1.1.9 CROATIA CONTROL, CROATIAN AIR NAVIGATION SERVICES LTD

Organisation	9 CCL/COOPANS	Service provider
Description	<p>Croatia Control is a state-owned limited liability company.</p> <p>Location: The headquarter is located in Zagreb and subsidiaries are located in Pula, Rijeka, Lošinj, Split/Brač, Zadar, Dubrovnik and Osijek.</p> <p>Divisions: Air Traffic Management, Technical Division, Aeronautical Meteorology, Military Operations and Human Resources Management, Legal and Financial Affairs.</p> <p>Governance structure: An Assembly, a Supervisory Board and main Management. The Assembly consists of the Chairman - the Minister responsible for transport, Minister of Finance and the Minister of Defence. The Supervisory Board monitors the activities of the organization. Supervisory Board appoints the Director General.</p> <p>Director General manages and represents the organization.</p> <p>The primary business of Croatia Control is provision of air navigation services, pursuing the basic principle of a high level of air traffic safety in compliance with Single European Sky framework, and Croatia Control has been certified for provision of the following services:</p> <ul style="list-style-type: none"> <li>• Air Traffic Services (ATS)</li> <li>• Communication, Navigation and Surveillance Services (CNS)</li> <li>• Aeronautical Information Services (AIS)</li> <li>• Aeronautical Meteorological Services (MET)</li> </ul> <p>Croatia Control is a member of COOPANS Consortium consisting of 5 Air Navigation Service Providers: Austro Control (ACG), Croatia Control (CCL), Irish Aviation Authority (IAA), Naviair and LFV. Cooperation between COOPANS partners goes beyond SESAR – partners has for a long time worked together with Thales under a common framework agreement in a joint program based on the incremental development of a common ATM platform. The overarching goal for COOPANS is to enable each individual ANSP to achieve financial savings through cost, resource, and competence sharing and to meet the EU objective of harmonizing ATM systems. This work is now expanded to Research &amp; Innovation by the establishment of the COOPANS Consortium.</p> <p>Croatia Control has many years of experience, both in the delivery of Air Traffic Services, design of concepts and in development, validation and implementation of Air Traffic Management tools.</p> <p>Croatia Control is certified ISO 9001, ISO 14001 and BS OHSAS 18001.</p>	
Previous experience	<p>Croatia Control has an extensive experience in:</p> <ul style="list-style-type: none"> <li>• Definition and validation of support and separation tools in EUROCAT-E system since 2001.</li> <li>• Development of the current ATM systems' core functionality is 4D trajectory based MTCD.</li> <li>• Definition, validation and implementation of FRA</li> <li>• Definition, validation and implementation of trajectory management, cross-border FRA and separation management in FRA.</li> <li>• Development, validation and implementation of separation management tools and safety tools – implementation of 4D trajectory management ATM system as a part of COOPANS since 2012.</li> </ul>	

	<p>Croatia Control has participated in SESAR 2020 Wave 1 as a member of COOPANS Consortium in the following projects, solutions or VLDs:</p> <p>PJ.01-01 PJ.04-02 PJ.05-02 PJ.05-03 PJ.06-01 PJ.09-02 PJ.10-02A PJ.10-02B PJ.10-05 PJ.15-09 PJ.16-03 PJ.16-04 PJ.18.02 PJ.18.04 PJ.18-06 PJ.19-CI02 PJ.19-CI05 PJ.20 PJ.24</p> <p>In project PJ.10, Croatia Control participated in validation exercises in PJ.10-02A and PJ.10-02B validating new concepts and operational requirements. Croatia Control's experts worked on Human Performance assessments as well.</p>
Entity Profile matching the task	<p>Croatia Control as a part of COOPANS has a long experience in cooperating with industry partner Thales at expert and management level for the development of core ATM system EUROCAT-E and TopSky since 2001. TopSky is one of the most modern ATM systems in the world, and Croatia Control together with COOPANS partners are continuing to develop the ATM system in anticipation of future European Mandates and SESAR in a cost efficient manner.</p> <p>Many of the Croatia Control's experts had been working in EUROCAT-E developments and implementation, and now are working with COOPANS partners and Thales on development of the functionalities in the TopSky. COOPANS has particular expertise in the development of common operational solutions, the development of ATM functions and ATC support tools and future concepts of operations.</p> <p>Croatia Control has experience in many areas related to this project, as for example:</p> <ul style="list-style-type: none"> <li>• Development and supervision of operational concepts</li> <li>• Safety concepts &amp; Safety Assessments</li> <li>• CWP design</li> <li>• Development and implementation of ATM systems and tools</li> <li>• Trajectory management (core functionality in EUROCAT-E and TopSky)</li> <li>• Development and implementation of safety and monitoring tools (core functionality in EUROCAT-E and TopSky – 4D MTCD)</li> <li>• Free route (already implemented cross border full FRA operations throughout Vienna, Ljubljana, Zagreb, Sarajevo and Belgrade FIRs, known as SECSI FRA)</li> </ul>

	<ul style="list-style-type: none"> <li>• Validation and Integration</li> <li>• Participation in European deployment activities (IDSG)</li> <li>• HP Expert - Human Performance Assessment</li> <li>• ATM expert – Operations</li> <li>• ATFCM Expert – Operations</li> </ul> <p>ATC User Requirements</p>
Contribution	<p>As ANSP, Croatia Control can firstly provide operational experts. Croatia Control will participate in solutions PJ.10-93 and PJ.10-96 by providing ATM subject matter experts emphasizing on operational work, mainly providing input to the operational concepts and supporting the validations with the goal to:</p> <ul style="list-style-type: none"> <li>• Alleviate ATCOs of tedious and error-prone manual tasks thus reducing AC workload</li> <li>• Improving the safety due to automation</li> </ul> <p>Moreover, Croatia Control will support the project with Human Performance expertise with Human Performance expert providing Human Performance assessment in PJ10-96.</p>

#### 4.1.1.10 UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY

Organisation	10 IAA/COOPANS	Service provider
Description	<p>Irish Aviation Authority is a state-owned limited liability company. Locations: The headquarter is located in Dublin and subdivisions are located in Shannon and Cork</p> <p>Divisions: Two main divisions - Operations and Strategy, Technology and Training supported by corporate services. Furthermore, Irish Aviation Authority has a Safety Regulation Directorate, as Irish Aviation Authority oversees and regulates the implementation of standards for the Irish civil aviation industry.</p> <p>Governance structure: Irish Aviation Authority has a Board of Directors having responsibility for the corporate governance.</p> <p>Irish Aviation Authority (IAA) is a member of COOPANS Consortium consisting of 5 Air Navigation Service Providers: Austro Control (ACG), Croatia Control (CCL), Irish Aviation Authority (IAA), Naviair and LFV. Cooperation between COOPANS partners goes beyond SESAR – partners has for a long time worked together with Thales under a common framework agreement in a joint program based on the incremental development of a common ATM platform. The overarching goal for COOPANS is to enable each individual ANSP to achieve financial savings through cost, resource, and competence sharing and to meet the EU objective of harmonizing ATM systems. This work is now expanded to Research &amp; Innovation by the establishment of the COOPANS Consortium.</p> <p>Irish Aviation Authority (IAA) has many years of experience, both in the delivery of Air Traffic Services; design of concepts and in development, validation and implementation of Air Traffic Management tools.</p> <p>The enterprise is certified ISO 9001.</p>	
Previous experience	<p>Irish Aviation Authority (IAA) has participated in SESAR via NORACON consortium in the following WPs:</p>	

	<p>WP5 TMA Operations (5.3, 5.6.1, 5.6.4, 5.6.7, 5.9), WP6 Airport Operations (6.7.1), WP 10 En-Route &amp; Approach ATM Systems (10.2.1, 10.3.8, 10.10.3), WP 16 R&amp;D Transversal Areas (16.4.3, 16.6.1), WP C Master Plan Maintenance (C3)</p> <p>IAA has participated in SESAR 2020 wave 1 in the following projects: PJ.10, PJ.16, PJ.17, PJ.25 and PJ.27</p>
Entity Profile matching the task	<p>IAA has expertise in development of new concepts and operational tools. Through work in PJ.16 IAA have gained experienced and knowledge both about the virtual centre concept and technical dimension as well as new HMI tools and development. Expertise is present in the company in many areas:</p> <ul style="list-style-type: none"> <li>• Development and supervision of operational concepts</li> <li>• Safety concepts &amp; Safety Assessments</li> <li>• Collaborative Decision Making</li> <li>• Air traffic forecast/Capacity planning incl. runway capacity enhancement</li> <li>• CWP design</li> <li>• Development and implementation of ATM systems &amp; Tools (common development and implementation of TopSky)</li> <li>• 4D Trajectory management (core functionality in TopSky)</li> <li>• Development and implementation of safety and monitoring tools (core functionality in TopSky – 4D MTCD)</li> <li>• Validation and Integration</li> <li>• Participation in European deployment activities (IDSG)</li> </ul> <p>Human Performance Assessment</p>
Contribution	<p>IAA will participate with operational expertise with knowledge from work in SESAR 2020 wave 1.</p>

#### 4.1.1.11 LUFTFARTSVERKET

Organisation	11 LFV/COOPANS	Service provider
Description	<p>Luftfartsverket (LFV) is a state enterprise with headquarter located in Norrköping, Sweden. LFV has subdivisions located in 22 different sites, most important being in Stockholm (Arlanda) and Malmö (Sturup), where the two area control centres are located.</p> <p>LFV has three main divisions:</p> <ul style="list-style-type: none"> <li>- Operational Systems &amp; Development</li> <li>- ATM Operations</li> <li>- Sales</li> </ul> <p>All supported by corporate services.</p> <p>Governance Structure:</p> <p>LFV has a Board of Directors having responsibility for the corporate governance. The Director general is appointed by the Board of Directors. LFV is a member of COOPANS Consortium consisting of five Air Navigation Service Providers: Austro Control (ACG), Croatia Control (CCL), Irish Aviation Authority (IAA), Naviar, Navegação Aérea de Portugal (NAV Portugal) and Luftfartsverket (LFV). Cooperation</p>	

	<p>between COOPANS partners goes beyond SESAR- partners has for a long time worked together with Thales under a common framework agreement in a joint program based on the incremental development of a common ATM platform. The overarching goal for COOPANS is to enable each individual ANSP to achieve financial savings through cost, resource, and competence sharing and to meet the EU objective of harmonizing ATM systems. This work is expanded to Research &amp; Innovation by the establishment of the COOPANS Consortium.</p> <p>Luftfartsverket (LFV) has many years of experience, both in the delivery of Air Traffic Services; design of concepts and in development, validation and implementation of Air Traffic Management tools.</p> <p>LFV has an extensive experience and a close interaction with the industry and Swedish Transport Agency, developing new technology. The effect of this is a flexible product portfolio of functional and cost efficient solutions, like the development of Remote Tower Services (RTS) that went from idea to reality in record time.</p> <p>The enterprise is certified ISO 9001.</p>
Previous experience	<p>LFV has participated, contributing to and also been leading projects in SESAR 1 within NORACON Consortium in the following WPs:</p> <ul style="list-style-type: none"> <li>- <b>WP00 - SESAR2020 preparation:</b> 00.14, 00.15</li> <li>- <b>WP3 - Validation infrastructure adaptation and integration:</b> 03.01.01, 03.02.01, 03.02.02, 03.03.02, 03.03.03</li> <li>- <b>WP4 - En-route Operations:</b> 04.08.04, 04.10</li> <li>- <b>WP5 - TMA Operations:</b> 05.03.00, 05.06.01 (Lead), 05.06.02, 05.06.04, 05.06.07, 05.07.02, 05.09</li> <li>- <b>WP6 - Airport Operations:</b> 06.06.02, 06.07.01, 06.08.01, 06.08.02, 06.08.04, 06.08.08, 06.09.03(Lead)</li> <li>- <b>WP7 - Network Operations:</b> 07.05.02, 07.05.03, 07.05.04</li> <li>- <b>WP8 - Information Management:</b> 08.00 (Lead), 08.01.03, 08.01.04, 08.01.05, 08.01.06, 08.01.09, 08.03.00, 08.03.03, 08.03.04, 08.03.06, 08.03.10</li> <li>- <b>WP9 - Aircraft Systems :</b> 09.48</li> <li>- <b>WP10 - En-Route &amp; Approach ATM Systems:</b> 10.02.01, 10.02.03, 10.03.01, 10.03.08, 10.04.04, 10.07.01, 10.09.04, 10.10.03</li> <li>- <b>WP12 - Airport Systems :</b> 12.02.01, 12.04.06, 12.04.07, 12.04.08, 12.04.10</li> <li>- <b>WP14 - SWIM Technical Architecture:</b> 14.01.03, 14.04</li> <li>- <b>WP15 - Non-Avionic CNS System:</b> 15.01.06, 15.01.07, 15.02.04, 15.04.05.a, 15.04.05.b</li> <li>- <b>WP16 - R&amp;D Transversal Areas:</b> 16.01.02, 16.04.01, 16.04.03, 16.04.04, 16.05.04, 16.06.01.b</li> <li>- <b>WP B - Target Concept and Architecture Maintenance:</b> B.04.01, B.04.02, B.04.03, B.04.05</li> <li>- <b>WP C - Master Plan Maintenance:</b> C.02, C.03</li> </ul> <p>Of special relevance for this project is Wave 1, PJ.16-03 and 15-9, where LFV In the exercise, a virtual centre platform connected CWP in Denmark and Ireland with a data centre in Paris. LFV and COOPANS will continue to develop the virtual centre concept as well as required</p>

	<p>infrastructure with our industrial partner, to enable a potential deployment of virtual centre platforms for future needs.</p> <p>In SESAR 2020, wave 1, LFV has contributed to and also been leading solutions within COOPANS Consortium in the following solutions:</p> <ul style="list-style-type: none"> <li>- <b>PJ.01-01</b> - Extended Arrival Management with overlapping AMAN operations and interaction with DCB</li> <li>- <b>PJ.01-03B</b> - Use of Arrival and Departure Management Information for Traffic Optimisation in the TMA</li> <li>- <b>PJ.02-08</b> - Traffic optimisation on single and multiple runway airports (lead)</li> <li>- <b>PJ.02-11</b> - Enhanced Terminal Area for efficient curved operation</li> <li>- <b>PJ.05-02</b> - Remotely Provided Air Traffic Service for Multiple Aerodromes (lead)</li> <li>- <b>PJ.05-03</b> - Remotely Provided Air Traffic Services from a Remote Tower Centre with a flexible allocation of aerodromes to Remote Tower Modules (lead)</li> <li>- <b>PJ.06-01</b> - Optimized traffic management to enable Free Routing in high and very high complexity environments</li> <li>- <b>PJ.10-01a</b> - High Productivity Controller Team Organisation</li> <li>- <b>PJ.10-02b</b> - Controller Automated Support Tools in En-Route Environment</li> <li>- <b>PJ.10-05</b> - IFR RPAS Integration</li> <li>- <b>PJ.15-09</b> - Data Centre Service for Virtual Centres Service</li> <li>- <b>PJ.16-03</b> - Virtual Centre Concept</li> <li>- <b>PJ.16-04</b> - Workstation, Controller productivity</li> <li>- <b>PJ.18-02</b> - Integration of trajectory management processes</li> <li>- <b>PJ.19-CI01</b> - ATM operations</li> <li>- <b>PJ.19-CI02</b> - Systems and services</li> <li>- <b>PJ.19-CI04</b> - Support and Evolution of the Content Integration Framework</li> <li>- <b>PJ20</b> - Masterplan maintenance</li> <li>- <b>PJ.25</b> - E-AMAN VLD</li> <li>- <b>PJ.27</b> - Flight Object Interoperability VLD</li> <li>- <b>PJ.31</b> - Initial Trajectory Information Sharing VLD</li> </ul> <p>During SESAR 2020, wave 1, LFV has participated and contributed in PJ.10-02b, PJ.10-06, PJ.15-09, PJ.16-03 and 16-04. LFV, as a member of COOPANS, have been an active partner in development of the virtual centre technical and operational concept. LFV ATCOs have also participated in the development of new HMI tools in Solution 16-4. LFV (as part of COOPANS) have executed a successful validation in PJ.16-03 together with our industrial partner Thales. LFV and COOPANS will continue to develop the virtual centre concept as well as required infrastructure with our industrial partner, to enable a potential deployment of virtual centre platforms for future needs.</p>
Entity Profile matching the task	<p>LFV has expertise in development of separation and safety tools. The development of S2000 ( now Thales TopSky) was defined, evaluated and validated by huge involvement of LFV operational and Human Factors experts many of these competencies are now working with Thales within the COOPANS context on future developments of functionalities within</p>

	<p>the TopSky ATM system. LFV has gained knowledge and experience from previous engagement in these fields and plan to continue in wave 2 to contribute to and extend the development of HMI tools from wave1. Expertise is present in the company in many areas:</p> <ul style="list-style-type: none"> <li>• Remote airport ATC</li> <li>• Development and supervision of operational concepts</li> <li>• Safety concepts &amp; Safety Assessments</li> <li>• Airport safety support tools</li> <li>• Collaborative Decision Making</li> <li>• Air traffic forecast/Capacity planning incl. runway capacity enhancement</li> <li>• CWP design</li> <li>• Development and implementation of ATM systems &amp; Tools (common development and implementation of TopSky)</li> <li>• Trajectory management (core functionality in TopSky)</li> <li>• Development and implementation of safety and monitoring tools (core functionality in TopSky – 4D MTCD)</li> <li>• Flight procedures, special approach procedures (incl. RNAV)</li> <li>• Performance Based Navigation</li> <li>• Integration, validation and analysis of test result</li> <li>• Extended lab environment including NARSIM and Thales IBP</li> <li>• Participation in European deployment activities (IDSG)</li> </ul> <p>Human performance assessment</p>
Contribution	<p>LFV will contribute with operational experts (ATCOs) with focus on concepts, operational issues and evaluations additionally safety and Human Performance expertise will be provided.</p> <p>The current ATM systems' core functionality is 4D trajectory based Medium Term Based Conflict Detection (MTCD). LFV work within the COOPANS context Delegation of airspace amongst ATSUs and all related system functionalities/tools/concepts etc.</p> <p>Further, LFV has experience from trajectory management, cross-border Free Route airspace and separation management in Free Route airspace.</p>

#### 4.1.1.12 Naviair

Organisation	12 Naviair/COOPANS	Service provider
Description	<p>Naviair is a 100% state owned company originating in “Statens Luftfartsvæsen” founded in 1938. Headquarter is located in Copenhagen (TWR/APP/En-route) and subdivisions are located in Roskilde, Billund, Århus, Rønne and Ålborg (TWR/APP) and in Vagar &amp; Nuuk (FIS/FIC).</p> <p>Naviair has three main divisions - Operations, Technical Maintenance and ATM Projects &amp; Engineering supported by Corporate Services. Naviair is a member of COOPANS Consortium consisting of 5 Air Navigation Service Providers: Austro Control (ACG), Croatia Control (CCL), Irish Aviation Authority (IAA), Luftfartsverket (LFV) and Naviair. Cooperation between COOPANS partners goes beyond</p>	

	<p>SESAR – partners has for a long time worked together with Thales under a common framework agreement in a joint program based on the incremental development of a common ATM platform.</p> <p>The overarching goal for COOPANS is to enable each individual ANSP to achieve financial savings through cost, resource, and competence sharing and to meet the EU objective of harmonizing ATM systems. This work is now expanded to Research &amp; Innovation by the establishment of the COOPANS Consortium.</p> <p>Naviar has many years of experience, both in the delivery of Air Traffic Services; design of concepts and in development, validation and implementation of Air Traffic Management tools. The company is certified ISO 9001.</p>
Previous experience	<p><b>SESAR 1 experience:</b> Naviar has participated in SESAR via NORACON consortium in the following WPs:</p> <ul style="list-style-type: none"> <li>• WP00 SESAR2020 preparation 00.14, 00.15</li> <li>• WP3 Validation infrastructure adaptation and integration: 3.2.1, 3.2.2, 3.3.2, 3.3.3 WP5 TMA Operations: 5.3, 5.6.1, 5.6.4, 5.6.7, 5.9</li> <li>• WP6 Airport Operations: 6.8.4</li> <li>• WP7 Network Operations: 7.5.4</li> <li>• WP 8 Information Management: 08.1.3, 8.1.5, 8.1.9, 8.3.4, 8.3.10</li> <li>• WP 10 En-Route &amp; Approach ATM Systems: 10.2.1, 10.2.3, 10.3.1, 10.3.8, 10.9.4, 10.10.3</li> <li>• WP 14 SWIM Technical Architecture: 14.1.3, 14.4</li> <li>• WP 16 R&amp;D Transversal Areas: 16.2.3, 16.6.2</li> <li>• WP B Target Concept and Architecture Maintenance: B4.2, B4.3, B4.5</li> <li>• WP C Master Plan Maintenance: C2 &amp; C3</li> </ul> <p><b>SESAR 2020 experience:</b> Naviar has participated and contributed in several projects during Wave 1</p> <ul style="list-style-type: none"> <li>• PJ.01-01 E-AMAN - Extended Arrival Management with overlapping AMAN operations and interaction with DCB</li> <li>• PJ.06-01 Free Route - Optimized traffic management to enable Free Routing in high and very high complexity environments</li> <li>• PJ.10-02A Separation Management - Improved Performance in the Provision of Separation</li> <li>• PJ.10-02B Separation Management - Advanced Separation Management</li> <li>• PJ.14-02-02 Future Satellite Communications Data Link</li> <li>• PJ.14-04-01 Surveillance Performance Monitoring (Task 1)</li> <li>• PJ.14-04-03 New use and evolution of Cooperative and Non-Cooperative Surveillance (Task 3)</li> <li>• PJ.15-9 Common Services, Virtual Centre data centre service</li> <li>• PJ.16-3 CWP Controller productivity - Workstation, Service Interface Definition &amp; Virtual Centre Concept</li> <li>• PJ.16-4 CWP Virtual Centre concept - Solution Workstation, Controller Productivity (Advanced Speech Recognition)</li> </ul>

	<ul style="list-style-type: none"> <li>• PJ.18-2 Trajectory Management Process</li> <li>• PJ.18-6 Performance Based Trajectory Prediction</li> <li>• PJ.19 CI1/WP2 ATM Operations (SESAR CONOPS)</li> <li>• PJ.20 Master Plan Maintenance</li> <li>• PJ.25 E-AMAN VLD</li> <li>• PJ.27 Flight Object Interoperability VLD</li> <li>• PJ.31 Initial Trajectory Information Sharing VLD</li> </ul> <p>Of special relevance for this project is Wave 1, PJ.16-03 and 15-9, where Naviar as a member of COOPANS, have been an active partner in development of the virtual centre technical and operational concept. Naviar ATCOs have also participated in the development of new HMI tools in Solution 16-4. Naviar (and COOPANS) have executed a successful validation in PJ.16-03 together with our industrial partner Thales. In the exercise, a virtual centre platform connected CWP in Denmark and Ireland with a data centre in Paris. Naviar and COOPANS will continue to develop the virtual centre concept as well as required infrastructure with our industrial partner, to enable a potential deployment of virtual centre platforms for future needs.</p>
Entity Profile matching the task	<p>Naviar has expertise in development of new concepts and operational tools. Through work in PJ.16 Naviar have gained experienced and knowledge both about the virtual centre concept and technical dimension as well as new HMI tools and development. Naviar will continue to build on the already executed validation in PJ.16-03 to further develop the virtual centre concept and platform. A continued development and validation of new HMI tools will take place in one of the solutions in the project. Expertise is present in the company in many areas:</p> <ul style="list-style-type: none"> <li>• Development and supervision of operational concepts</li> <li>• Safety concepts &amp; Safety Assessments</li> <li>• Airport safety support tools</li> <li>• Collaborative Decision Making</li> <li>• Air traffic forecast/Capacity planning incl. runway capacity enhancement</li> <li>• CWP design</li> <li>• Development and implementation of ATM systems &amp; Tools (common development and implementation of TopSky)</li> <li>• 4D Trajectory management (core functionality in TopSky)</li> <li>• Development and implementation of safety and monitoring tools (core functionality in TopSky – 4D MTCD)</li> <li>• Flight procedures, special approach procedures (incl. RNAV and TBS)</li> <li>• Performance Based Navigation</li> <li>• Validation and Integration</li> <li>• Participation in European deployment activities (IDSG)</li> </ul> <p>Human Performance Assessment</p>
Contribution	<p>Naviar will participate with operational experts (ATCOs) and engineers with expertise from wave 1 projects and validations. Naviar will</p>

contribute to continued operational and technical development of concepts and platforms to support the virtual centre and new enhanced HMI functionalities.

#### 4.1.1.13 *DIRECTION DES SERVICES DE LA NAVIGATION AERIENNE*

Organisation	13 DSNA	Service provider
Description	<p>DSNA (Direction des Services de la Navigation Aérienne) is the national air navigation services provider of France. DSNA is entrusted with the provision of air traffic services, associated communication, navigation and surveillance services and aeronautical information services in all airspace under French responsibility and at designated airports. DSNA is member of A6, FABEC and SESAR JU. DSNA has supported the principle of the SESAR programme since its inception and has participated as a major contributor to its definition phase study, has been a major active contributor to the SESAR 1 development phase and is an active contributor to SESAR2020 wave 1. DSNA is also involved in the deployment of many PCP and non PCP SESAR solutions..</p>	
Previous experience	<p>DSNA has developed significant experiences valuable for PJ10, solution 93, while working in previous projects:</p> <p>SESAR1:</p> <ul style="list-style-type: none"> <li>• Lead of project B04.04, Virtual Centre,</li> <li>• Contribution to WP 07.05.04, Dynamic Airspace Configuration, and lead of an exercise.</li> </ul> <p>SESAR 2020 wave 1:</p> <ul style="list-style-type: none"> <li>• Contribution to solution PJ16.03, lead of services definition and contribution to exercises;</li> <li>• Contribution to PJ08, Advanced Airspace Management, and lead of an exercise on Dynamic Sectors Configuration.</li> </ul> <p>It is to be noted also a strong involvement in projects related to DCB, in SESAR1 (13.2.3) and SESAR2020 wave 1 (PJ07 and PJ09), from local level to regional level.</p>	
Entity Profile matching the task	<p>DSNA will offer different kind of skills to serve the project needs:</p> <ul style="list-style-type: none"> <li>• ATC, DCB and DAC operational expertise,</li> <li>• Human Factors expertise,</li> <li>• Safety risk assessment expertise (in particular in contingency plans).</li> </ul>	
Contribution	<p>DSNA will participate to solution 93 in the following activities:</p> <ul style="list-style-type: none"> <li>• Contribution to the development of the OSED;</li> <li>• Participation to the development of the VALP;</li> <li>• Participation to validation exercises and VALR development.</li> </ul>	

#### 4.1.1.14 ENTIDAD PUBLICA EMPRESARIAL ENAIRE

Organisation	14 ENAIRE	Service provider
Description	<p>The Spanish Business Public Entity “Entidad Pública Empresarial ENAIRE”, hereinafter referred to as “ENAIRE”, is the entity designated by the Spanish State to provide Air Navigation Services for En-Route and Approach phases, ruling 7 En-route/TMA ATC Centres and 22 Control Towers, being one of the major Air Navigation Service Providers in Europe.</p> <p>Airspace under ENAIRE control includes the Peninsula Ibérica (except Portugal), Balearic and Canary Island, and part of North Atlantic, West Mediterranean and West Sahara.</p> <p>ENAIRE is a major European company in ATM, R&amp;D and project management in the field of Airspace and Air Navigation and a founding member of the A6 alliance, which represents the ANSPs common view within SESAR Programme.</p> <p>ENAIRE has already been an active part of SESAR Programme from the very beginning and has substantially contributed as a SJU member in the different fields of airport and air navigation services management, planning and provision, and other ATM R&amp;D related activities, in order to support the cooperative accomplishment of the European ATM Target Network and the associated European ATM Master Plan. As a quantitative illustration of this commitment, the more than ninety SESAR projects in which ENAIRE has been involved up to the present could be mentioned, playing a leading role in sixteen of them.</p> <p>As a services provider and also as owner of related systems and infrastructure, proactive promoter of research and development activities which are at the leading edge and highly experienced executor of validation and system integration processes, ENAIRE expects to maintain its participation in the SJU as one of its major members in those areas of activity where its technical and managerial expertise and know-how, systems and projects can bring the most added value to the deployment of the European ATM Master Plan. The added value provided to SESAR 2020 by ENAIRE and its linked third parties is based in the large set of available assets:</p> <ul style="list-style-type: none"> <li>• Up to 7 En-route/TMA ATC centres, covering both Continental and Oceanic Airspaces, fitted with an advanced and evolving ATM system (SACTA/LIS ATM and in the future iTEC). Four of them, those covering the Continental Spanish Airspace, interconnected and working as a network;</li> <li>• Platforms are able to assume validations and simulations in a wide range of maturity levels, covering from the more immature phases of the R&amp;D till complex simulations using both industrial products and also prototypes;</li> <li>• ATCOs from different ACC’s, who are familiar with traffics, contingencies and events of multiple characteristics; and also from towers of different categories;</li> <li>• Engineers/ATCOs with vast expertise on the definition of future CNS and ATM;</li> </ul>	

	Paving the way for deployment of mature concepts, especially those included in the PCP, will constitute a paramount and permanent priority for ENAIRE..
Previous experience	<p>ENAIRE is the company designated by the Spanish State to provide air traffic services in the en-route and approach phases. As part of an extensive ANSP work, ENAIRE manages the air traffic control and aeronautical information services, as well as the communication, navigation and surveillance networks required so that airlines and their fleet can fly safely and smoothly throughout the Spanish airspace. In addition, ENAIRE has defined several requirements in order to develop and improve the trajectory management within and among different ACCs. ENAIRE also participates in the definition and specification of the iTEC flight plan processing systems, besides the definition of its interoperability requirements to be compatible with other service provider initiatives.</p> <p>ENAIRE is the leading air navigation and aeronautical information service provider in Spain, the fourth largest in Europe by traffic volume and one of the most important in the world. As a public business entity reporting to the Ministry of Public Works, we manage the Spanish airspace over a territory of 2.19 MN square kilometres. ENAIRE provides air traffic services to 2 million flights carrying over 250 million passengers each year. Through our five control centres, 21 control towers and a comprehensive network of aeronautical infrastructure and equipment, we provide en-route, approach and aerodrome ATC services, as well as flight information, alerts and consulting services. We are the communications, navigation and surveillance service provider across the whole of the Spanish airspace and at airports in Aena network.</p> <p>This activity as Service Provider has been combined with several research and deployment projects. Actually, ENAIRE has been an active part of the SESAR from the very beginning of the Programme, contributing substantially as a SJU member in different fields (airports, ANS management, ANS planning and provision, etc.). This has been done in order to support the cooperative accomplishment of the European ATM Target Network and the associated European ATM Master Plan. The participation within the SESAR Programme began with SESAR 1, where ENAIRE took an active role in several projects, being the project leader in some of them. After the work performed in SESAR 1, ENAIRE has contributed in the great majority of the projects launched in SESAR 2020 Wave 1 programme, being an important part of the Service Providers Stakeholder group.</p> <p>Participation in SESAR 1 projects:</p> <ul style="list-style-type: none"> <li>• WP3 – Validation infrastructure adaptation and management</li> <li>• WP4 – En route Operations</li> <li>• WP5 - TMA Operations</li> <li>• WP6 – Airport Operations (taking the leadership of the work package)</li> <li>• WP7 – Network Operations</li> <li>• WP8 – Information Management</li> </ul>

- WP10 – En-Route & Approach ATC Systems
- WP12 – Airport system
- WP13 – Network Information Management System
- WP15 – Non-Avionics Communication, Navigation, Surveillance (CNS) System
- WP16 – R&D Transversal Areas
- WPB – Target Concept and Architecture Maintenance
- WPC – Master Plan Maintenance

Within these projects, ENAIRE has participated in the operational concept development and has been also responsible for the execution of several validations.

Participation in SESAR 2020 Wave 1:

- PJ01: Enhanced Arrivals and Departures
- PJ02: Increased Runway and Airport Throughput
- PJ03a: Integrated Surface Management
- PJ04: Total Airport Management
- PJ06: Trajectory based Free Routing
- PJ07: Optimised Airspace Users Operations
- PJ08: Advanced Airspace Management
- PJ09: Advanced DCB
- PJ10: Controller Tools and Team Organisation for the Provision of Separation in Air Traffic Management
- PJ11: Enhanced Air and Ground Safety Nets
- PJ14: Essential and Efficient Communication Navigation and Surveillance Integrated System
- PJ15: Common Services
- PJ16: Controller Working Position / Human Machine Interface - CWP/HMI
- PJ17: SWIM Technical Infrastructure
- PJ18: 4D Trajectory Management
- PJ19: Content Integration
- PJ20: Master Plan Maintenance
- PJ24: Network Collaborative Management
- PJ27: Flight Object Interoperability VLD Demonstration

Other projects managed by the SESAR Joint Undertaking:

- DEMORPAS (Demonstration Activities for Integration of RPAS in SESAR), playing ENAIRE a leading role.
- ARIADNA (Activities on RPAS Integration Assistance and Demonstration for operations in Non-segregated Airspace).

Previous participation in EC projects:

- OPTIMAL – Optimized Procedures and Techniques for Improvement of Approach and Landing
- RESET – Reduced separation minima
- GIANT – GNSS Introduction In the Aviation sector & GIANT 2 – GNSS Introduction In the Aviation sector -2

	<ul style="list-style-type: none"> <li>• ACCEPTA – ACCelerating EGNOS adoPTion in Aviation</li> <li>• FilGAPP – Filling the Gap in GNSS Advanced Procedures and Operations</li> <li>• HEDGE Next – Helicopter Deploy GNSS in Europe – NEXT</li> <li>• CREDOS – Crosswind Reduced Separations for Departure Operations</li> </ul> <p>Additionally, ENAIRE and its linked third parties has contributed to several Framework Programme (FP) projects such as:</p> <ul style="list-style-type: none"> <li>• EPISODE 3, Single European Sky Implementation support through validation, FP6, 2004-2010, Key Performance Targets for the future ATM system.</li> <li>• GATE TO GATE, Validation of a European ATM gate to gate operational concept for 2005 – 2010, FP5, 2002-2005, operational concept development and validation.</li> </ul> <p>Regarding deployment activities, the Spanish Automated Air Traffic Control System (SACTA) has been continuously evolved. One example could be the following TENT-T project:</p> <ul style="list-style-type: none"> <li>• FRASAI, TENT-T, 2014, Free Routing concept implementation in Santiago – Asturias sector.</li> </ul> <p>In addition to these projects, ENAIRE is currently carrying out the following research projects related to RPAS:</p> <ul style="list-style-type: none"> <li>• DOMUS</li> <li>• SAFEDRONE</li> </ul> <p>As well as the contribution, through any of ENAIRE's Linked Third Parties, to TERRA, IMPETUS and the advisory board of CORUS.</p>
Entity Profile matching the task	Operational Experts, ATC system experts, En-Route and App Air Traffic Controllers, validation experts, human factors experts and safety and performances experts.
Contribution	<p>ENAIRE is highly interested in the improvement of provided air navigation service in En-Route and TMA phase, especially in terms of capacity and quality of service and cost-effectiveness.</p> <p>The final development, industrialization and deployment of services and functions to allow the delegation of airspace will allow ENAIRE improving the efficiency and flexibility in the provision of ATC services in all its TWRs and ACCs. With that objective in mind, ENAIRE would be deeply involved in the operational validation activities that would be executed on an Industry-Based Platform (IBP iTEC-based or SACTA). These activities would aim to evolve the concept and its supporting technology to a final V3 maturity level.</p> <p>ENAIRE is also committed to improve HMI interaction modes with the controller working position, in particular with the introduction of the Automatic Speech recognition as a mechanism to reduce the controller's workload and improve safety. To address this, ENAIRE will work on</p>

small-scale experiments to assess the benefits of integrating the Automatic Speech recognition within the ATC system.

Finally, ENAIRE will be deeply involved in the validation of new concepts that imply a change in the paradigm of the ATC control such as the Flight Centric ATC. This new concept will be tested by ENAIRE through V3 Real-time simulations on an Industrial Based Platform (IBP iTEC-based). This will allow going further on the work performed in Wave 1.

#### 4.1.1.15 ENAV SPA

Organisation	15 ENAV	Service provider
Description	<p>ENAV S.p.A. (ENAV) is one of the 5 largest European Air Navigation Service Provider in terms of traffic managed, investments in innovation technology and R&amp;D and is one of the top performers in terms of quality of services provided.</p> <p>ENAV is fully committed to the Single European Sky and, since 2006, operates under the Common Requirement for ANS provision and from 2012 is subject to the European Performance Scheme, as all other European ANSPs.</p> <p>ENAV is a Joint-Stock Company, the only ANSP worldwide listed on a stock exchange, 53% of the share capital is held by the Italian Government, in charge of the provision of air traffic control and navigation services within the airspace and the airports placed under its own responsibility by national law without time limit.</p> <p>ENAV's core business is to manage the regulated Air Traffic Control Services (ATCS), for which it is entrusted, allowing aircraft to fly within the assigned airspace with constantly enhanced levels of safety, optimizing the effectiveness of the service provided and the efficiency of the company, in particular:</p> <ul style="list-style-type: none"> <li>✓ “En route” services: handling of air traffic crossing Italian airspace managed from 4 Areas Control Centres located in Rome, Milan, Padua and Brindisi;</li> <li>✓ “Terminal” services: assistance during the phases of approach, takeoff and landing from 45 Control Towers located throughout Italy and divided into 3 charging zones.</li> <li>✓</li> </ul> <p>Thanks to these complex operational units, ENAV provides around the clock air traffic services ensuring air traffic flow and regularity, with absolute safety.</p> <p>ENAV provides ATCS to more than 1.8 million flights per year, with peaks of up to 6,575 per day.</p> <p>ENAV provides also supporting services to other ANSP on a commercial basis, forming an independent source of revenue which is not regulated. ENAV leverages its significant experience and reputation for promoting development projects worldwide, pursuing further opportunities for growth: currently delivers services in Malaysia, Saudi Arabia, Kenya, Morocco, Albania, UAE and Libya.</p> <p>As in all high complexity sectors, a constant and consistent technological</p>	

innovation has to be placed side by side to human skill and experience. For this reason, ENAV continues to invest in modernisation, new technologies and professional training. ENAV is a component of the European ATM (Air Traffic Management) system and it participates with full rights in all the activities of development, operational validation, research and coordination with systems that are perfectly integrated with the international technological context.

ENAV Group consists of:

- Techno Sky, responsible for the operational management, the support, the maintenance and the hardware/software development of entire range of systems and equipment used to provide flight assistance services.
- IDS AirNav is the company of the ENAV Group that serves the world of Air Traffic Management (ATM) and airports with Commercial Off-The-Shelf (COTS) solutions and software products aimed at supporting the transition from Aeronautical Information Services (AIS) to Aeronautical Information Management (AIM) in full compliancy with the ICAO and EUROCONTROL mandates for Aeronautical Data Quality (ADQ).
- D-flight is the first public-private partnership created by ENAV and its partners for the timely development and deployment of U-space, in order to safely and seamlessly integrate complex drones operations within the civil aviation airspace. The company is controlled by ENAV, with a 60% stake, with the remainder of the share capital held by a group of leading Italian technological partners.
- ENAV Asia Pacific, set up in 2013 with head office in Kuala Lumpur, provides air traffic control management and consultancy services, as part of marketing and sales activity, as well as other essential air navigation services.
- ENAV North Atlantic is a company established in USA on January 2014 for the purpose of managing the acquisition of 12.5% of the Aireon LLC share capital. Aireon is the company responsible for the development, financing and deployment of a global satellite surveillance system.
- ESSP - with a 16.6% stake in the Company, ENAV provides the European satellite navigation service EGNOS.

The services supplied by the Company are Planning, management and provision of Air Navigation Services (ANS) including:

- Air Traffic Services (ATS), including Air Traffic Control Service (ATC), Flight Information Service (FIS) and Alerting Service (ALRS);
- Aeronautical Information Service and related publications (AIS);
- Meteorological Services for Air Navigation (MET);
- Communication, Navigation, Surveillance Services (CNS);
- Air Space Management;
- Air space design and air traffic capacity planning;
- Flight procedures design and obstacles analysis;
- ATM system definition, acquisition, operation and maintenance

	<p>of operational infrastructures;</p> <ul style="list-style-type: none"> <li>• Flight inspection services of radio nav aids, broadcasting and surveillance systems for Air Traffic Services;</li> <li>• Training of ATM personnel.</li> </ul> <p>ENAV is among the main players in SESAR (Single European Sky ATM Research), the ambitious initiative launched by the European Commission to implement the Single European Sky by supporting technical developments for fully interconnected and interoperable systems at European level.</p> <p>ENAV is also member of the SESAR Joint Undertaking, created under European Community law on 27 February 2007, with EUROCONTROL and the European Union as founding members, in order to manage the SESAR Development Phase. ENAV contributes to SJU in a lot of projects providing the technical and operational expertise and infrastructures necessary to develop and validate the evolution of the operational concepts.</p>
Previous experience	<p>ENAV is involved in R&amp;D, strategic planning, technical co-operation and service provision programs with international organisations (e.g. SESAR Joint Undertaking, EUROCONTROL, European Commission, ESSP) and foreign countries, aiming at contributing to the advancement of ATM technology and processes and at improving the service level provided.</p> <p>ENAV has a long-lasting experience in international initiatives and has been participating, managing, coordinating and actively contributing to several international projects and large scale researches, developments and validations.</p> <p>ENAV has been participating in SESAR Programme since its very beginning (SESAR 1 and SESAR 2020 Wave 1) and is strongly determined to support the successful outcome of the initiative in line with its strategic objectives.</p> <p>Previous R&amp;D projects:</p> <ul style="list-style-type: none"> <li>• SESAR 1 (2009-2016): WPB, WPC, WP3, WP4, WP5, WP6, WP7, WP8, WP10, WP12, WP13, WP14, WP15, WP16</li> <li>• SESAR 1 Large Scale Demonstrations: <ul style="list-style-type: none"> <li>○ ATC Full Datalink (AFD)</li> <li>○ WE-FREE</li> <li>○ MEDALE</li> <li>○ RACoon</li> <li>○ FREE SOLUTIONS</li> </ul> </li> <li>• BEYOND (H2020, 2015-2017)</li> <li>• DARWIN (H2020, 2015-2018)</li> <li>• SAWSOC (FP7, 2013-2016)</li> <li>• GAMMA (FP7, 2013-2017)</li> <li>• FUTURE SKY SAFETY (H2020, 2015-2019)</li> <li>• OPTIMAL (FP6, 2004-2008)</li> <li>• AD4 (FP6, 2005-2007)</li> <li>• RETINA (H2020, 2016-2018)</li> <li>• BLUEGNSS (H2020, 2016-2018)</li> </ul>

	<p>Current R&amp;D projects:</p> <ul style="list-style-type: none"> <li>• SESAR 2020 Wave 1 IR Projects (H2020, 2016-2019): PJ01, PJ02, PJ03a, PJ03b, PJ05, PJ06, PJ08, PJ09, PJ10, PJ15, PJ16, PJ18, PJ19, PJ20, PJ22</li> <li>• SESAR2020 Wave 1 VLD PJ31 (H2020, 2016-2020)</li> <li>• DIODE VLD (SJU/CEF2017, 2018-2020)</li> <li>• CORUS ER (H2020, 2017-2019)</li> </ul>
Entity Profile matching the task	<p>ENAV profiles matching the tasks include:</p> <ul style="list-style-type: none"> <li>• ATM Operational expert</li> <li>• Air Traffic Controller</li> <li>• Pilot and Pseudo-pilot</li> <li>• KPA expert</li> <li>• RPAS expert</li> <li>• Project manager</li> <li>• Procedure designer</li> <li>• Validation expert and engineer</li> </ul> <p>All those skills will be made available by ENAV to support the project developments and conduct validation activities</p>
Contribution	<p>ENAV is joining PJ 10 to explore the possibility to improve the air navigation service provision in terms of capacity and quality of service and cost-effectiveness. ENAV is especially interested in the identification and consolidation of services that could be offered in a virtual centre environment, especially in the context of delegation of airspace and contingency.</p> <p>For this reason and in continuity with the ENAV work in the frame of SESAR 2020 Wave 1 solutions PJ.15-09 and PJ.16-03, ENAV will take the leadership of the WP03 dedicated to Delegation of Airspace (solution 93) where, above the overall coordination and guidance of the solution work, will participate in two validation exercises and actively contribute to the data pack elaboration.</p> <p>Furthermore, ENAV will participate as contributor in the sol. 73 (WP02) for Validation of Flight Centric ATC in En-Route environment. Specifically,</p> <p>ENAV intends to participate to in the validation activities led by DFS, providing with operational personnel supporting the exercise execution via suitable validation techniques.</p> <p>Moreover, ENAV intends to support and to review the development of operational concept/ATC procedures related to Flight-centric ATC operations defined in the OSED.</p>

#### 4.1.1.16 EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION

Organisation	16 EUROCONTROL	Intergovernmental Organisation
Description	<p>EUROCONTROL, the European Organisation for the Safety of Air Navigation, is an intergovernmental Organisation with 41 Member States, committed to building, together with its partners, a Single European Sky that will deliver the ATM performance required for the 21st century. EUROCONTROL employs more than 1,900 highly</p>	

	<p>qualified professionals spread over four European countries. Their expertise is deployed to address ATM challenges in a number of key roles:</p> <ul style="list-style-type: none"> <li>• The Network Manager has extended the role of the former Central Flow Management Unit to proactively manage the entire ATM Network (nearly ten million flights every year), in close liaison with ANSPs, airspace users, the military and airports.</li> <li>• The Maastricht Upper Area Control Centre provides air traffic control services for the Netherlands, Belgium, Luxembourg and northern Germany.</li> <li>• The Central Route Charges Office handles billing, collection and redistribution of aviation charges.</li> <li>• It provides a unique platform for civil-military aviation coordination in Europe.</li> <li>• EUROCONTROL is a major player in European ATM research, development and validation and in this respect makes the largest contribution to the SESAR Joint Undertaking.</li> <li>• EUROCONTROL is supporting the deployment through contributions to the Deployment Programme and is supporting the European Commission, EASA and National Supervisory Authorities in their regulatory activities.</li> </ul>
Previous experience	<p>EUROCONTROL has experience in many aspects of relevance to PJ.10, from its Research Directorate, its Network Manager function, and through the MUAC centre.</p> <p>Maastricht has been a partner in the most relevant project in respect of delegation of provision of ATC service, and despite MUAC is not actively involved in the SOL 93, the existing knowledge and experience is available within the organisation.</p> <p>EUROCONTROL in particular has gained experience from B04.04/PJ16-03/PJ15-09 projects .</p> <p>EUROCONTROL also brings to the project its network management expertise and the liaising with civil and military airspace users. Together with CFSP's, EUROCONTROL NM division has as its core competency the ability to manage flight trajectory in a holistic way and of harmonizing the needs of various ATM stakeholders as well as those of airspace users. In addition, it has the executive role in airspace design planning and capacity management, which extremely important for the validation of the FCA concept on sub-regional and regional scale This experience, has allowed EUROCONTROL research directorate, teaming with the NM division, to lead PJ07-W2 and PJ09-W2 validating all network aspects of the SESAR concept. EUROCONTROL Research Directorate is deeply involved in PJ10-02a, 10-02b, PJ18-06 and leading PJ18-02a.</p> <p>EUROCONTROL is also already involved in standardization activities, such as EUROCAE, FIXM, ICAO (MET and Flight plan groups), which can ensure the SESAR results in the area of trajectory management , airspace design ,planning and ATC procedures are correctly channelled in future standards and regulations . In respect of the regulatory changes</p>

	expected as a result of SOL 73 and SOL 93 this involvement is very important.
Entity Profile matching the task	<p>EUROCONTROL Research Directorate with support from NM, will provide:</p> <ul style="list-style-type: none"> <li>• Deep knowledge of the Virtual Centre services developed successively by B04.04 and PJ16-03</li> <li>• Deep knowledge and understanding of the FCA concept and complexity management principles applied in ATM layered palming</li> <li>• Strong and recognised Architecture expertise: SESAR PJ19 (Lexicon, EATMA, System lead), including also set-up and opening up of MEGA Db;</li> <li>• Management and coordination activities</li> <li>• System engineering expertise</li> <li>• Modelling capabilities running Fast Time Simulations and Models to assess various enablers and Real Time Simulations capabilities to perform operational validation</li> <li>• Network Manager Operational Expertise, mostly in relation to capacity panning.</li> <li>• Network manager Technical expertise, in trajectory calculation, flight plan processing</li> <li>• Frequency spectrum management expertise</li> <li>• Operational concept development and operational requirement development expertise</li> <li>• Strong and recognised expertise in Cost-Benefits Analysis and in Safety &amp; Human Factors;</li> <li>• Strong and recognised expertise in ATM simulation and validation, including multi systems and ANSPs.</li> </ul>
Contribution	<p>EUROCONTROL will provide contribution to the concept development and planning of the validation activities. It will execute RTS concerning transitional aspects of the FCA with emphases of the use of automation, changes to HF and use of CPDLC and Datalink in FCA environment</p> <p>EUROCONTROL will address impact to FCA on NM operations in particular.</p> <p>It will address the issues of the FCA impact on the frequency spectrum management and potential physical limitations for FCA deployment. EUROCONTROL will contribute to the solution 93 technical thread. EUROCONTROL will also provide technical prototyping and simulation platforms/facilities (i.e. ESCAPE, eDEP) to support the exercises for both solutions 73 and 93.</p> <p>EUROCONTROL will also review the operational concepts of FCA and Airspace delegation to identify impact and gaps related to ATFCM operations</p> <p>More generally, EUROCONTROL will contribute to the PJ10-W2 solutions 73 and 93 through operational, engineering and technical expertise, operational and validation platforms, modelling tools, and prototype development.</p>

EUROCONTROL/NM will contribute to Solution 73 and 93 and EUROCONTROL Research Directorate will contribute to the Solutions 73 and 93.

#### 4.1.1.17 FREQUENTIS AG

Organisation	17 FRQ (FSP)	Ground Industry
Description	<p>Frequentis AG, member of SESAR1 and SESAR 2020, is an international expert for communication and information systems for control centres with safety-critical tasks. Frequentis AG maintains a worldwide network of subsidiaries and local representatives in more than 50 countries to ensure closeness to our customers.</p> <p>Frequentis AG successfully designs and supplies systems and solutions for the domains of communication, networks, SWIM, aeronautical information management, and airport traffic optimization, both in service and infrastructure as well as in the visualisation part of the independent CWP; based on service oriented and open, standardised architecture. In SESAR1 and S2020 Wave 1 we successfully demonstrated remarkable achievements towards the next generation ATM system architecture.</p> <p>Special interest is given to the users of ATM systems. Our expertise and tooling guarantees early indications of the future user acceptance. Frequentis AG is member of the Frequentis SESAR Partners consortium together with the companies HUNGAROCNTRIL MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG and Atos Belgium, founded in 2014 for the main purpose of joining SESAR 2020 activities. Frequentis SESAR Partners is member of the SESAR Joint Undertaking.</p> <p>The consortium is comprised of companies having a variety of complementary capabilities. Having former SESAR experience within its framework, an ANSP whose expertise will result in early feedback loops during certain projects, and the wide range IT, data management and security expertise of the consortium forming entities, Frequentis SESAR Partners believes in the high added value of its participation in SESAR 2020 wave 2 efforts.</p>	
Previous experience	<p>Frequentis is currently committed contributor in S2020 wave1 PJ10-01b "Flight Centric ATC" where both low and medium to high complex environment will be analysed and demonstrated in validations. The topic addresses the demand concerning voice communications within the sectorless ATC and the exploration of the transition for voice communication and will aim for benefits with regards to workload and controller tools for flight centric ATC environment. After our successful contribution to B4.4. in SESAR1 and the continuation in PJ16 strongly underpins the Frequentis experience with service oriented architecture and contingency and virtual center concepts.</p>	

Entity Profile matching the task	<ul style="list-style-type: none"> <li>• Communication Analysis: study conduction, expertise, analysis, suggestions, study documentation</li> <li>• Communication WS: expertise, analysis, suggestions.</li> <li>• Communication Simulation: Communications HMI</li> </ul> <p>Integration Simulation: expertise, analysis, suggestions with focus on voice communication</p>
Contribution	<p>Frequentis AG will contribute to the following two solutions:</p> <p><b>Solution 10-73</b></p> <ul style="list-style-type: none"> <li>• The prototype used in wave 1 will be adapted to support the validation exercise with DLR and HungaroControl</li> <li>• Expertise in Air Traffic Control Radio Communications</li> <li>• Expertise in Digital Signal Processing skills in Algorithm Design and Simulation</li> <li>• ATC Voice and Data Communication know-how</li> </ul> <p><b>Solution 10-93</b></p> <p>OPS Thread</p> <ul style="list-style-type: none"> <li>• Support of the required validation activities based on the defined use cases</li> </ul> <p>Tech Thread:</p> <ul style="list-style-type: none"> <li>• Provide voice services for virtual centre ATSU consumed at the CWP (from one or several specialized ADSPs)</li> <li>• Implement voice ADSPs (Voice services)</li> <li>• Contribute to technical validation of voice services</li> <li>• Support the use cases of static and dynamic contingency and delegation of airspace, that require additional R&amp;D and technical validation activities in the En-route and approach domains</li> <li>• Definition and validation of the required SDDs</li> <li>• Contribute to more complex architectures and implementation options beyond those addressed by #16-03 involving multiple ADSPs;</li> <li>• Support safety and security considerations</li> </ul>

#### 4.1.1.18 **HUNGAROCONTROL MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG**

Organisation	18 HC (FSP)	Ground Industry
Description	<p>HUNGAROCONTROL MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG is a state-owned company in Hungary, which provides air navigation services in the Hungarian airspace and (on a NATO assignment) in the upper airspace over Kosovo, trains air control personnel and conducts air navigation research and development.</p> <p>HC (FSP) is member of the Frequentis SESAR Partners consortium together with the companies Atos Belgium and Frequentis AG and was founded in 2014 for the main purpose of joining SESAR2020 activities.</p>	

	<p>Frequentis SESAR Partners is member of the SESAR Joint Undertaking.</p> <p>The consortium is comprised of companies having a variety of complementary capabilities. Having former SESAR1 experience within its framework, an ANSP whose expertise will result in early feedback loops during certain projects, and the wide range IT, data management and security expertise of the consortium forming entities, Frequentis SESAR Partners believes in the high added value of its participation in SESAR2020 efforts.</p> <p>HC (FSP) has more than 50 years of experience in ATM and is committed to implementing and deploying state-of-the-art technology. HC has a well-established relationship with universities and scientific centers and is active in ATM R&amp;D&amp;I activities. HC has participated in SESAR 1 demonstration activities such as REACT-Plus and has also received EU co-funding from the SESAR JU for a Large Scale Demonstration project, Budapest 2.0.</p>
Previous experience	<p>HungaroControl Zrt. has participated in SESAR 2020 Wave 1 as a member of FSP Consortium in the following projects, solutions or VLDs:</p> <p>PJ.03-A PJ.05-02 PJ.05-03 PJ.10-01B PJ.16-03 PJ.16-04 PJ.28 (as a linked third-party) SESAR Exploratory research - USIS project</p>
Entity Profile matching the task	<p>Air Navigation Service Providers including the profiles:</p> <ul style="list-style-type: none"> <li>• ATM Operational expertise,</li> <li>• ATM System expertise</li> <li>• Simulation expertise (Simulation HUB)</li> <li>• En-Route and Approach Air Traffic Controllers,</li> <li>• Human Factors expertise,</li> <li>• Safety expertise</li> </ul> <p>Experience relevant to the project as a remote air traffic service provider in the Kosovo upper airspace from 700 km. HC participates in three validation exercise in PJ16.03 with ATM and ATCO experts and also actively involved in the use case description and transition tasks.</p>
Contribution	<p>The main contribution of HungaroControl Zrt. (as a member of FSP), as ANSP, will be in PJ10:</p> <ul style="list-style-type: none"> <li>• Support with ATCOs</li> <li>• ATM system experts</li> <li>• Airspace Design expertise</li> <li>• Validation and technical experts</li> <li>• Security expert</li> <li>• Human factors expertise</li> </ul>

#### 4.1.1.19 INDRA SISTEMAS SA

Organisation	19 INDRA	Ground Industry
Description	<p>Indra is one of the leading global technology and consulting companies and the technological partner for core business operations of its customers world-wide. It is a world-leader in providing proprietary solutions in specific segments in Transport and Defence markets, and the leading firm in Digital Transformation Consultancy and Information Technologies in Spain and Latin America through its affiliate Minsait. Its business model is based on a comprehensive range of proprietary products, with a high-value focus and with a high innovation component. In the 2017 financial year, Indra achieved revenue of €3.011 billion, with 40,000 employees, a local presence in 46 countries and business operations in over 140 countries.. Indra ranks second in Europe by R&amp;D spent. .</p> <p>With the aim to provide our Customers with comprehensive, full and turnkey solutions, Indra product range covers the whole range of Air Traffic Management Systems, including Surveillance, Automation, Communications, Simulators and NAVAIDs.</p> <p>At Indra we have developed air traffic management systems that are deployed across the world, with over 4,000 installations in 160 countries. We are positioned as the market's leading supplier of air traffic management and communications, navigation and surveillance (ATM-CNS) systems. In the field of R&amp;D, we are one of the leading companies in the SESAR program, the key technology behind the Single European Sky initiative.</p> <p>Indra has the in-depth experience and products necessary to undertake any Air Traffic Management programme, with both a proven international management approach and a history of responsible program execution. That experience, together with a solid technology base, permanent innovations and quality in processes and projects are the pillars sustaining Indra leadership position in Air Traffic Management, completely oriented towards Customer needs and aimed to provide our Customers with the highest level of service.</p> <p>Indra is the world leader for Flight Data Processing Systems, having supplied over 40 installations worldwide and has grown to be leader Air Traffic Management system supplier in Europe. In December 2008, Indra supplied EUROCONTROL with the new next-generation interoperable Flight Data Processing System at Maastricht Upper Area Control Centre, one of the busiest and most complex en-route Air Traffic Control Centres in Europe.</p> <p>The implementation of this Flight Data Processing System is a high technological advance directed to improve the safety, capacity, efficiency and environmental performance of Air Traffic management in Europe, and actively contributing to achieving the European's Commission Single European Sky objectives.</p> <p>Indra has been selected by the most advanced European Air Navigation Service Providers to develop the future Air Traffic Management systems following the Single Sky Concept, through the iTEC Program</p>	

	(Interoperability Through European Collaboration). This is currently formed by ENAIRE (Spain), DFS (Germany), NATS (United Kingdom) and LVNL (The Netherlands), with Indra as industrial partner. Recent new partners are PANSA (Poland), AVINOR (Norway), Oro Navigacija (Lithuania). iTEC is currently the most advanced next-generation air traffic management system, after entering full operational service at the Prestwick control center in Scotland.
Previous experience	Since 2009, Indra is full member of the SESAR Joint Undertaking. In SESAR 1 Indra participated in more than 120 projects within the Programme and co-leading both WP10 (En Route and Approach ATC) and WP12 (Airports), as well as playing a key role in many projects under WP14 (SWIM), WP15 (Non-Avionics CNS) and WP13 (NIMS). In SESAR2020 Wave 1, Indra participated in IR/VLD Projects 01, 02, 03a, 03b, 04, 05, 06, 07, 08, 09, 10, 11, 14, 15, 16, 17, 18, 19, 20, 22, 24, 25, 27 and 31, being Project Coordinator in PJ15 and PJ18. We have also participated in other SESAR related projects (VLDs and RPAS).
Entity Profile matching the task	As explained in the previous sections, Indra has a solid entity profile in ATM Research due to the background knowledge, human resources and facilities to perform the R&D activities. The ATM background has continuously grown from the 80's first developments for the Spanish ATM system, to joint ventures with other ATM worldwide companies, until alliances with key European ANSPs. In term of human resources, hundreds of skilled personnel support the activities, while in terms of facilities, a significant number of laboratories and hardware resources equipped with the latest technology are used.
Contribution	The main contribution of Indra, as Ground Industry Supplier, will be: <ul style="list-style-type: none"> <li>• Support to the elaboration of the operational concepts, from the industrial perspective</li> <li>• Specification, development and testing of the Industry Base Platforms to be used by the ANSPs to perform the Validations</li> </ul> Support to the ANSPs in the Validations and in the elaboration of the conclusions

#### 4.1.1.20 LEONARDO - SOCIETA PER AZIONI

Organisation	20 LDO	Ground Industry
Description	LEONARDO is a global player in the high-tech sectors and a major operator worldwide in the Aerospace, Defence and Security sectors. LEONARDO is based in Italy, has over 45,000 employees, of whom about 36% abroad, and in 2017 recorded 11.5 billion euro in revenues and received orders in the amount of 11.5 billion. Gianni De Gennaro has been the President since 4 July 2013 and Alessandro Profumo has been the CEO since 16 May 2017. LEONARDO designs and creates products, systems, services and integrated solutions both for the defence sector and for public and private customers of the civil sector, both in Italy and abroad.	

	<p>The wide range of defence and security solutions that LEONARDO offers Governments, private citizens and institutions includes every possible intervention scenario: airborne and terrestrial, naval and maritime, space and cyberspace. In close contact with local customers and partners, LEONARDO works every day to strengthen global security, provide essential physical protection and cybersecurity services for people, territories and infrastructure networks and supports scientific and technological research.</p> <p>LEONARDO operates in about 20 countries with offices and industrial plants in all of the five continents and can rely on a very large network of subsidiaries, joint ventures and international partnerships, with significant industrial presence in three main markets, United Kingdom, Poland and United States and structured partnerships in the most important high potential markets in the world.</p> <p>The new Leonardo is the culmination of a radical renewal and transformation process: from a financial holding company to a great integrated industry focused on <b>five</b> divisions:</p> <ul style="list-style-type: none"> <li>• Helicopters</li> <li>• Aircraft</li> <li>• Aerostructures</li> <li>• Electronics</li> <li>• Cyber Security</li> </ul> <p>LEONARDO also retains Parent Company and Corporate Centre functions for participated companies and joint ventures not included in the divisional scope.</p> <p>These are: the US subsidiary DRS Technologies, which deals with the supply of products, services and integrated support for the military, intelligence agencies and defence companies; ATR, the joint venture established with Airbus Group for the manufacture of regional aircraft; MBDA, the joint venture established with BAE Systems and Airbus Group for missile systems; Telespazio and Thales Alenia Space, the two joint ventures established with Thales as part of the Space Alliance, for satellite services and the manufacture of satellites and orbiting infrastructures, respectively.</p>
Previous experience	<p>Leonardo is a member of the SESAR Joint Undertaking, participating in a lot of projects from SESAR1, like WP3, WP4, WP5, WP6, WP7, WP8, WP9, WP10, WP12, WP13, WP14, WP15, WP16 and WPB.</p> <p>Further, Leonardo has been and is participating to the following international programme:</p> <ul style="list-style-type: none"> <li>• ELSA to analyse and optimise the VDL2 Infrastructure communication network for the Europe)</li> <li>• GAMMA to study and develop a global ATM solution in order to cope with cyber-security aspects</li> <li>• SANDRA to study, implement and demonstrate in flight a new digital communication system that will lead pilots into the digital world of the 21st century, where a single device transmits communications with the ground and via satellite, digitally at high speed. Detailed information, such as the weather, flight plan</li> </ul>

	or the traffic situation can be exchanged between the tower and the aircraft quickly and reliably, increasing the air traffic safety
Entity Profile matching the task	<p>Leonardo has relevant profiles and experts in order to support and manage all the activities needed to carry on the PJ 14 CNS, since it is working in this domain from long time ago, with an active participation to international working group as EuroCAE, EUROCONTROL, Wimax Forum, AEEC, IFATSEA, etc. starting from these activities Leonardo can provide a large numbers of experts for the following categories:</p> <ul style="list-style-type: none"> <li>• ATC Control System experts</li> <li>• Network and Digital Air-to-Ground Communications experts in order to develop the future Communication Infrastructure Solution both for En-Route and Airport segment according to the ICAO Technology Roadmap and ensuring the interoperability aspects</li> <li>• Navigation experts</li> <li>• Surveillance experts to support the new concept and development of the cooperative sensors</li> <li>• Cyber security experts in order to develop an embedded infrastructure for communication domain able to reduce malicious attacks as the men in the middle and to ensure the data confidentiality, integrity and availability according to the operational service criticality</li> </ul>
Contribution	<p>LEONARDO will contribute to the project enriching the operational discussions with a concrete technical point of view from the industry. The contribution on the ATM systems and service will be based on the long experience on integration, simulation, engineering, software design, and production of advanced technology systems.</p> <p>LDO will provide contributions to WP02 in Task 01 to support Content Integration, in Task 02 for the integration of LDO SESAR Solutions into the SESAR Architecture, in Task 03 to prepare the Maturity Gates, in Task 04 for CONOPS development, in Task 05 to support Cyber Security requirements identification.</p> <p>LDO will also contribute to WP04 in Task 01 for the definition of the Validation Targets relevant to LDO SESAR Solutions and in Task 03 to support Cost Benefit Analysis consolidation and Business Case definition.</p>

#### 4.1.1.21 SINTEF AS

Organisation	21 SINTEF (NATMIG)	Ground Industry
Description	<p>SINTEF AS is a part of North European ATM Industry Group (NATMIG) Consortium. The NATMIG consortium consists of Airtel ATN (SME - Ireland), Saab AB (multinational industrial concern - Sweden) and SINTEF AS (non-profit research organisation - Norway).</p> <p>SINTEF AS (<a href="http://www.sintef.no/">http://www.sintef.no/</a>) is the largest independent research organisation in Scandinavia and is a non-profit research organisation. We employ 2000 people most of whom are located in Trondheim and</p>	

	<p>Oslo (Norway). More than 90% of our annual turnover derives from contract research for industry and the public sector in Norway and internationally, and we receive minimal state funding (around 6%). Contract research carried out by SINTEF AS covers all scientific and technical areas, and ranges from basic research through applied research to commercialisation of results into new products and business ideas, for both the domestic and international markets.</p> <p>Although SINTEF DIGITAL has gained competence in state-of-the-art ATM research for several decades, the increased focus through the SESAR 1 (32 projects) and SESAR 2020 involvement has substantially improved our technology and aligned it further to the needs of the aviation industry and airspace users. The activity in SESAR has also increased SINTEF AS' aeronautical research portfolio outside SESAR. SINTEF AS is a multidisciplinary research foundation, and can still bring added value to the ATM domain through our state-of-the-art research in other domains like Oil &amp; Gas, Space, Health &amp; Medicine, Constructions, Energy, Marine, Railway, Roads, Harbours, and Resilience etc.</p> <p>The SINTEF AS contribution to SESAR is focused around optimisation, (traffic sequencing, routing, taxiing, dynamic airspace, A-CDM), Human Computer Interface, system architecture and development, Digitalisation, Automation, 3D modelling, Safety, Resilience, Cyber Security and navigation (GBAS).</p> <p>SINTEF AS' Human Computer Interaction Group have a high level of competence in evaluation and design of system for complex work situations. The group have been working within the emergency management domain and in air traffic management. The HCI group participated in SESAR 1 project with Human Performance Management (16.04), Human Performance in Automation Support (16.05) and with Human Performance support and coordination (16.06.05). In SESAR2020 Wave 1, the group has been active in PJ08 and PJ16. The group have a strong competence in modelling and have developed tools to demonstrate and evaluate how to design for a complex work situation and been responsible for evaluation of new concepts in simulated environments.</p>
Previous experience	<p>Publications:</p> <p>Eide Aslak Wegner, Ødegård Stian Støer, Karahasanovic Amela (2014). A Post- Simulation Assessment Tool for Training of Air Traffic Controllers. HCI International 2014, June 22 - June 27: Relevance: a novel human performance evaluation tool was developed to support human performance evaluation.</p> <p>Følstad Asbjørn, Haugstveit Ida Maria, Kvale Knut, Karahasanovic Amela (2015). Design feedback from users through an online social platform: Benefits and limitations. Interacting with computers. Relevance: The paper presents an on-line, cost-effective way to engage</p>

	<p>users to design together with the designer user interfaces.</p> <p>Petter Bae Brandtzæg and Asbjørn Følstad (2018), Chatbots: changing user needs and motivations, Interactions Volume 25 Issue 5, September-October 2018, Pages 38-43. Relevance: Shows how designing and developing natural language user interfaces is about understanding new user needs and motivations, which is required to make successful automatic conversational interfaces. Such conversational user interfaces to data and services means a dramatic shift in how designers and developers are used to thinking about interaction and user needs. Such user interfaces are changing user behaviour as well as user needs.</p> <p>Følstad, Asbjørn &amp; Brandtzaeg, Petter. (2017). Chatbots and the new world of HCI. ACM interactions. 24. Pages 38-42. Relevance: Chatbots and AI-powered conversational interfaces represent a new world to be conquered. The paper provides an initial overview of the challenges and opportunities for conversational user interfaces.</p> <p>Previous projects:</p> <ul style="list-style-type: none"> <li>• Project SESAR Wave 1 PJ16: SINTEF (NATMIG) is using 3D visualization controlled by multi touch interaction to enhance ATCOs understanding of how the air space changes at run time when applying DAC (Dynamic Airspace Configuration). This work is performed in cooperation with SESAR Wave 1 PJ08.</li> <li>• Project SESAR Wave 1 PJ08: SINTEF (NATMIG) is leading and participating to evaluation exercises validating acceptance of DAC (Dynamic Airspace Configuration) for ATCOs in simulated environment (Milano airspace).</li> <li>• Project ZEFMAP is successful SESAR WP-E project led by SINTEF (NATMIG) in collaboration with Frequentis and University of Salzburg. The aim of ZefMap was to make successful process improvement methods and tools coming from other domains effective in the context of tower control rooms. The project showed that optimization tools for planning can do calculations and trade-offs (probably) outside of human capability when handling Hamburg airport in simulated scenarios. The decrease in average taxi time was between 33% and 36% while punctuality improved from 57% to 67%.</li> </ul> <p>Project NextGenDST is a two-year strategic SINTEF (NATMIG) project for enabling better collaboration between humans and decision support systems in time-critical complex domains such as ATM</p>
Entity Profile matching the task	<p>The controller acceptance of the air space changing dynamically at run time, their understanding of the new configuration, as well as how this affects the traffic will be crucial, so it is important to develop prototypes and run evaluations with controllers to learn and tailor the proposed solutions. SINTEF (NATMIG) has knowledge and tools to develop rapid prototypes and run user evaluations with them. We also used these tools and simulations (SIMADES) in both project SESAR PJ08 and SESAR PJ16 in Wave 1. Since this project is a continuation of both, we have a</p>

	good match with the tasks at hand. This work requires competence and experience in Human Computer Interaction to be successful. SINTEF (NATMIG) has this expertise and applied these in many industries (see Description and previous experience).
Contribution	In Solution 96, SINTEF (NATMIG) will use findings from the exercise on DAC acceptance performed in Wave 1 to further develop the SIMADES ATC-CWP to enhance the ATCOs' understanding of the changes in the air space, particularly the layout of neighboring sectors, as well as how the sectorization changes influence the traffic to be controlled by different ATCOs. The focus of the work will be on introducing ASR and enhancing the AG in the SIMADES ATC-CWP. SINTEF (NATMIG) plans to run an exercise in collaboration with Solution 44 in PJ09, in which the SINTEF (NATMIG) simulator SIMADES is used (just as in PJ16-04) to mature the DAC concept and tools. Thereby, SINTEF (NATMIG) is a main contributor in Solution 96.

#### 4.1.1.22 NATS (EN ROUTE) PUBLIC LIMITED COMPANY

Organisation	22 NATS	Service provider
Description	<p>NATS (En Route) plc is the core business and the sole provider of ATC services for aircraft flying 'en route' in UK airspace and the eastern part of the North Atlantic. NATS manages 11% of Europe's airspace and circa 25% of Europe's traffic. It is regulated by the UK Civil Aviation Authority (CAA) within the framework of the European Commission's (EC) Single European Sky (SES) and operates under licence from the UK Secretary of State for Transport. It operates from two ATC centres at Swanwick in Hampshire (England) and Prestwick in Ayrshire (Scotland).</p> <p>NATS (En Route) plc purpose is to provide safe, efficient and effective air traffic control services to aircraft operating within airspace where such services are either required or provided, specifically providing:</p> <ul style="list-style-type: none"> <li>• En-route and Terminal Air Traffic Control (ATC) for all UK airspace under a 30 year operating licence to UK Government. In 2017, NATS handled over 2.5 million flights, carrying more than 200 million passengers safely through some of the busiest and most complex airspace in the world.</li> <li>• The design and management of airspace, engineering project and maintenance activities for ANS communications, navigation and surveillance systems, and IT and network management.</li> <li>• Cross business support to UK Ministry of Defence (MoD) which includes the provision of a joint ATC service in the UK FIR, and support to communications systems, radar, facilities and training.</li> <li>• Provision of Instrument Flight Procedure design services, publication of the International Air Pilot Publication (IAIP), Notice to Airmen (NOTAM) documentation, data management and charting services for the UK.</li> <li>• Consultancy services to UK and overseas customers in air traffic management, airspace design, instrument flight procedures,</li> </ul>	

	<p>control tower system integration and transition, safety management, engineering, project management.</p> <ul style="list-style-type: none"> <li>• Training of ATC staff, both as ab-initio controllers, for transition to new airspace or facilities and via supplementary courses including Supervisor Management, On Job Training (OJTI) and Incident Management.</li> <li>• Training of engineering staff.</li> </ul>
Previous experience	<p>NATS has proven experience of designing separation management tools in R&amp;D, refining and maturing these concepts through prototyping and validations, to deliver a product suitable for implementation. NATS' iFACTS tools deployed in the En-Route operation have delivered measureable and significant improvements to capacity, safety and efficiency of our En-Route operation. NATS was involved in the SESAR 1 separation management projects that cover both the En-Route and TMA operational environments. We created both planner and tactical controller tools to suit a number of sector team arrangements pertinent to such environments. Underpinning these achievements are advancements to Trajectory Prediction (TP), MTCD and flight-path and conformance monitoring, These are capable of being enhanced using datalink technology and PBN, to form the next generation of Separation Management tools.</p> <p>In Wave 1 project PJ10, NATS is involved in Solutions PJ.10-01c, PJ.10-02b and PJ.10-06.</p> <p><b>PJ.10-01c</b></p> <p>NATS is leading this Solution and is developing the concept of Collaborative Control that will be compatible with the needs of current and future operations (including Systemised and Free Route operations), building on the tools and concepts developed in PJ.10-02b and liaising with the Multi-Sector Planner and Flight Centric ATC concepts in PJ.10-01a and PJ.10-01b. Early maturity validations undertaken in Wave 1 have proved the viability and applicability of the concept.</p> <p><b>PJ.10-02b</b></p> <p>NATS is leading this Solution and is developing the concept and supporting tools for Advanced Separation Management that will be compatible with the needs of current and future operations (including Systemised and Free Route operations). These developments are expected to deliver significant levels of automation, building upon the tools and concepts developed in PJ.10-02a and the concepts developed in PJ.10-01a, PJ.10-01b and PJ.10-01c. Early maturity validations have proved the viability and applicability of the concept and tools.</p> <p><b>PJ.10-06</b></p> <p>NATS is leading this Solution and is evaluating the potential for, and needs of, controllers to be able to operate safely and efficiently in airspace for which there is no specific (geographical) ATCO validation, based on the tools and concepts being developed in PJ.10-01 and PJ.10-02.</p>

	<p><b>PJ.15-09 &amp; PJ.16-03</b></p> <p>In SESAR 1 and SESAR 2020 Wave 1, NATS has been a key contributor to the Virtual Centre development and the improved operation for delegation of airspace and contingency in a Virtual Centre environment:</p> <ul style="list-style-type: none"> <li>• SESAR 1 B.4.4 Feasibility of virtual centre and development of services</li> <li>• SESAR 2020 W1 (PJ15.09): OPS use cases for delegation of airspace and contingency concept</li> <li>• SESAR 2020 W1 (PJ16.03): Technical specification of virtual centre including contribution to the validation events</li> </ul> <p><b>PJ.16-04</b></p> <p>In SESAR 2020 Wave 1 PJ16.04 (Workstation Controller Productivity), NATS has been involved in the development of the prototypes for the Controller tools, such as Multi-touch, Automatic Speech Recognition and User Profile Management System.</p>
<p>Entity Profile matching the task</p>	<p>NATS has experience in ATCO decision support tools from initial research through to implementation (in relation to Solution PJ10–W2-73). NATS will provide our capabilities in research, concept development, validation and the prototype development of tools and procedures. NATS’ expertise in tools design with a rigorous understanding of current and future ATC principles will be key to the successful development of advanced concepts for separation management.</p> <p>NATS also has the following expertise in relation to Solutions PJ10–W2-93 and PJ10–W2-96:</p> <ul style="list-style-type: none"> <li>• Expertise and experience in Air Traffic Management particularly with En Route and TMA operation including delegation of airspace.</li> <li>• Industrial ATC system expertise</li> <li>• SOA architecture</li> <li>• Requirements capability</li> <li>• Service modelling expertise (NAF modelling)</li> </ul>
<p>Contribution</p>	<p><u>PJ10–W2-73: Flight-centric ATC and Improved Distribution of Separation Responsibility in ATC</u></p> <ul style="list-style-type: none"> <li>• NATS plan to continue developing the concept of Collaborative Control with planned boundaries.</li> <li>• The NATS validation in wave 2 is planned to mature the concept and validate it within the UK very high complexity en-route airspace. This will address OI CM-0310 (Collaborative Control in en-route, which has not as yet been progressed) but also continue to mature CM-0309 (Collaborative Control in TMA). It is planned that both OI steps will be matured to full V2 maturity.</li> </ul>

- NATS also plan to continue developing the work on Non Geographical Controller Validations. This work was matured to V1 in Wave 1 and it is hoped to mature it to V2 in Wave 2 through further concept development and a V2 activity (non real-time but controller in-the-loop) using the platform developed for the Collaborative Control RTS.
- NATS has assigned effort to work with DFS to investigate if there are any common technical requirements applicable to Flight Centric and Collaborative Control concepts.

PJ10-W2-93: Delegation of airspace amongst ATSU's

- NATS will provide Virtual Centre support to the use cases of static and dynamic contingency and delegation of airspace that require additional R&D and technical validation activities in the En-route and approach domains.
- NATS will be involved in developing more complex architectures and implementation options beyond those addressed by #16-03 involving multiple ADSPs.
- NATS will develop the Validation Activity in Exercise #3 with Indra and other partners.

PJ10-W2-96: HMI Interaction modes for ATC centre

- NATS will lead the requirements input and provide requirements expertise in maturing the specifications for the HMI Controller tools

NATS will provide HF input and further validation input based on exercise involvement.

**4.1.1.23 SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIENNE CIVILS ET MILITAIRES**

Organisation	23 SKYGUIDE	Service provider
Description	<p>Skyguide is the Swiss Civil and Military Air Navigation Services Provider. They are located in the European Core Area. 59% of the services are provided within the national boundaries and 41% within airspace delegated from European neighbours. Skyguide operates one airspace from two Area Control Centres, situated in Geneva and in Wangen in the Zurich area. As a fully integrated Civil and Military Service provider, they operate the Swiss Air Defence &amp; Direction Centre (ADDC) for the OAT operations. Skyguide is also present on 12 regional civilian and military airfields throughout the country. Skyguide is setting up the capability of running a virtual centre, i.e. operating one centre from two locations and setting the premises for future sector-exchange capabilities with foreign ANSPs. Skyguide was core-member of the EUROCONTROL FASTI (First ATC Support Tools Implementation) programme as from 2005 and declared as a FASTI pioneer, at the time already making use of fully electronic environment. Operations are equipped with CPDLC capability and</p>	

	<p>make use on a daily basis of 4d Trajectory based ATC Support tools (conflict detection and conflict resolution tools, monitoring aids, inter-sector coordination tools). In addition, Skyguide has set up an advanced R&amp;D platform equipped with new functionalities such as “what-if” and “what-else” functions or 4D-trajectory management. They intend also to migrate to a Multi-Sector Planner configuration, some initial validations have been performed in the frame of FASTI, in collaboration with ENAV. Skyguide has a dedicated SESAR platform available that offers 16 positions.</p> <p>SKYGUIDE is fully committed to its public service mandate. Switzerland’s air navigation service provider is an entrepreneurially-minded and customer-focused joint-stock company under Swiss private law which has its head office in Geneva.</p> <p>Located in the middle of the European ATM Network, SKYGUIDE is able to provide front-end expertise of a dynamic ANSP, dealing with the highest density and complexity airspace of Europe. In 2015, SKYGUIDE handled 1.4 Million IFR flights, 240'000 VFR flights and 2400 tactical air force missions with a very high safety and punctuality levels. In order to ensure the required level of performance in this really specific operational environment, SKYGUIDE adopts innovative approaches in various domains like new technologies (e.g. satellite navigation), advanced automated ATC support tools and HMIs, centralised ATC data processing systems. As confirmed by the European air traffic control agency EUROCONTROL, SKYGUIDE has continuously both increased airspace capacity and enhanced the punctuality of the flights over the past 10 years.</p> <p>Skyguide is joining with SkySoft-ATM (as LTP), allowing the provision of a RTD with advanced functionalities, replicating the skyguide HMI and allowing additional ATC Functions to be included. For further information visit us at: <a href="http://www.skyguide.ch">www.skyguide.ch</a></p>
Previous experience	<p>Previous projects:</p> <p>SESAR 1:</p> <p>SKYGUIDE is associate partner of DSNA and DFS and contributes in numerous Work Packages and has also developed experience by participating to several Large Scale Demonstrations as consortium member:</p> <p>Activities linked to PJ.18 solutions:</p> <ul style="list-style-type: none"> <li>• WP-4.2 (DSNA): Consolidation of operational concept definition and validation including operating mode and air-ground task sharing. SKYGUIDE <ul style="list-style-type: none"> <li>○ has the lead on the Detailed Operational Description (En-route DOD steps 1 &amp; 2) and is contributing to SESAR 2020 Transition CONOPS development, both including 4D Trajectory Management concept.</li> <li>○ is also actively involved in several task forces and issue management processes related to Trajectory Management and Free Routing concept.</li> <li>○ Contributes to Trajectory Management Framework OFA activities</li> </ul> </li> </ul>

- WP-4.3 (DSNA) : Integrated and pre-operational validation & cross-validation
  - Management of Free Route validation exercises performed on SKYGUIDE SCCD platform:
  - assessment of the operational feasibility and benefits of the free route concept
  - Usability of Extended Flight Plans defined by the Airlines Flight Operations Centres.
  - Contribution to Interoperability (IOP) validation exercises
- WP-10.2.5 (DSNA) : Flight Object IOP System Requirement & Validation
  - Participation to IOP Requirements
- WP-B4.4 (DSNA) : Workstation, Service Interface Definition, Definition of interface between CWP and external services Set-up of a demonstrator using Coflight services connected to skyvisu HMI
- Pegase Large Scale Demonstration (AIRBUS): "Providing Effective Ground & Air data Sharing via Extended Projected Profile" addressing the use of EPP in the ground Trajectory Prediction tools therefore with the aim of improving controller support tools reliability
- WeFree Large Scale Demonstration (Air France) : Week-end Free Route trials (Swiss, Italy and France airspace)
- Free Solutions Large Scale Demonstration (ENAV) : "Free Route Environmental and Efficient Solutions"
- OFA-03.01.01 (DSNA) : Free Route and Advanced Flexible Use of Airspace Participation to the Free Route & AFUA concept Free Route exercises Validation on SKYGUIDE SCCD platform

Other SESAR 1 activities:

Work Packages:

- WP-4.7.1 – WP13.2.3 (DFS) : Complexity Management in En-route Dynamic - Demand Capacity Balancing
- STAM Measures validation exercises
- Flight Adherence to Constraints for regulated flight at arrival
- WP-C2 (DSNA) : Deployment Performance Planning and Reporting

Participation to the Master Plan maintenance

- WP-16.6.5 (DFS) : Human Performance Support and Coordination Function

Large Scale Demonstrations:

- Fairstream (DSNA) : Enhanced Arrival Management trials
- iStream (DSNA) : "Integrated SESAR Trials for Enhanced Arrival Management"

- ODP (DFS) : "Optimised Descent Profile"
- AAL (Netjets) : "Augmented Approach"
- Proud (IdS) : PBN Rotorcraft Operations Under Demonstration

Other European Programmes :

- EUROCONTROL FASTI: First Air traffic control Support Tools Implementation programme. Awarded as FASTI Pioneer
- FASTI SYSCO : Full Electronic System Intercentre Coordination live trials
- CATS (EUROCONTROL) :Contract Based Air Transportation System simulation

SESAR 2020 Wave 1 :

SKYGUIDE, as full member of SESAR2020, contributed to :

- PJ.10 : PROSA
  - Solution 10-01a - High Productivity Controller Team Organisation
    - SKYGUIDE has led the solution
    - SKYGUIDE has performed a V3 validation with the aim of validating Multi Sector Concept in eTMA
  - Solution 10-02a - Improved performance in the provision of separation
    - SKYGUIDE has contributed operational concept of the solution
    - SKYGUIDE has performed a V3 validation with the aim of validating improved controller support tools including Conflict & Resolution Advisory tools.
  - Solution 10-02b - Advanced Separation Management
    - SKYGUIDE has contributed operational concept of the solution
  - Solution 10-06 - Generic' (non-geographical) Controller Validations
    - SKYGUIDE has contributed and led activities of operational concept and validation (V1) of the solution
- PJ.16 : Workstation, Service Interface Definition & Virtual Centre Concept
  - SKYGUIDE has contributed to the various activities in particular leading Communication activities for the project
  - Solution 16.03 - Workstation, Service Interface Definition & Virtual Centre Concept
    - SKYGUIDE has contributed to the various activities (OSED, TS VALP, VALR...)
    - SKYGUIDE has contributed to V2 validations in the frame of Virtual Centre concept
  - Solution 16.04 - Workstation, Controller Productivity
    - SKYSOFTATM has contributed to the various activities (FRD, TVALP, TVALR...) in the frame of attention guidance
- PJ.18 : 4D Trajectory Management
  - Solution 18-02a - Trajectory Management Processes
    - SKYGUIDE has contributed to the 4D Trajectory Management concept definition
    - SKYGUIDE has led a V2 validation with the aim of validating complex CPDLC clearances, use of EPP data

	<ul style="list-style-type: none"> <li>○ Solution 18-02c - Trajectory Management Processes <ul style="list-style-type: none"> <li>▪ SKYGUIDE has contributed to the technical Management of eFPL in ATC</li> <li>▪ SKYGUIDE has led the iteration 1 of the validation with the aim of validating the distribution and use of eFPL data by ATC.</li> </ul> </li> <li>• PJ.02 : Traffic optimisation on single and multiple runway airports <ul style="list-style-type: none"> <li>○ Solution 02-08 - Trajectory Management Processes <ul style="list-style-type: none"> <li>▪ SKYGUIDE has contributed to the various activities (OSD, TS VALP, VALR...)</li> <li>▪ SKYGUIDE has led V2/V3 validation with the aim of Coupling AMAN/DMAN with Single runway</li> </ul> </li> </ul> </li> <li>• PJ.09 : Integration of Trajectory Management Processes in Planning and Execution <ul style="list-style-type: none"> <li>○ Solution 09-02 - Integrated Local DCB Processes <ul style="list-style-type: none"> <li>▪ SKYGUIDE has contributed to the various activities (OSD, TS VALP, VALR...)</li> <li>▪ SKYGUIDE has contributed to V2 validations in the frame of Airspace and Constraint Management and Demand Management and INAP</li> </ul> </li> </ul> </li> <li>• PJ.19 : Content Integration <ul style="list-style-type: none"> <li>○ WP 19-02 – ATM Operation <ul style="list-style-type: none"> <li>▪ SKYGUIDE has contributed to SESAR 2020 Concept of Operations and to several Dataset campaign management</li> </ul> </li> </ul> </li> <li>• PJ.20 : AMPLE <ul style="list-style-type: none"> <li>○ WP 20-02 - Master Plan Maintenance <ul style="list-style-type: none"> <li>▪ SKYGUIDE has contributed to the Master Plan Maintenance and related activities</li> </ul> </li> </ul> </li> <li>• PJ.25 : XSTREAM <ul style="list-style-type: none"> <li>○ SKYGUIDE has contributed to the various activities (Demonstration Plan, Demonstration Report...)</li> <li>○ WP 8 - Demonstration – Zurich Implementation <ul style="list-style-type: none"> <li>▪ SKYGUIDE has led demonstration live trials held in Zurich area</li> </ul> </li> </ul> </li> </ul>
Entity Profile matching the task	<p>Air Navigation Service Provider including profiles :</p> <p>Operational Expertise :</p> <ul style="list-style-type: none"> <li>• En-route and TMA Air Traffic Controllers acting in one of the most complex ATC environment</li> <li>• Ops experts : experts already contributing to SESAR 1</li> </ul> <p>Simulator expertise :</p> <ul style="list-style-type: none"> <li>• Simulator team use to prepare and run R&amp;D simulation</li> </ul> <p>Technical Development expertise :</p> <ul style="list-style-type: none"> <li>• Major software developments of the operational system</li> <li>• Dedicated software development team for R&amp;D.</li> </ul>

	<ul style="list-style-type: none"> <li>• System Engineering: Platform development, integration and validation</li> </ul> <p>Safety expertise :</p> <ul style="list-style-type: none"> <li>• Safety expertise – operation expertise</li> </ul> <p>Human Performance expertise :</p> <ul style="list-style-type: none"> <li>• HP team expertise – operation expertise</li> </ul>
Contribution	<p>Being in charge of the most complex airspace in Europe (EUROCONTROL Performance Review Unit assessment), SKYGUIDE shall be innovative in all fields of ATC/ATM in order to provide required performance to the ATM network. Therefore SKYGUIDE is already operating ATC/ATM with advanced ATC tools and is willing to further investigate new system functionalities and new steps of automation and working methods and towards Virtual Centre.</p> <p>As described above, SKYGUIDE is strongly involved in SESAR2020 activities and in particular in activities related to Virtual Centre and CWP HMI (Wave 1 PJ.16-03). Therefore, SKYGUIDE has set up an advanced R&amp;D platform equipped with new functionalities linked to Virtual Centre and Service Oriented Architecture</p> <p>Within Solution 73 Flight-centric ATC and Improved Distribution of Separation Responsibility in ATC, SKYGUIDE intends to contribute to Sub-solution 73C: Generic (non-geographical) Controller Validations, and continue activities performed in PJ.10-06 therefore identifying and validating needs that might allow a more flexible ATCO validation regime that would allow a Controller to operate in any airspace classified as a particular type. That is, the ATCO will be validated on method and tools rather than a geographic specified airspace.</p> <p>Within Solution 93 Delegation of airspace amongst ATSUs. SKYGUIDE will contribute to Operational Scenarios Definitions of the concept of Delegation of Airspace. SKYGUIDE will contribute to validation exercises focused on delegation of airspace.</p> <p>Within Solution 96 HMI Interaction modes for ATC centre. SKYGUIDE intends to contribute to improve air traffic controller HMI in the future environment where more information and more complex input will be delivered demanding different management and procedures to cope with achieving the optimum efficiency, capacity and safety. In particular, SKYGUIDE will concentrate on the air situation display in optimising the information displayed to the ATCO (attention guidance).</p>

#### 4.1.1.24 THALES - LAS FRANCE SAS

Organisation	24 THALES	Ground Industry
Description	<p>Thales ATM, from take-off to touchdown and everything in between.</p> <p>World leader in ATM, Thales , represented in SESAR 2020 by the Thales LAS France company and its Linked Third Parties, offers integrated gate-to-gate solutions, from pre-flight to landing, ensuring airport safety, efficient traffic handling operations, data sharing on aircraft and seamless handover operations between territories.</p> <p>Thales has the largest installed base of solutions and technologies with over 360 TopSky - ATM Solutions, 7,000 nav aids, 700 surveillance radars, and 1,800 ADS-B and multilateration equipment. Thales is trusted by key ATM decision makers across 170 nations, and helps key decision makers master complexity and make timely decisions for better outcomes.</p> <p>At the forefront of all major modernisation initiatives around the world</p> <p>Growing aircraft numbers make Air Traffic Management more complex. Thales solutions help to make the skies safer, greener and more efficient.</p> <p>A key player in all major ATM modernisation initiatives, ICAO Aviation System Block Upgrades (ASBU), SESAR and NextGen, Thales focuses on international harmonization. Our product roadmaps are aligned with ICAO ASBU concepts, NextGen and SESAR. Thales has an important experience in approach and more globally in Tower systems developing and deploying systems across the world.</p>	
Previous experience	<p>Previous main projects:</p> <p><b>SESAR 1:</b> Thales has been involved in all SESAR 1 WorkPackages. Thales has been Co-Leader for :</p> <ul style="list-style-type: none"> <li>• WP10 (En-Route &amp; Approach ATC Systems)</li> <li>• WP 14 (SWIM technical architecture)</li> <li>• WP15 (Communication, Navigation, Surveillance)</li> </ul> <p><b>SESAR 2020 Wave 1:</b> THALES is a key contributor to the programme and is being involved in all S2020 Wave 1 projects. Thales is project coordinator for :</p> <ul style="list-style-type: none"> <li>• PJ16 (Controller Working Position / Human Machine Interface)</li> <li>• PJ17(SWIM Technical Infrastructure)</li> </ul> <p><b>4-FLIGHT:</b> Thales is delivering the future innovative Air Traffic Management system for France, 4-Flight. DSN will enjoy a new generation ATM system to respond to the increasing complexity and density of air traffic, integrating a new advanced flight data processing system (CoFlight) with Thales's latest generation human machine interface (TopSky - Controller HMI) and sophisticated new controller tools, to better detect conflicts, facilitate traffic analysis.</p>	

**COFLIGHT:** Coflight is a new advanced Flight Data Processing System (FDPS), jointly developed by DSNA and ENAV and Skyguide ANSPs, together with industrial partners Thales and Leonardo. Designed to meet SESAR performance objectives, Coflight is a unique product, a fundamental enabler to achieve interoperability throughout Europe.

**COOPANS** (CO-Operation of Air Navigation Service providers) is a unique innovative partnership, between five major ANSPs together with Thales as industry provider. IAA, LFV, Naviair, Austro Control and Croatia Control have implemented an advanced and unified Air Traffic Control system thanks to harmonized functionalities and joint investments. With Thales TopSky - ATC system in operation, the five countries members benefit from a unified solution, through an open architecture which allows them to introduce the latest innovations via regular stepwise evolutions.

**OneSKY:** The OneSKY project for the Australian ANSP Airservices of Australia consists of merging civil and military airspace into one unique airspace managed by the same integrated system. It is the most complex 'system of system' project that THALES ATM has ever competed for, including TopSky - ATC solutions deployed in 15 interconnected civil and military ATC centres.

**MARSHALL:** The Marshall Project is a transformational infrastructure programme for UK MoD, seeking to ensure safe, efficient and sustainable Air Traffic Management (ATM) service for the UK Armed Forces. Thales provides a complete civil ATM capability for Military Airbases with:

- Efficient and secure solutions for Approach, Tower and Runway operations
- A totally harmonized solution for operations between civil and military ATC
- Civil-military data control

**TAAATS:** provides the Air Traffic Management Service (En-Route and Approach) for the whole of Australia and for the related oceanic areas as well as the civil-military co-ordination. It is the only system in the world that simultaneously provides fully integrated ADS/CPDLC facilities and allows integrated display of radar tracks, ADS-C tracks, ADS-B tracks and Flight Plan tracks.

**NESACC:** aims at providing the Air Traffic Management Service (En-Route and Approach) for the whole north east of China controlling around 60% of Chinese total air traffic. Air traffic control of areas outside radar coverage is also provided. The Beijing, Shanghai and Guangzhou ATC centres are connected to the three (3) control towers of the largest Chinese airports.

## **MODERNISATION INITIATIVES**

	<p><b>NextGen</b></p> <p>Thales has a unique position in the ATM Industry, participating to both SESAR and NextGen. NextGen is transforming the US National Airspace System (NAS) to meet future needs and avoid gridlock in the sky and at airports.</p> <p>Thales is a key contributor to NextGen</p> <p>Member of RTCA NextGen Advisory Committee</p> <p>Key technology provider for ADS-B program</p> <p>Enabling data comm with Thales automation platform</p> <p>Providing analysis work with the areas of safety and security</p> <p><b>ICAO ASBUs</b></p> <p>All Thales solutions are compliant with Block 0, and on the way to meet Block 1 requirements. Thales has the knowledge and expertise in the ASBUs together with the largest worldwide ATM installed base to advise our users about implementing them wherever they are.</p>
Entity Profile matching the task	<p>Thales Air Sys will provide expertise on these domains:</p> <ul style="list-style-type: none"> <li>• Knowledge of the SESAR environment and processes</li> <li>• Development of Industrial Based Platform (IBP)</li> <li>• Expertise on Service definition for ATC system</li> <li>• Expertise on Speech recognition</li> <li>• Exercise management with partners</li> <li>• Expertise on Operational concept</li> </ul>
Contribution	<p>Thales Air Sys will participate to all solutions:</p> <ul style="list-style-type: none"> <li>• In Solution 93, contribution to the OSED definition, active participation in service definition, large exercise with partners.</li> <li>• In solution 96, contribution to ASR documents, in particular leading TVALP, TVALR, participation to ASR exercise.</li> </ul> <p>In Solution 73, contribution to the TS/IRS document and review of all other solution documents. Provision of ATC tools to be integrated into ECTRL ESCAPE platform to support common exercise together with COOPANS.</p>

#### 4.1.1.25 AIRBUS SAS

Organisation	25 AIRBUS	Airborne Industry
Description	<p>Airbus is a leading global manufacturer of the most innovative commercial aircraft. Its comprehensive product line comprises highly successful families of aircraft, from the single-aisle A220 Family to the double-deck A380.</p> <p>Over the last years, Airbus has built a reputation on reacting to market demands, developing and evolving its products to meet the needs of customers and the wider world. As such, technological innovation has been at the core of Airbus' strategy since its creation.</p> <p>The A320 is one aircraft in four sizes (A318, A319, A320 and A321), representing the most successful and versatile jetliner family ever. Seating from 100 to 240 passengers and flying throughout the world –</p>	

	<p>and landing on every continent – an A320 takes off or lands every 1.6 seconds. The A320neo (new engine option) is the latest upgrade to the A320 Family. These new A319, A320 and A321 models feature new engines and large wingtip devices known as Sharklets. Together they result in a 15% fuel-burn reduction, corresponding to an annual CO2 reduction of 3,600 tonnes per aircraft. The A220 expands the Airbus single-aisle family to cover the 100-150 seat segment – and respond to a worldwide market demand for smaller single-aisle jetliners.</p> <p>In the wide-body segment, the A330neo is powered by high-bypass ratio, new generation engines and designed with an advanced high-span wing vastly improving the aerodynamics. New materials have also been used across the wing including titanium pylon and composite nacelle. All these features combined, ensures that the A330neo has the lowest seat-mile cost of any mid-size widebody and burns 25% less fuel burn than the previous generation A330.</p> <p>The A350 XWB brings together the very latest in aerodynamics, design and advanced technologies to shape the efficiency of medium- to long-haul operations. The aircraft's innovative all-new carbon fibre reinforced plastic fuselage results in lower fuel burn as well as easier maintenance. Meanwhile, the combination of low operating costs, flexibility and optimised performance makes the A330 Family popular with an ever-increasing operator base.</p> <p>The A380 provides airlines with the best opportunities to optimise revenue across their networks, with more seats for growth, connecting traffic and higher yields by offering more capacity when and where people want to fly.</p> <p>Continuously striving to develop new technologies, Airbus is a world leader in the modern aviation industry. Helping it stay at the forefront is the introduction of new systems, materials and designs that improve the quality and efficiency of aircraft to benefit everyone – from the passengers to airlines.</p>
Previous experience	Not applicable
Entity Profile matching the task	Not applicable
Contribution	Not applicable

#### 4.1.1.26 ATOS BELGIUM

Organisation	26 ATOS (FSP)	Ground Industry
Description	<p>Atos Belgium is a company within Atos SE (Societas Europaea) group. Atos is a leader in digital services with 2014 pro forma annual revenue of €10 billion and 86,000 employees in 66 countries. Serving a global client base, the Group provides Consulting &amp; Systems Integration services, Managed Services, Cloud operations, Big Data &amp; Security solutions, as well as transactional services. Throughout Europe, more than 300 Atos ATM experts provide solutions and architecture support</p>	

	<p>to Air Navigation Service Providers, Airports, Airlines and EUROCONTROL Network Manager.</p> <p>Atos Belgium is member of the Frequentis SESAR Partners consortium together with the companies HUNGAROCNTRM MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG and Frequentis AG and was founded in 2014 for the main purpose of joining SESAR2020 activities. Frequentis SESAR Partners is member of the SESAR Joint Undertaking.</p> <p>The consortium is comprised of companies having a variety of complementary capabilities. Having former SESAR1 experience within its framework, an ANSP whose expertise will result in early feedback loops during certain projects, and the wide range IT, data management and security expertise of the consortium forming entities, Frequentis SESAR Partners believes in the high added value of its participation in SESAR2020 efforts..</p>
Previous experience	Atos (FSP) is participating in PJ04, PJ07, PJ08 and PJ09 in SESAR 2020 wave1 implementation.
Entity Profile matching the task	Not applicable, ATOS (FSP) initially will not participate actively in this action.
Contribution	Support to participating members of Frequentis SESAR Partners if required.

#### 4.1.1.27 AIRTEL ATN LIMITED

Organisation	27 AIRTEL (NATMIG)	Ground Industry
Description	<p>AIRTEL ATN LTD is a part of North European ATM Industry Group (NATMIG) Consortium. NATMIG is a member of SESAR 1. The NATMIG consortium consists of Airtel ATN (SME - Ireland), Saab AB (multinational industrial concern - Sweden) and SINTEF AS (non-profit research organisation - Norway).</p> <p>AIRTEL ATN LTD is an SME which has an extensive line of ATN &amp; FANS data link products and technology used in 35 countries worldwide. Its operational systems include ATN/OSI routers deployed on more than 2,500 aircraft. Its ground systems include Air/Ground Data Link Servers deployed in several European Countries and Air/Ground routers used in VDL Mode-2 networks. It provides data link test and monitoring equipment. It has developed experimental version of future data link systems such as ATN/IPS, SATCOM and AeroMACS.</p> <p>AIRTEL ATN LTD is providing Test and Monitoring equipment to the FAA DCIS program. It has extended its research collaboration to include organisations in China. It is also providing Data Link networking equipment in collaboration with Russian companies.</p> <p>AIRTEL ATN LTD also provides Data Link test services and products in support of Aircraft Data Link certification for ACARS, FANS and ATN/OSI, in particular EU Data Link and US DCIS aircraft testing..</p>	

Previous experience	Not applicable
Entity Profile matching the task	Not applicable
Contribution	Support to participating members of NATMIG Partners if required.

#### 4.1.1.28 SAAB AKTIEBOLAG

Organisation	28 SAAB (NATMIG)	Ground Industry
Description	<p>SAAB AKTIEBOLAG is part North European ATM Industry Group (NATMIG) Consortium. The NATMIG consortium consists of Airtel ATN (SME - Ireland), Saab AB (multinational industrial concern - Sweden) and SINTEF AS (non-profit research organisation - Norway). While SAAB AKTIEBOLAG originates in military and civil aircraft manufacturing and is one of the few companies in the world with the ability to develop, integrate and maintain complete aircraft systems, we are today active in several transport modes and a global supplier in the ATM domain.</p> <p>SAAB AKTIEBOLAG's over 75 years of history in aeronautics, over 4000 civil and military aircraft produced and as well as our broad involvement in ATM businesses, provide a solid background and deep competence in aeronautics in general and RPAS in specific. For the future we plan to continue to be able to provide market-leading aeronautical products including manned and unmanned (RPAS) products that can operate safely in civil airspace, as well as solutions to facilitate others to allow safe RPAS operations in their airspace, whether it's an RPA, a Detect &amp; Avoid system or related ATM components.</p> <p>SAAB AKTIEBOLAG is a global supplier in the ATM domain and Saab has a long history of developing and delivering ATM solutions. SAAB AKTIEBOLAG has pioneered future concepts such as the Remote Tower, which in operational use in Sweden and is undergoing trials in several other countries. In total, SAAB AKTIEBOLAG has deployed 240 ATM systems and subsystems to serve over 60 customers in 40 countries. Our air traffic management systems and tools serve 18 of the 20 busiest airports in the world, 10 of the 12 largest Air Navigation Service Providers (ANSPs), and the 3 largest airlines by passenger count. SAAB AKTIEBOLAG ATM systems guide 2 million aircraft movements each month via our airport surface safety systems. SAAB AKTIEBOLAG's main areas of interest are:</p> <ul style="list-style-type: none"> <li>• RPAS</li> <li>• Remote Tower</li> </ul>	
Previous experience	<p>Saab (NATMIG) has been a SESAR member from the start with the SESAR project experience:</p> <p>SESAR 1 (WP05, WP06, WP10, WP12 and WP16): The main areas of contribution were in AMAN/DMAN, Remote Tower and safety.</p>	

	SESAR 2020 W1 (PJ05): The main area of contribution is in Remote Tower
Entity Profile matching the task	Not applicable
Contribution	Support to participating members of NATMIG Partners if required.

#### 4.1.2 Main profiles/CV

- CV Project Manager

Jörg Bergner (DFS) has been working in aerospace R&D for almost 20 years. Since joining DFS R&D department in 2006, he led various interdisciplinary, multi-national project teams. Jörg has considerable experience in HMI design for ATC controllers, queue management and separation management. He has been involved with SESAR since 2010 as project manager for SESAR 1 P05.04.02 “Co-Operative Planning in the TMA” and as Project Coordinator for SESAR 2020 Wave 1 PJ10 “Controller Tools and Team Organisation for the Provision of Separation in Air Traffic Management”. Jörg graduated in 2000 with a Diploma degree in Mechanical Engineering and received his Doctoral degree for experimental work on aerothermodynamics both from Technische Universität Darmstadt.

- CV Solution Lead PJ10-W2-73

John Godsell (NATS) has over 25 years’ experience in the aviation industry and 10 years’ experience in NATS. Employed as a Flying Instructor and Corporate Air Transport Pilot before joining NATS in 2009, then involved in the initiation phase for SESAR 1 and going on to lead project 4.7.3 PBN in En-route and P5.6.3 before taking up the role as Deputy WP5 Leader towards the latter end of SESAR 1.

In SESAR 2020 Wave 1 John has been Solution Lead for three solutions in Project 10: PJ.10-01c Collaborative Control, PJ.10-02b Advanced Separation Management and PJ.10-06 Generic (non-geographical) Controller validation.

- CV Solution Lead PJ10-W2-93

Maurizio Romano has over 14 years’ experience in Real Time Simulations “RTS” as a “Scenario Designer” within the ATM context. He worked with the Concept of Operation (ConOps) applied at the beginning in the European programme 6th Framework Programme then in SESAR and nowadays in SESAR 2020 framework context, with the responsibility of to coordinate the VMG (Validation Management Group) and to properly coordinate all RTS activities.

In SESAR 1 Maurizio has been the OFA coordinator for ASAS S&M management the Concept of Operation of ASAS S&M in the ATM context and the responsible for the preparation of Experimental /Validation Design in ENAV Experimental Centre for SESAR Framework. (SESAR Best Release Exercise 2012 and 2014 for ASAS S&M EXE199 and I4D Operation in TMA environment Integrated and Pre-Operational Validation & Cross Validation EXE 805).

In SESAR 2020 Wave 1 Maurizio has been Solution Lead for solution in Project 15.09: Data Centre for virtual Centre in the context of Delegation of Airspace.

- CV Solution Lead PJ10-W2-96

Corinna Cortese is employed as ATMS System Engineer in LEONARDO S.p.A. The main responsibilities are: analysis, identification, definition and review of technical specification, starting from operative requirements up to international bids preparation. The main expertise are *conflict detection* and *monitoring aids*, grown up during the functional validation activity in house and on-site with customers. Already involved in SESAR2020 in project PJ10 as LEONARDO’s PoC.

## 4.2 Third parties involved in the project (including use of third party resources)

### 4.2.1 Linked to DFS – Company 1

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
<p>As continuation and detailing of SESAR 2020 Wave 1 work, it is foreseen in this project that data about IFR flight relevant adverse weather zones shall be assessed in order to determine its potential for the improvement of controller tools, flight procedures and team organisations. In detail, the following non-core tasks / contributions as preparatory work are planned to be subcontracted in the context of Solution PJ.10-W2-73-FCA:</p> <ul style="list-style-type: none"> <li>• Support in selection, justification and documentation of suitable convective thunderstorm scenarios for the considered use cases and applications</li> <li>• Meteorological consultancy regarding the enhancement of cells with cloud and echo top information (3D data) and thunderstorm type clustering</li> <li>• Mapping and visualisation of meteorological data</li> <li>• Evaluation and testing of reasonable adverse WX zones thresholds and clearance distances based on pilots' vertical and lateral avoidance behaviour for the appropriate consideration in controller assistance functions</li> </ul> <p>DFS as an international organisation, follows strict legislation in terms of external assistance selection, H2020 specifications and internal procurement rules. These requirements will be applied for the selection process of the subcontracting parties in the framework of PJ10-W2 and take especially into account “best value for money” assessment.</p>	
Does the participant envisage that part of its work is performed by linked third parties <sup>1</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>2</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

<sup>1</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>2</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

#### 4.2.2 Linked to DLR (AT-One) – Company 2

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>3</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>4</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.3 Linked to NLR (AT-One) – Company 3

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>5</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	

<sup>3</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>4</sup> 'International Partner' is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>5</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

Does the participant envisage that part of the work is performed by International Partners <sup>6</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.4 Linked to ANS CR (B4) – Company 4

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>7</sup>	Y
<p>• <b>INTEGRA (ANS CR LTP):</b></p> <p>Integra is a privately owned consultant company with close to 30 years of experience providing consultancy services to the aviation and defence industries. Within aviation, Integra is specialized in the fields of Air Traffic Management (ATM), airports as well as regulatory and oversight functions.</p> <p>Integra has performed more than 500 consultancy projects for aviation organisations such as ANSPs, airports, national authorities and defence organisations in more than 30 different countries on five continents, as well as for a long list of international organisations like NATO, European Commission, EUROCONTROL, ICAO, World Bank and European Bank for Reconstruction and Development.</p> <p>Integra Consult's key assets are our high profile consultants, many with a background from an ANSP, national authority, EU or other relevant institutions or defence organisations. Its unique experience and continuously updated knowledge of recent regulations, programs and best practices are available to our customers. A key element of Integra Consult's strategy is to provide independent, flexible and high-quality consultancy services that generate added value to our customers at a reasonable cost.</p> <p>INTEGRA will participate in following activities for SOL 73:</p> <ul style="list-style-type: none"> <li>▪ expert review of deliverables using the experience from current PJ10-1b Solution (SAF and HP particularly)</li> </ul> <p>INTEGRA will participate in following activities for SOL 96:</p> <ul style="list-style-type: none"> <li>▪ leading of Safety related parts using the experience from current PJ.16-04 Solution (SAP; SAR)</li> <li>▪ contribution to CBA, VALP and VALR documents</li> <li>▪ expert review of deliverables using the experience from current PJ.16-04 Solution</li> </ul> <p>• <b>AgentFly Technologies (ANS CR LTP) for SOL 73:</b></p>	

<sup>6</sup> 'International Partner' is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>7</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

AgentFly Technologies was established in 2010 to commercialize outcomes of research projects carried out at the Czech Technical University in Prague since 2005. Initial research sponsored by U.S Air Force, U.S Army and U.S Navy focused on simulation of UAS teams. In 2009, acquisition of hardware platforms (both fixed wing and rotary) and deployment of AgentFly to these platforms have been started. Air traffic simulation branch has been initiated under sponsorship of FAA in 2008 and extended by participation in SESAR 2020 and cooperation with Czech ANSP.

AgentFly Technologies will participate in following activities:

- development and participation in FTS
- contribution to VALP/VALR and CBA regarding the FTS

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
--	---

N/A

Does the participant envisage that part of the work is performed by International Partners <sup>8</sup> (Article 14a of the General Model Grant Agreement)?	N
---	---

N/A

#### 4.2.5 Linked to LPS SR (B4) – Company 5

##### Objective

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
--	---

N/A

Does the participant envisage that part of its work is performed by linked third parties <sup>9</sup>	N
---	---

N/A

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
--	---

N/A

Does the participant envisage that part of the work is performed by International Partners <sup>10</sup> (Article 14a of the General Model Grant Agreement)?	N
--	---

<sup>8</sup> 'International Partner' is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>9</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>10</sup> 'International Partner' is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

N/A

#### 4.2.6 Linked to ON (B4) – Company 6

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>11</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>12</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.7 Linked to PANSA (B4) – Company 7

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>13</sup>	N
N/A	

<sup>11</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>12</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>13</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>14</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.8 Linked to ACG/COOPANS – Company 8

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
<p>Austro Control intends to subcontract parts of the document work (particularly VALP and VALR) to Think Research. This company has sound knowledge and specific expertise in technical and operational aspects of ATM. While the core content-related expertise will be delivered by Austro Control experts, Think Research will be responsible for the actual drafting and consolidation of the documents or parts of them.</p> <p>In particular the following tasks will be subcontracted to Think Research:</p> <ol style="list-style-type: none"> <li>1. Elaboration of the ACG/COOPANS contribution to the OSED as part of D4.1 based on content provided by Austro Control experts. Estimated cost € 4000,-</li> <li>2. Elaboration of the ACG/COOPANS contribution to the VALP as part of D4.1 based on content provided by Austro Control experts. Estimated cost € 9000,-</li> <li>3. Elaboration of the ACG/COOPANS contribution to the VALR as part of D4.1 based on content provided by Austro Control experts. For this document the participation of Think Research staff as observers to the validation exercise is planned. Estimated cost € 17093,-</li> </ol> <p>Organizational Data: Think Research Ltd. Suite 3 Branksome Park House, Branksome Business Park, Bourne Valley Rd, Bournemouth, BH12 1ED.</p>	
Does the participant envisage that part of its work is performed by linked third parties <sup>15</sup>	N
N/A	

<sup>14</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>15</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>16</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.9 Linked to CCL/COOPANS – Company 9

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>17</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>18</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.10 Linked to IAA/COOPANS – Company 10

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	

<sup>16</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>17</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>18</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

Does the participant envisage that part of its work is performed by linked third parties <sup>19</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>20</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.11 Linked to LFV/COOPANS – Company 11

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>21</sup>	N
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>22</sup> (Article 14a of the General Model Grant Agreement)?	N

<sup>19</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>20</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>21</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>22</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

N/A

#### 4.2.12 Linked to Naviair/COOPANS – Company 12

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>23</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>24</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.13 Linked to DSNA – Company 13

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
<p>DSNA has in house expert engineers with the ability to develop new concepts and define specifications for new ATM tools. But, in order to fulfil its prospective studies, DSNA needs additional expertise. Subcontracted activities will encompass the support to: prototype development in preparation of validation exercises, data collection stemming from the validations, analysis of the results through specific tooling and HP assessment.</p> <p>DSNA subcontracts allow DSNA/DTI to buy these necessary required studies/services. These subcontracts are a framework for placing specific purchase orders and have been attributed in accordance to the French “Code des Marchés Public”.</p>	

<sup>23</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>24</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

Does the participant envisage that part of its work is performed by linked third parties <sup>25</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>26</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.14 Linked to ENAIRE – Company 14

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
<p>ENAIRE plans to perform several validation exercises within PJ10 that require the involvement on both, Air Traffic Controller Operators and pseudo-pilots. ENAIRE ATCos' with proven experience will contribute on the exercises execution by providing their impressions and also improvement areas. However, ENAIRE does not have enough pseudo-pilots in its staff to perform all tasks envisaged, so subcontracting pseudo pilots is needed to perform the exercises. For this reason, ENAIRE plans to subcontract pseudo-pilots services for SESAR 2020 w2 PJ10 Solution 73 (WP2) and Solution 93 (WP3) from SENASA, company with a long tradition in aeronautics in the areas of training, in order to complete the validation exercises involved with the best guarantees.</p>	
Does the participant envisage that part of its work is performed by linked third parties <sup>27</sup>	Y
<p><u>CRIDA</u></p> <p>CRIDA A.I.E. (Reference Center for Research, Development and Innovation in ATM) is a non-profit joint venture between ENAIRE, The Polytechnic University of Madrid and Ineco. CRIDA's mission is to improve the performance of the Spanish ATM management system. As an integral part of the global system, CRIDA intends to increase the safety, capacity, environmental and economic impact of ATM through ideas and R&amp;D+i projects. CRIDA's investigative priorities revolve around three main lines in which CRIDA leverages its proven experience and solid international reputation:</p>	

<sup>25</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>26</sup> 'International Partner' is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>27</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

- System monitoring and diagnostics to identify problems and their causes. This continuous system observation is realized through systematic performance quantification;
- Analysis and validation of R&D+i solutions, viability studies and quantification of the benefits in terms of system performance improvements;
- Collaboration in the development and subsequent deployment of those solution alternatives that provide the best system benefit.

CRIDA will support ENAIRE in the definition and execution of the validation activities to be performed in PJ10. CRIDA makes available to ENAIRE the experimental laboratory with several Industrial-Based Platforms with the required capabilities to execute the real-time simulations of the solutions 73 and 93. Additionally, CRIDA will also participate in the solution 96 experiments and be deeply involved in the analysis of results and conclusions of all solutions.

### INECO

INECO (Ingeniería y Economía del Transporte, S.M.E., M.P. S.A.) is an engineering and consulting Public Entity 45,85% owned by ENAIRE, focused on the transport sector in general, and also in the air transport field in particular, including ATM and airport operations and management.

INECO will support ENAIRE in the definition and execution of the validation activities to be performed in solution 73. INECO will contribute in the development of the concept and algorithm to support the defined strategies of Flight Centric Allocation. Additionally, INECO will contribute to the Human Performance (HP) assessment on this solution by using Touch It, a specific HP oriented tool owned by INECO.

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	Y
--	---

Several companies have been collaborating by means of third party in kind contribution with ENAIRE for long time, and a close collaboration exists in this sense. This has been the habitual practice in SESAR1 and in SESAR 2020 Wave 1 activities and the results have become optimal in terms of efficiency and mutual collaboration.

The use of this in kind contribution is identified as a key factor for the proper development of the activities under this project. The complementarity of the know-how and expertise profile obtained by this form of collaboration is necessary to achieve the targets with the expected level of quality.

This contribution corresponds to the one referred to in Art. 11 of the AMGA (in-kind contributions against payment), in turn corresponding to category “A.3- seconded persons” of the Annex 2 of the Grant Agreement , and currently is estimated to amount to around 54.400 € (direct costs) for the work developed on ENAIRE’s premises (since there is no specific place in Annex 2 to indicate these costs).

Does the participant envisage that part of the work is performed by International Partners <sup>28</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.15 Linked to ENAV – Company 15

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>29</sup>	Y
<p>ENAV contribution in the project is complemented by the following LTPs: Techno Sky, BIP-Business Integration Partners, NAIS and VMware.</p> <p><b>Techno Sky</b></p> <p>Techno Sky S.r.l. (Techno Sky) is an ENAV Group Company having the responsibility for the management and maintenance of systems and equipment used for Air Navigation Services in Italy as well as for the support to the ATM operational innovation and for all the relevant ENAV Group R&amp;D activities.</p> <p>As ENAV's mission critical systems integrator, Techno Sky controls the full value chain, i.e. Research and Development, System Engineering, Design, ATM Software Development, Weather System Development, Verification, Validation, Installation, Integration, Training, Logistics and Maintenance.</p> <p>In 2017 Techno Sky extended its background of knowledge and expertise on R&amp;D following the transfer of competences and experts coming from SICTA, the former ATM R&amp;D branch of ENAV Group.</p> <p>The acquisition of ATM R&amp;D experts is showing the Techno Sky constant commitment and focus on technological innovation, as a key factor for its continuous improvement and increased competitiveness on the market.</p> <p>In addition, by investing in the study and implementation of new and more effective products and applications, Techno Sky acts significantly within the value chain of the ENAV Group and contributes to the efficiency, regularity and safety of Air Traffic Management operations. Special care is devoted to the study of innovative systems to be used in the Company's core business. These studies and surveys are intended to improve innovative operational services supported by several simulators, platforms, tools and advanced methodologies.</p> <p>Techno Sky, working in close cooperation with ENAV, has also gained an outstanding expertise in the development of innovative Air Traffic Management operations, in the development and validation of new concepts and procedures for the continuous improvement</p>	

<sup>28</sup> 'International Partner' is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>29</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

of performances, in assisting the supply industry to design and engineer new systems to safely support the Air Traffic Controllers in their highly demanding tasks.

Techno Sky, as ENAV Linked Third Party, is involved in ENAV ATM strategic planning, technical co-operation and service provision programs with international organizations (e.g. SESAR Joint Undertaking, SESAR Deployment Manager, EUROCONTROL, European Commission, etc.) and foreign countries, aiming at contributing to the advancement of ATM technology and processes and at improving all the linked services.

Techno Sky participation is quite significant from an ENAV perspective considering it brings an important piece of transversal technical, operational and management expertise.

Moreover, Techno Sky is currently extensively contributing to SESAR 2020 Wave 1 Programme as ENAV LTP by complementing ENAV activities and expertise in 14 W1 projects including Industrial Research, Transversal activities and Very Large Demonstrations. Based on the considerations and skills depicted above, ENAV and Techno Sky, as part of the ENAV Group, can be considered as a single entity.

Techno Sky contribution to this project is intended to be provided in all activities where ENAV has expressed interest, with special emphasis on the operational validation of the concepts developed within the project solutions.

Specifically, transversal contribution to the tasks for the concept, procedures and requirements definition; for structuring and organising all validation activities as well as for executing and reporting related to all validation exercises envisaged to be performed within this project.

### **BIP-Business Integration Partners**

BIP is the major Italian consulting firm, and one of the largest players in the European management consulting. Fourteen years after its foundation, with more than 1.500 professionals, more than 175 clients and an annual consolidated turnover of more than € 130 million in 2016, Bip is regarded as a true success story in European strategy and management consulting and as an ideal business advisor for its quality, innovation, efficiency, expertise in modernisation and development, delivered to large Corporations, Public Institutions and Agencies and International Corporations.

Bip possesses distinctive capabilities in designing and realising tangible consulting projects, merging coherently Clients' strategic vision, business model, and operational deployment, while fully preserving their corporate culture. Bip consultants are recognised for deep business knowledge, significant reliability and superior capacity to deliver tailor-made solutions for performance improvements. Moreover, Bip is an independent business advisor, with no conflicts of interest of sort, such as those potentially arising from advisory / auditing or advisory / software providers.

In particular, Bip is recognised as a major player and thought leader in the following competence areas:

- Strategic and organisational consulting for Public Customers and Private large international companies;
- Economic and financial areas of excellence in economic and business due diligence, financial assessment, development of alternative economic scenarios, Cost-Benefit Analysis, Sensitivity analysis, What-If analysis, business cases delivery and execution;
- Capability to run effectively complex international projects, with the involvement of several stakeholders
- over different countries;
- Information Technology strategy and operational governance, where Bip professionals developed
- Innovative methodologies, frameworks and best practices

Bip has a long experience in Aviation sector and has matured a unique experience as a quality strategic partner for important ANSPs at national and international level.

More than 10 years ago BIP has started a long and fruitful collaboration with ENAV in the governance of different initiatives that go from operations, participation to SESAR JU and to SESAR Deployment Manager, strategy, organization, human resources, and commercial and international development. Such experience has allowed BIP to create a solid and specific competence in the aviation industry, and ENAV to gain a partner that can provide a useful and trusted support in the execution of studies, business cases, reports and governance activities.

In the framework of SESAR W2 PJ 10, BIP will support ENAV in the execution of Cost Benefit Analysis studies for Sol.93 Delegation of airspace

## **NAIS**

Established at the end of 2006, NEXTANT Applications & Innovative Solutions (NAIS) is an Italian, private- owned, ICT Company, classified as SME according to the European Commission classification (2003/361/EC). The company's mission is to develop and propose, to the proper market sectors, innovative applications and services based on ICT technologies and Satellite Navigation, EO & Communication assets.

NAIS' main expertise in the Space & Defence market domains plays a strategic role in the development of innovative application based on ICT and enabling satellite technologies.

NAIS executes the whole Technology Transfer Process from R&D Projects to product industrialization and commercialization

NAIS is based in Rome, and its HQ hosts the following facilities: R&D centre, 2° level Helpdesk, Customer support team, product & service provisioning team. Its Quality System is certified ISO 9001:2008. It operates in the following business segments: Space & Defence, Transport/Maritime, Information & Communication Technology, Aeronautical.

Innovative applications and services are available in the field of Smart-mobility (solution for both citizens and tourists, transportation support and information), Emergency (mission management and resource planning), Cultural Heritage (safeguard, fruition and prevention), Maritime (search & rescue, mission management and access to harbour and docks), Defence (air defence systems radar), and Aeronautics (Air Traffic Management systems, conventional and unconventional 2D & 3D operational displays, flight information systems and portable flight displays for VFR General Aviation aircraft), all based on Satellite technologies (Navigation (EGNOS/GALILEO), Communication, and Earth Observation), innovative HMI techniques based on Virtual and Augmented Reality techniques and Engineering / architectural aspects.

In addition, NAIS is currently participating in SESAR 2020 Wave 1 as ENAV LTP and is supporting with its technical and management expertise the ENAV work in W1 projects PJ01, PJ02, PJ03a, PJ05 and PJ16, with special focus on validation activities and KPA assessment. NAIS, with its KPA and ICT expertise, will complement ENAV work in WP03 by providing support to the ENAV technical developments, validation activities and relevant KPA assessment.

## **VMware**

VMware Bulgaria EOOD is a private limited company in Bulgaria with R&D staff of over 900 located in Sofia, Bulgaria, and part of the global group in the VMware portfolio. With 2017 revenue of \$7.92 billion, VMware is a global leader in cloud infrastructure and business mobility, and has over 500,000 customers, 75,000 partners worldwide, and 20,000+ employees in 120+ locations around the world. Built on VMware's industry-leading virtualization technology, the company's software solutions deliver instruments to IT that are

fluid, instant and more secure. For its tenure of 20 years, VMware has more than 2,000 U.S. granted patents -- a testament to the tremendously innovative energy of its R&D team, and the tremendous contributions to the fields of compute, network, storage virtualization, as well as cloud computing. As part of the Office of the CTO, VMware's research group is bootstrapped with expertise in distributed systems, computer architecture, and algorithms. Key additions to the team around the globe have expanded its expertise to include operating systems, hypervisors, compilers, networking, data structures, file systems, distributed ledgers (e.g., Blockchain), key management, verification, constraint solving (SAT), coding, and big data, as well as excellence in prototyping and engineering of novel solutions in trending areas such as the Internet of Things. VMware collaborates with the world's leading faculty and universities to develop and incubate innovative research approaches, and to accelerate the transformation of ideas into world-class technology solutions.

VMware, given its solid, recognized and specific background and in line with the proposed participation as ENAV LTP, will contribute and complement ENAV activity in Solution 93 "Delegation of Airspace".

Specifically, VMware will support ENAV and the Solution to design and initially deploy technological solutions to support the provision of a robust, performant and usable infrastructure for Virtual Centre based on the operational needs of the delegation and Contingency use cases.

Such technological solutions should manage to overcome the low flexibility in managing traffic flows, natively supporting load-balancing between ATSUs, Delegation of Airspace or manage contingency situations. Cloud-based approaches, together with flexible networking methods (i.e. software-defined networking) will be put in place to host virtual center services (beside the standard methodologies such as the direct remote connections).

Those approaches shall address, to reach adequate TRLs maturity for V3, the performance and robustness needed to host ATC services nodes. The study and eventual implementation of technological layers – transparent to actual implementations and saving legacy systems approaches will be also taken into account. Such technologies will bring benefits especially for Contingency use case, thanks to the possibility to choose between local and remote platforms on synchronised geographically distributed nodes.

Together with ENAV, by the use of the ENAV National Test Facility (as leading edge in Cloud and Virtualization technologies), VMware will bring benefits by supporting with relevant technical expertise from R&D facilities in Sofia and at affiliated Corporate locations.

Finally, VMware will support the Technical Specifications and Validation Plans and Reports for the Solution, participating actively to the selected EXEs.

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
--	---

N/A

Does the participant envisage that part of the work is performed by International Partners <sup>30</sup> (Article 14a of the General Model Grant Agreement)?	N
--	---

N/A

<sup>30</sup> 'International Partner' is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

#### 4.2.16 Linked to EUROCONTROL – Company 16

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
<p>EUROCONTROL will subcontract activities that are not within the core business of EUROCONTROL to fulfil their PJ10-W2 commitments. The following tasks are going to be subcontracted:</p> <ul style="list-style-type: none"> <li>• Software development tasks for the necessary adaptations of EUROCONTROL modelling and validation platforms (ESCAPE real time simulator, modelling or fast time simulation platforms)) that will support verification and validation</li> <li>• Specialised expertise support related to validations or processes: it includes for example expertise to prepare, run or report validations</li> <li>• Operational expertise to support validation, workshops or concept definition such as pseudo-pilots, Air Traffic Controllers, Airspace Users</li> </ul> <p>EUROCONTROL, as an international organisation, follows strict rules in terms of external assistance selection and procurement. These rules will be applied for the selection of the subcontracting parties in the framework of PJ10-W2.</p>	
Does the participant envisage that part of its work is performed by linked third parties <sup>31</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>32</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.17 Linked to FRQ (FSP) – Company 17

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N

<sup>31</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>32</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>33</sup>	Y
<p>The linked third party <b>PDTS GmbH</b> will contribute to this action.</p> <p>The PDTS GmbH is integrated into the research and development process of Frequentis AG, hence its contribution is to be seen as a joint activity.</p> <p>PDTS GmbH is an affiliated company of Frequentis AG and develops complex IT-solutions and systems in the fields of chip cards, voice communication and networked data systems. PDTS already contributed for several SESAR1 and S2020 wave1 projects, especially where their high level of competence in relation to VoIP communications was required. For this action PDTS contribution will focus again on its core competence for complex IT and VoIP expertise for both solutions (WP2 &amp; WP3) where Frequentis will contribute.</p> <p>The linked third party PDTS GmbH will contribute to the solution PJ10-93 with software development for the voice communication service for the Frequentis contribution to the validation exercises 1 and 3 in the virtual center context. Hence the contribution is linked to the development tasks.</p> <p>PDTS will also contribute to the solution PJ10-73 with software tasks to update the prototype to the needs of wave 2. Hence the task is linked to the Frequentis development task.</p>	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>34</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.18 Linked to HC (FSP) – Company 18

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	

<sup>33</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>34</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

Does the participant envisage that part of its work is performed by linked third parties <sup>35</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>36</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.19 Linked to INDRA – Company 19

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>37</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>38</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

<sup>35</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>36</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>37</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>38</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

#### 4.2.20 Linked to LDO – Company 20

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
<p>Leonardo plans to subcontract the following activities to support/complement its personnel both on project management (as Leonardo is solution leader in solution 93), validation and software development tasks:</p> <ul style="list-style-type: none"> <li>• Low-level software design &amp; coding, integration or verification tasks</li> <li>• Specialised expertise support related to validations or processes: it includes for example expertise to prepare, run or report validations</li> <li>• Operational expertise to support validation, workshops or concept definition such as pseudo-pilots, Air Traffic Controllers, Airspace Users</li> </ul>	
Does the participant envisage that part of its work is performed by linked third parties <sup>39</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>40</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.21 Linked to SINTEF (NATMIG) – Company 21

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>41</sup>	N

<sup>39</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>40</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>41</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>42</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.22 Linked to NATS – Company 22

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>43</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>44</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.23 Linked to SKYGUIDE – Company 23

Objective
-----------

<sup>42</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>43</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>44</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>45</sup>	Y
Skyguide will entrust platform technical elements for solutions 93 and 96 to SkySoft-ATM, a daughter company of skyguide. SkySoft-ATM provide the CWP/HMI and the servers for our Area Control Centres and also provide the off-line and demonstration/simulation platforms. SkySoft-ATM will ensure the connectivity of the skyguide internal platform for the validation exercises and will provide a flexible CWP/HMI for the Attention Guidance sub-solution of 96.	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>46</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.24 Linked to THALES AIR SYS – Company 24

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
Thales Air Sys (Thales LAS France SAS) has a general policy to outsource a limited proportion of some of its non-critical activities. In accordance with this policy, Thales Air Sys intends to subcontract part of its work in certain non-core activities of this project, typically related to technical specifications, low-level software design & coding, integration or verification tasks. Thales Air Sys is not in a position to name its subcontractors for this project at this stage as, in accordance with the company's subcontracting and procurement policy, the selection of adequate subcontractors will be done in a timely manner through a competitive selection process.	
Does the participant envisage that part of its work is performed by linked third parties <sup>47</sup>	N

<sup>45</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>46</sup> 'International Partner' is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>47</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>48</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.25 Linked to AIRBUS – Company 25

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>49</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>50</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.26 Linked to ATOS (FSP) – Company 26

Objective
-----------

<sup>48</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>49</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>50</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>51</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>52</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

#### 4.2.27 Linked to AIRTEL (NATMIG) – Company27

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>53</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>54</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

<sup>51</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>52</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

<sup>53</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>54</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

#### 4.2.28 Linked to SAAB (NATMIG) – Company 28

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
N/A	
Does the participant envisage that part of its work is performed by linked third parties <sup>55</sup>	N
N/A	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	N
N/A	
Does the participant envisage that part of the work is performed by International Partners <sup>56</sup> (Article 14a of the General Model Grant Agreement)?	N
N/A	

---

<sup>55</sup> A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action. (Article 14 of the Model Grant Agreement).

<sup>56</sup> ‘International Partner’ is any legal entity established in a non-associated third country which is not eligible for funding under Article 10 of the Rules for Participation Regulation No 1290/2013.

## **5 Ethics and Security**

### **5.1 Ethics**

All participants of the PJ10-W2 project will conform to national and European legislation and regulations. In relation to this project these include:

- The Charter of Fundamental Rights of the EU
- General Data Protection Regulation (EU) 2016/679 (GDPR)

During the project, WP5 will ensure compliance with ethics. This means that WP5 will verify that all documents from the PJ10-W2 project are following European ethical rules and the ethical rules of the concerned country.

During project Kick-off Meeting, WP5 will conduct an information session in order to draw attention to, and inform partners of all relevant ethical issues.

In the following sub-section further explanation is given for the self-assessment presented in the Proposal Submission Forms “Ethics issue table”. This is to provide an overview about the potential ethical issues and handling relating to research activities in the PJ10-W2 project.

#### **5.1.1 Humans**

In the project, experimental studies will be conducted to gain knowledge about human-machine interaction. For these experimental studies healthy adults (no vulnerable adults), like Pilots or Air Traffic Controllers, will be recruited on a voluntary basis. Participants of these studies will be clearly informed of the research goals, the methodology of data protection and possible adverse events in a presentation of the research project and in interviews at the beginning of the study. According to the declaration of Helsinki, subjects are free to leave any test at any time without giving any reason and without raising any disadvantages – the project thereby complies with standard protocols surrounding a participant having the right to withdraw from the study. This will be ensured by a written agreement between the experimenter and the test subject (see questionnaire below).

## Participant Agreement Form SESAR 2020 Validation/Demonstration activities

**Full title of project/solution:**

**Full title of validation/demonstration activity and dates:**

**Name and contact details of project/solution leader:**

**Please Initial  
or  
Tick Here**

I am aware of the main aspects of the Validation/Demonstration Plan for the above SESAR 2020 activity.	
I confirm that I have had the opportunity to ask questions.	
I understand that my participation is voluntary.	
I understand that my answers to any questionnaire related to human factors aspects (evaluation of workload, situational awareness, human machine interface usability...) will remain anonymous.	
Should I not wish to answer any particular question(s), I am free to decline.	
I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the outputs that result from the research without my agreement.	
I agree to take part in the above validation/demonstration activity.	

\_\_\_\_\_  
Name of Participant

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Name of Project/Solution Leader

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

*This form should be signed and dated by all parties after the participant receives a copy of the participant information sheet and any other written information provided to the participants. A copy of the signed and dated participant agreement form should be kept with the project's main documents which must be kept in a secure location.*

Section: Humans		YES	NO	Information to be provided	Documents to be provided
<b>Does your research involve human participants?</b>		X		Confirmation about obtained Informed consent of the participants.	
<b>If YES:</b>	Are they volunteers for social or human sciences research?		X	Volunteers will be registered volunteers. Details on recruitment, inclusion and exclusion criteria and informed consent procedures	Examples of “informed consent form” and “information sheets”
	Are they persons unable to give informed consent (including children/minors)?		X		
	Are they vulnerable individuals or groups?		X		
	Are they children/minors?		X		
	Are they patients?		X		
	Are they healthy volunteers for medical studies		X	Note: The project will use healthy volunteers, but in the project no medical studies are foreseen.	
<b>Does your research also involve physical interventions on the study participants?</b>			X		

### 5.1.2 Protection of Personal Data

In advance and during the study personal data will be acquired. This data will be protected regarding article 8 – protection of personal data – of the European Charter of Fundamental Rights and the Treaty on the Functioning of the European Union. Furthermore, a strategy and methodology based on the General Data Protection Directive 2016/679 will be developed and implemented to ensure the integrity and security of data during the project.

During the recruitment of subjects for the study, some necessary personal information relevant to the study (e.g. experience of work, age, gender) will be stored electronically in computers on a hard drive. This data will not be stored in a cloud solution or portable hard drives or USB sticks. This data will be password protected and only accessible to authorised researchers.

During the study only necessary data will be acquired and stored electronically. This data will be password protected and only accessible to authorised researchers. All data will be stored in a strict anonymous way. Subjects are allocated a unique subject number instead of their first- or surname. The subject number will be assigned randomly at the beginning of the study. This procedure ensures that it will not be possible to somehow associate the data to individual persons. Thus, the data will not be used to judge or assess the professional capabilities of the recruited subjects. The data is purely a means to investigate general cognitive processes.

Eye tracking etc. might be used to determine, e.g. the alertness and workload of the research participants.

Section: Protection of Personal Data		YES	NO	Information to be provided	Documents to be provided
<b>Does your research involve personal data collection and/or processing?</b>		X			Free and fully Informed consent sheets (see section 2) of the persons concerned (data subjects) will be obtained
<b>If YES:</b>	Does it involve the collection or processing of sensitive personal data (e.g. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?		X		
	Does it involve processing of genetic information?		X		
	Does it involve tracking or observation of participants (e.g. surveillance or localization data, and WAN data such as IP address, cookies, etc.)?	X			
<b>Does your research involve further processing of previously collected personal data (secondary use) (including use of pre-existing data sets or sources, merging existing data sets, sharing data with non-EU member states)?</b>			X		

### 5.1.3 Misuse

Not applicable to PJ.10-W2.

### 5.1.4 Other Ethics Issues

At this stage of the project proposal there are no other ethics issues that should be taken into consideration. In the case that other ethical issues arise unexpectedly during the project, the project coordinator will contact the Commission immediately and provide detailed information on the issue and how the project team intend to handle it.

Dedicated ethics deliverables will be provided to address the Ethics requirements set up as a result of the Ethics evaluations.

## 5.2 Security<sup>57</sup>

Section: Security	YES	NO	Information to be provided	Documents to be provided
Are activities planned or results expected raising security issues?		X	Tbc	Tbc
Are 'EU-classified information' as background or results foreseen?		X		

## 6 Abbreviations

This list extends the list given in the Call documents.

ABSR	Assistant Based Speech Recognition
ASR	Automatic Speech Recognition
ACC	Area Control Centre
ADSP	ATM Data Service Provider
AG	Attention Guidance
AI	Artificial Intelligence
ANSP	Air Navigation Service Provider
ASR	Automatic Speech Recognition
ATC	Air Traffic Control
ATCA	Air Traffic Control Association
ATCO	Air Traffic Controller
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATS	Air Traffic Service
ATSU	Air Traffic Service Unit
CBA	Cost Benefit Analysis
CCB	Change Control Board
CD&R	Conflict Detection and Resolution
CNS	Communication-Navigation-Surveillance
CoE	Coefficient of Efficiency
CPDLC	Controller Pilot Data Link Communication
CWP	Controller Working Position
DAC	Dynamic Airspace Configuration
DoW	Description of Work
EASA	European Aviation Safety Agency
EC	Executive Controller or European Commission
ECAC	European Civil Aviation Conference
EOCVM	European Operational Concept Validation Methodology
EPMB	Extended Project Management Board
EU	European Union
EXE	Exercise
FAA	Federal Aviation Administration
FAB	Functional Airspace Block
FASTI	First ATC Support Tools Implementation
FCA	Flight Centric ATC

<sup>57</sup> See article 37 of the [Model Grant Agreement](#). For more information on the classification of Information, please refer to the Horizon 2020 guidance: [https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/secur/h2020-hi-guide-classif\\_en.pdf](https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/secur/h2020-hi-guide-classif_en.pdf).

FCEC	Flight Centric ATC Executive Controller
FCPC	Flight Centric ATC Planner Controller
FDP	Flight Data Processing
FIR	Flight Information Region
FL	Flight Level
FTS	Fast-time simulation
H2020	HORIZON 2020 (research and innovation program of the EU, 2014-2020)
HF	Human Factors
HMI	Human Machine Interface
HP	Human Performance
IBP	Industry Based Platform
IFATCA	International Federation of Air Traffic Controllers
IFATSEA	International Federation of Air Traffic Safety Electronics Association
INTEROP	Interoperability Requirements
IR	Industrial Research project
ISA	Instantaneous Self-Assessment
LTP	Linked Third Party
KPA	Key Performance Area
MALORCA	Machine Learning of Speech Recognition Models for Controller Assistance
MET	Meteorology
MSP	Multi Sector Planner
MTCD	Medium Term Based Conflict Detection
NGCV	Generic (non-geographical) Controller Validation
NM	Nautical Mile or Network Manager
OI	Operational Improvement
OLDI	On-Line Data Interchange
OSD	Operational Service and Environment Definition
PCIL	Project Content Integration Lead
PCIT	Project Content Integration Team
PJ00-W2	Project No. 00
PJ00-W2-01	Solution No 01 in PJ00
PM	Project Manager (used as synonym for SGA coordinator [SESAR] as well as for Action Coordinator [H2020; PPP Membership Agreement Appendix E] in this proposal)
PMB	Project Management Board
PMP	Project Management Plan
PPP	Private Public Partnership
R&D	Research and Development
RT	Radio Telephony
RTS	Real-time simulation
SAF	Safety
SDD	Service Definition Document
SE-DMF	System Engineering Data Management Framework
SJU	SESAR Joint Undertaking
SL	Solution Lead
SMA	SESAR2020 Membership Agreement
SGA	Specific Grant Agreement
SPD	Single Programming Document
SPO	Single Person Operations
SPR	Safety Performance Requirements
STCA	Short Term Conflict Alert

STELLAR	SESAR Tool enabling collaborative ATM research
SWIM	System Wide Information Management
TBO	Time Based Operations
TMA	Terminal Manoeuvring Area
TP	Trajectory Prediction
TRL	Technology Readiness Levels
TS/IRS	Interface Requirements Specification
UK	United Kingdom
UPMS	User Profile Management System
Vx	Addressed Maturity Level (V1/ V2/ V3)
VAL	Validation
VALP	Validation-Plan
VALR	Validation-Report
VC	Virtual Centre
VLD	Very Large Demonstration
WAC	World ATM Congress
WP	Work Pack

-end of document-

ESTIMATED BUDGET FOR THE ACTION

	Estimated eligible <sup>1</sup> costs (per budget category)										JU contribution			Additional information		
	A. Direct personnel costs				B. Direct costs of subcontracting	[C. Direct costs of fin. support]	D. Other direct costs		E. Indirect costs <sup>2</sup>	Total costs	Reimbursement rate %	Maximum JU contribution <sup>3</sup>	Maximum grant amount <sup>4</sup>	Information for indirect costs	Information for auditors	Other information:
	A.1 Employees (or equivalent)		A.4 SME owners without salary				D.1 Travel	D.5 Costs of internally invoiced goods and services						Estimated costs of in-kind contributions not used on premises	Declaration of costs under Point D.4	Estimated costs of beneficiaries/ linked third parties not receiving JU funding/ international partners
Form of costs <sup>6</sup>	Actual	Unit <sup>7</sup>	Unit <sup>8</sup>		Actual	Actual	Actual	Unit <sup>9</sup>	Flat-rate <sup>10</sup>							
									25%							
	a	Total b	No hours	Total c	d	[e]	f	Total g	h = 0,25 x (a +b+c+f+g +[i1] <sup>13</sup> + [i2] <sup>13</sup> -n)	j = a+b+c+d +[e]+f+g+h +[i1]+[i2]	k	l	m	n	Yes/No	
1. DFS	2 363 773.00	0.00	0.00	0.00	150 000.00	0.00	152 640.00	0.00	629 103.25	3 295 516.25	70.00	2 306 861.38	1 488 652.79	0.00	No	n/a
2. DLR	431 428.00	0.00	0.00	0.00	0.00	0.00	60 000.00	0.00	122 857.00	614 285.00	70.00	429 999.50	277 485.23	0.00	No	n/a
3. NLR	47 142.86	0.00	0.00	0.00	0.00	0.00	10 000.00	0.00	14 285.72	71 428.58	70.00	50 000.01	32 265.76	0.00	No	n/a
4. ANS CR (B4)	280 400.00	0.00	0.00	0.00	0.00	0.00	22 000.00	0.00	75 600.00	378 000.00	70.00	264 600.00	170 750.41	0.00	No	n/a
- AFT	156 000.00	0.00	0.00	0.00	0.00	0.00	12 000.00	0.00	42 000.00	210 000.00	70.00	147 000.00	94 861.34	0.00	No	n/a
- Integra	219 600.00	0.00	0.00	0.00	0.00	0.00	30 000.00	0.00	62 400.00	312 000.00	70.00	218 400.00	140 936.85	0.00	No	n/a
Total beneficiary	656 000.00	0.00	0.00	0.00	0.00	0.00	64 000.00	0.00	180 000.00	900 000.00		630 000.00	406 548.60	n/a	n/a	0.00
5. LPS SR (B4) <sup>14</sup>	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	290 158.75
6. ON (B4)	139 150.00	0.00	0.00	0.00	0.00	0.00	20 850.00	0.00	40 000.00	200 000.00	70.00	140 000.00	90 344.13	0.00	No	n/a
7. PANSa (B4)	208 816.00	0.00	0.00	0.00	0.00	0.00	30 840.00	0.00	59 914.00	299 570.00	70.00	209 699.00	135 321.96	0.00	No	n/a
8. ACG/ COOPANS	109 440.00	0.00	0.00	0.00	30 093.00	0.00	22 485.00	0.00	32 981.25	194 999.25	70.00	136 499.48	88 085.19	0.00	No	n/a
9. CCL/COOPANS	49 800.00	0.00	0.00	0.00	0.00	0.00	30 200.00	0.00	20 000.00	100 000.00	70.00	70 000.00	45 172.07	0.00	No	n/a
10. IAA/ COOPANS	14 164.00	0.00	0.00	0.00	0.00	0.00	4 838.00	0.00	4 750.50	23 752.50	70.00	16 626.75	10 729.50	0.00	No	n/a
11. LFV/ COOPANS	145 600.00	0.00	0.00	0.00	0.00	0.00	54 818.00	0.00	50 104.50	250 522.50	70.00	175 365.75	113 166.19	0.00	No	n/a
12. Naviair/ COOPANS	133 285.00	0.00	0.00	0.00	0.00	0.00	26 715.00	0.00	40 000.00	200 000.00	70.00	140 000.00	90 344.13	0.00	No	n/a
13. DSNA	216 000.00	0.00	0.00	0.00	100 000.00	0.00	0.00	0.00	54 000.00	370 000.00	70.00	259 000.00	167 136.64	0.00	No	n/a
14. ENAIRE	769 497.20	0.00	0.00	0.00	43 680.00	0.00	36 400.00	0.00	201 474.30	1 051 051.50	70.00	735 736.05	474 781.68	0.00	No	n/a
- INECO	131 250.00	0.00	0.00	0.00	0.00	0.00	8 000.00	0.00	34 812.50	174 062.50	70.00	121 843.75	78 627.63	0.00	No	n/a
- CRIDA	780 000.00	0.00	0.00	0.00	0.00	0.00	84 000.00	0.00	216 000.00	1 080 000.00	70.00	756 000.00	487 858.31	0.00	No	n/a
Total beneficiary	1 680 747.20	0.00			43 680.00	0.00	128 400.00	0.00	452 286.80	2 305 114.00		1 613 579.80	1 041 267.62	n/a	n/a	0.00
15. ENAV	252 000.00	0.00	0.00	0.00	0.00	0.00	28 000.00	0.00	70 000.00	350 000.00	70.00	245 000.00	158 102.23	0.00	No	n/a
- TECHNO SKY	180 000.00	0.00	0.00	0.00	0.00	0.00	20 000.00	0.00	50 000.00	250 000.00	70.00	175 000.00	112 930.17	0.00	No	n/a
- NAIS	72 000.00	0.00	0.00	0.00	0.00	0.00	8 000.00	0.00	20 000.00	100 000.00	70.00	70 000.00	45 172.07	0.00	No	n/a
- BIP	108 000.00	0.00	0.00	0.00	0.00	0.00	12 000.00	0.00	30 000.00	150 000.00	70.00	105 000.00	67 758.10	0.00	No	n/a
- VMware	72 000.00	0.00	0.00	0.00	0.00	0.00	8 000.00	0.00	20 000.00	100 000.00	70.00	70 000.00	45 172.07	0.00	No	n/a
Total beneficiary	684 000.00	0.00	0.00	0.00	0.00	0.00	76 000.00	0.00	190 000.00	950 000.00		665 000.00	429 134.64	n/a	n/a	0.00
16. EUROCONTROL <sup>14</sup>	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	8 438 441.25
17. FRQ (FSP)	199 489.20	0.00	0.00	0.00	0.00	0.00	66 440.00	0.00	66 482.30	332 411.50	70.00	232 688.05	150 157.14	0.00	No	n/a
- PDTS	143 192.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35 798.20	178 991.00	70.00	125 293.70	80 853.93	0.00	No	n/a
Total beneficiary	342 682.00	0.00			0.00	0.00	66 440.00	0.00	102 280.50	511 402.50		357 981.75	231 011.07	n/a	n/a	0.00

ESTIMATED BUDGET FOR THE ACTION

	Estimated eligible <sup>1</sup> costs (per budget category)									JU contribution			Additional information			
	A. Direct personnel costs			B. Direct costs of subcontracting	<i>[C. Direct costs of fin. support]</i>	D. Other direct costs		E. Indirect costs <sup>2</sup>	Total costs	Reimbursement rate %	Maximum JU contribution <sup>3</sup>	Maximum grant amount <sup>4</sup>	Information for indirect costs	Information for auditors	Other information:	
	A.1 Employees (or equivalent)		A.4 SME owners without salary				D.1 Travel	D.5 Costs of internally invoiced goods and services					Estimated costs of in-kind contributions not used on premises	Declaration of costs under Point D.4	Estimated costs of beneficiaries/ linked third parties not receiving JU funding/ international partners	
A.2 Natural persons under direct contract		A.5 Beneficiaries that are natural persons without salary		D.2 Equipment												
A.3 Seconded persons				D.3 Other goods and services												
	<i>[A.6 Personnel for providing access to research infrastructure]</i>						<i>[D.4 Costs of large research infrastructure]</i>									
Form of costs <sup>6</sup>	Actual	Unit <sup>7</sup>	Unit <sup>8</sup>		Actual	Actual	Actual	Unit <sup>9</sup>	Flat-rate <sup>10</sup>							
									25%							
	a	Total b	No hours	Total c	d	<i>[e]</i>	f	Total g	$h = 0,25 \times (a + b + c + f + g + [i1]^{13} + [i2]^{13} - n)$	$j = a + b + c + d + [e] + f + g + h + [i1] + [i2]$	k	l	m	n	Yes/No	
18. HC (FSP)	456 676.00	0.00	0.00	0.00	0.00	0.00	123 700.00	0.00	145 094.00	725 470.00	70.00	507 829.00	327 709.79	0.00	No	n/a
19. INDRA	2 842 234.00	0.00	0.00	0.00	0.00	0.00	149 591.00	0.00	747 956.25	3 739 781.25	70.00	2 617 846.88	1 689 336.46	0.00	No	n/a
20. LDO	2 378 746.00	0.00	0.00	0.00	140 000.00	0.00	355 821.00	0.00	683 641.75	3 558 208.75	70.00	2 490 746.13	1 607 316.41	0.00	No	n/a
21. SINTEF (NATMIG)	0.00	149 516.57	0.00	0.00	0.00	0.00	14 000.00	0.00	40 879.14	204 395.71	70.00	143 077.00	92 329.77	0.00	No	n/a
22. NATS	1 385 860.00	0.00	0.00	0.00	0.00	0.00	94 140.00	0.00	370 000.00	1 850 000.00	70.00	1 295 000.00	835 683.22	0.00	No	n/a
23. SKYGUIDE	700 042.00	0.00	0.00	0.00	0.00	0.00	100 006.00	0.00	200 012.00	1 000 060.00	70.00	700 042.00	451 747.76	0.00	No	n/a
- SKYSOFT	700 042.00	0.00	0.00	0.00	0.00	0.00	100 006.00	0.00	200 012.00	1 000 060.00	70.00	700 042.00	451 747.76	0.00	No	n/a
Total beneficiary	1 400 084.00	0.00			0.00	0.00	200 012.00	0.00	400 024.00	2 000 120.00		1 400 084.00	903 495.52	n/a	n/a	0.00
24. THALES AIR SYS	4 402 541.00	0.00	0.00	0.00	566 040.00	0.00	176 101.00	0.00	1 144 660.50	6 289 342.50	70.00	4 402 539.75	2 841 025.96	0.00	No	n/a
25. AIRBUS SAS <sup>14</sup>	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
26. ATOS (FSP) <sup>14</sup>	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
27. AIRTEL (NATMIG) <sup>14</sup>	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
28. SAAB (NATMIG) <sup>14</sup>	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.00
Total consortium	20 088 169.06	149 516.57		0.00	1 029 813.00	0.00	1 861 591.00	0.00	5 524 819.16	28 653 908.79		20 057 736.18	12 943 562.65			8 728 600.00

<sup>1</sup> See Article 6 for the eligibility conditions.

<sup>2</sup> Indirect costs already covered by an operating grant (received under any EU or Euratom funding programme; see Article 6.5.(b)) are ineligible under the GA. Therefore, a beneficiary/linked third party that receives an operating grant during the action's duration cannot declare indirect costs for the year(s)/reporting period(s) covered by the operating grant, unless it can demonstrate that the operating grant does not cover any costs of the action (see Article 6.2.E).

<sup>3</sup> This is the theoretical amount of JU contribution that the system calculates automatically (by multiplying all the budgeted costs by the reimbursement rate). This theoretical amount is capped by the 'maximum grant amount' (that the JU decided to grant for the action) (see Article 5.1).

<sup>4</sup> The 'maximum grant amount' is the maximum grant amount decided by the JU. It normally corresponds to the requested grant, but may be lower.

<sup>5</sup> Depending on its type, this specific cost category will or will not cover indirect costs. Specific unit costs that include indirect costs are: costs for energy efficiency measures in buildings, access costs for providing trans-national access to research infrastructure and costs for clinical studies.

<sup>6</sup> See Article 5 for the forms of costs.

<sup>7</sup> Unit : hours worked on the action; costs per unit (hourly rate) : calculated according to the beneficiary's usual accounting practice.

<sup>8</sup> See Annex 2a 'Additional information on the estimated budget' for the details (costs per hour (hourly rate)).

<sup>9</sup> Unit and costs per unit : calculated according to the beneficiary's usual accounting practices.

<sup>10</sup> Flat rate : 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs (see Article 6.2.E).

<sup>11</sup> See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit).

<sup>12</sup> See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit, estimated number of units, etc).

<sup>13</sup> Only specific unit costs that do not include indirect costs.

<sup>14</sup> See Article 9 for beneficiaries not receiving JU funding.

<sup>15</sup> Only for linked third parties that receive JU funding.

## ANNEX 2a

### ADDITIONAL INFORMATION ON THE ESTIMATED BUDGET

- Instructions and footnotes in blue will not appear in the text generated by the IT system (since they are internal instructions only).
- For options [in square brackets]: the applicable option will be chosen by the IT system. Options not chosen will automatically not appear.
- For fields in [grey in square brackets] (even if they are part of an option as specified in the previous item): IT system will enter the appropriate data.

**⚠ Transitory period:** Until SyGMA fully supports Annex 2a, you must prepare it manually (using this template by choosing and deleting the options/entering the appropriate data).  
For the 'unit cost tables': either fill them out manually or use currently existing tables from Annex 1 or the proposal.  
The document can then be uploaded in SyGMA and attached to the grant agreement.

#### Unit cost for SME owners/natural beneficiaries without salary

##### **1. Costs for a [SME owner//beneficiary that is a natural person] not receiving a salary**

Units: hours worked on the action

Amount per unit ('hourly rate'): calculated according to the following formula:

{the monthly living allowance for researchers in MSCA-IF actions / 143 hours}  
multiplied by  
{country-specific correction coefficient of the country where the beneficiary is established}

The monthly living allowance and the country-specific correction coefficients are set out in the Work Programme (section 3 MSCA) in force at the time of the call:

- for calls *before* Work Programme 2018-2020:
  - for the monthly living allowance: **EUR 4 650**
  - for the country-specific correction coefficients: see Work Programme 2014-2015 and Work Programme 2016-2017 (available on the [Participant Portal Reference Documents](#) page)
- for calls *under* Work Programme 2018-2020:
  - for the monthly living allowance: **EUR 4 880**
  - for the country-specific correction coefficients: see Work Programme 2018-2020 (available on the [Participant Portal Reference Documents](#) page)

**[additional OPTION for beneficiaries/linked third parties that have opted to use the unit cost (in the proposal/with an amendment):** For the following beneficiaries/linked third parties, the amounts per unit (hourly rate) are fixed as follows:

- beneficiary/linked third party [short name]: EUR [insert amount]
  - beneficiary/linked third party [short name]: EUR [insert amount]
- [same for other beneficiaries/linked third parties, if necessary] ]

Estimated number of units: see Annex 2

## **Energy efficiency measures unit cost**

### **2. Costs for energy efficiency measures in buildings**

Unit: m<sup>2</sup> of eligible ‘conditioned’ (i.e. built or refurbished) floor area

Amount per unit\*: see (for each beneficiary/linked third party and BEST table) the ‘unit cost table’ attached

\* Amount calculated as follows:  
{EUR 0.1 x estimated total kWh saved per m<sup>2</sup> per year x 10}

Estimated number of units: see (for each beneficiary/linked third party and BEST table) the ‘unit cost table’ attached

Unit cost table (energy efficiency measures unit cost)<sup>1</sup>

Short name beneficiary/linked third party	BEST No	Amount per unit	Estimated No of units	Total unit cost (cost per unit x estimated no of units)

---

<sup>1</sup> Data from the ‘building energy specification table (BEST)’ that is part of the proposal and Annex 1.

## **Research infrastructure unit cost**

### **3. Access costs for providing trans-national access to research infrastructure**

Units<sup>2</sup>: see (for each access provider and installation) the ‘unit cost table’ attached

Amount per unit<sup>\*</sup>: see (for each access provider and installation) the ‘unit cost table’ attached

\* Amount calculated as follows:

$$\frac{\text{average annual total access cost to the installation (over past two years}^3\text{)}}{\text{average annual total quantity of access to the installation (over past two years}^4\text{)}}$$

Estimated number of units: see (for each access provider and installation) the ‘unit cost table’ attached

Unit cost table (access to research infrastructure unit cost)<sup>5</sup>

Short name access provider	Short name infrastru cture	Installation		Unit of access	Amount per unit	Estimated No of units	Total unit cost (cost per unit x estimated no of units)
		No	Short name				

## **Clinical studies unit cost**

### **4. Costs for clinical studies**

Units: patients/subjects that participate in the clinical study

Amount per unit<sup>\*</sup>: see (for each sequence (if any), clinical study and beneficiary/linked third party) the ‘unit cost table’ attached

\* Amount calculated, for the cost components of each task, as follows:

For **personnel costs**:

For personnel costs of doctors: ‘average hourly cost for doctors’, i.e.:

{certified or auditable total personnel costs for doctors for year N-1

{ 1720 \* number of full-time-equivalent for doctors for year N-1 }

multiplied by

estimated number of hours to be worked by doctors for the task (per participant)}

For personnel costs of other medical personnel: ‘average hourly cost for other medical personnel’, i.e.:

{certified or auditable total personnel costs for other medical personnel for year N-1

{ 1720 \* number of full-time-equivalent for other medical personnel for year N-1 }

<sup>2</sup> Unit of access (e.g. beam hours, weeks of access, sample analysis) fixed by the access provider in proposal.

<sup>3</sup> In exceptional and duly justified cases, the Commission/Agency may agree to a different reference period.

<sup>4</sup> In exceptional and duly justified cases, the Commission/Agency may agree to a different reference period.

<sup>5</sup> Data from the ‘table on estimated costs/quantity of access to be provided’ that is part of the proposal and Annex 1.

**H2020 Templates: Annex 2a (Additional information on the estimated budget)**

multiplied by  
estimated number of hours to be worked by other medical personnel for the task (per participant)}

For personnel costs of technical personnel: 'average hourly cost for technical personnel', i.e.:

$$\frac{\{\text{certified or auditable total personnel costs for technical personnel for year N-1}\}}{\{1720 * \text{number of full-time-equivalent for technical personnel for year N-1}\}}$$

multiplied by  
estimated number of hours to be worked by technical personnel for the task (per participant)}

'total personnel costs' means actual salaries + actual social security contributions + actual taxes and other costs included in the remuneration, provided they arise from national law or the employment contract/equivalent appointing act

For **consumables**:

For each cost item: 'average price of the consumable', i.e.:

$$\frac{\{\{\text{certified or auditable total costs of purchase of the consumable in year N-1}\}}{\text{total number of items purchased in year N-1}\}}$$

multiplied by  
estimated number of items to be used for the task (per participant)}

'total costs of purchase of the consumable' means total value of the supply contracts (including related duties, taxes and charges such as non-deductible VAT) concluded by the beneficiary for the consumable delivered in year N-1, provided the contracts were awarded according to the principle of best value- for-money and without any conflict of interests

For **medical equipment**:

For each cost item: 'average cost of depreciation and directly related services per unit of use', i.e.:

$$\frac{\{\{\text{certified or auditable total depreciation costs in year N-1} + \text{certified or auditable total costs of purchase of services in year N-1 for the category of equipment concerned}\}}{\text{total capacity in year N-1}}$$

multiplied by  
estimated number of units of use of the equipment for the task (per participant)}

'total depreciation costs' means total depreciation allowances as recorded in the beneficiary's accounts of year N-1 for the category of equipment concerned, provided the equipment was purchased according to the principle of best value for money and without any conflict of interests + total costs of renting or leasing contracts (including related duties, taxes and charges such as non-deductible VAT) in year N-1 for the category of equipment concerned, provided they do not exceed the depreciation costs of similar equipment and do not include finance fees

For **services**:

For each cost item: 'average cost of the service per study participant', i.e.:

$$\frac{\{\text{certified or auditable total costs of purchase of the service in year N-1}\}}{\text{total number of patients or subjects included in the clinical studies for which the service was delivered in year N-1}\}}$$

'total costs of purchase of the service' means total value of the contracts concluded by the beneficiary (including related duties, taxes and charges such as non-deductible VAT) for the specific service delivered in year N-1 for the conduct of clinical studies, provided the contracts were awarded according to the principle of best value for money and without any conflict of interests

For **indirect costs**:

$$\{\{\{\text{cost component 'personnel costs'} + \text{cost component 'consumables'} + \text{cost component 'medical equipment'}\}\}$$

minus

$$\{\{\text{costs of in-kind contributions provided by third parties which are not used on the beneficiary's premises} + \text{costs of providing financial support to third parties (if any)}\}\}$$

multiplied by

$$25\% \}$$

**H2020 Templates: Annex 2a (Additional information on the estimated budget)**

The estimation of the resources to be used must be done on the basis of the study protocol and must be the same for all beneficiaries/linked third parties/third parties involved.

The year N-1 to be used is the last closed financial year at the time of submission of the grant application.

Estimated number of units: see (for each clinical study and beneficiary/linked third party) the 'unit cost table' attached

Unit cost table: clinical studies unit cost<sup>6</sup>

Task, Direct cost categories	Resource per patient	Costs year N-1 Beneficiary 1 [short name]	Costs year N-1 Linked third party 1a [short name]	Costs year N-1 Beneficiary 2 [short name]	Costs year N-1 Linked third party 2a [short name]	Costs year N-1 Third party giving in-kind contributions 1 [short name]
<b>Sequence No. 1</b>						
<b>Task No. 1</b> Blood sample						
(a) <b>Personnel costs:</b> - Doctors	n/a					
- Other Medical Personnel	Phlebotomy (nurse), 10 minutes	8,33 EUR	11,59 EUR	10,30 EUR	11,00 EUR	9,49 EUR
- Technical Personnel	Sample Processing (lab technician), 15 minutes	9,51 EUR	15,68 EUR	14,60 EUR	15,23 EUR	10,78 EUR
(b) <b>Costs of consumables:</b>	Syringe	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
	Cannula	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
	Blood container	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(c) <b>Costs of medical equipment:</b>	Use of -80° deep freezer, 60 days	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
	Use of centrifuge, 15 minutes	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(d) <b>Costs of services</b>	Cleaning of XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(e) <b>Indirect costs (25% flat-rate)</b>		XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
<b>Task No. 2</b>						
...						
<b>Amount per unit (unit cost sequence 1):</b>		XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
<b>Sequence No. 2</b>						
<b>Task No. 1</b>						

<sup>6</sup> Same table as in proposal and Annex 1.

## H2020 Templates: Annex 2a (Additional information on the estimated budget)

XXX						
(a) <b>Personnel costs:</b>						
- Doctors	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
- Other Medical Personnel	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
- Technical Personnel	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(b) <b>Costs of consumables:</b>	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(c) <b>Costs of medical equipment:</b>	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(d) <b>Costs of services</b>	XXX	XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
(e) <b>Indirect costs</b> (25% flat-rate)		XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
<b>Task No. 2</b>						
...						
<b>Amount per unit (unit cost sequence 2):</b>		XX EUR	XX EUR	XX EUR	XX EUR	XX EUR
...						
<b>Amount per unit (unit cost entire study):</b>		XX EUR	XX EUR	XX EUR	XX EUR	XX EUR

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV (DLR)**, established in Linder Hoehe, KOELN 51147, Germany, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('2')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**STICHTING NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM (NLR)**, established in Anthony Fokkerweg 2, AMSTERDAM 1059CM, Netherlands, VAT number: NL002760551B01, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary No ('3')**

**in Grant Agreement No 874464 ('the Agreement')**

**between DFS DEUTSCHE FLUGSICHERUNG GMBH and the Single European Sky ATM Research Joint Undertaking ('the JU'),**

**for the action entitled 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.**

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK (ANS CR (B4))**, established in JENEC NAVIGACNI 787, JENEC 252 61, Czechia, VAT number: CZ699004742, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('4')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**LETOVE PREVADZKOVE SLUZBY SLOVENSKEJ REPUBLIKY, STATNY PODNIK (LPS SR (B4))**, established in IVANSKA CESTA 93, BRATISLAVA 823 07, Slovakia, VAT number: SK2020244699, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary No ('5')**

**in Grant Agreement No 874464 ('the Agreement')**

**between DFS DEUTSCHE FLUGSICHERUNG GMBH and the Single European Sky ATM Research Joint Undertaking ('the JU'),**

**for the action entitled 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.**

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**VALSTYBES IMONE ORO NAVIGACIJA (ON (B4))**, established in RODUNIOS KEL 2, VILNIAUS 02188, Lithuania, VAT number: LT100604610, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('6')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**POLSKA AGENCJA ZEGLUGI POWIETRZNEJ (PANSa (B4))**, established in UL. WIEZOWA 8, WARSZAWA 02 147, Poland, VAT number: PL5222838321, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('7')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**AUSTRO CONTROL OSTERREICHISCHE GESELLSCHAFT FUR ZIVILLUFTFAHRT MBH (ACG/COOPANS)**, established in WAGRAMER STRASSE 19, WIEN 1220, Austria, VAT number: ATU37259408, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('8')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**CROATIA CONTROL, CROATIAN AIR NAVIGATION SERVICES LTD (CCL/COOPANS)**, established in RUDOLFA FIZIRA 2, VELIKA GORICA 10410, Croatia, VAT number: HR33052761319, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary No ('9')**

**in Grant Agreement No 874464 ('the Agreement')**

**between DFS DEUTSCHE FLUGSICHERUNG GMBH and the Single European Sky ATM Research Joint Undertaking ('the JU'),**

**for the action entitled 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.**

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY (IAA/ COOPANS)**, established in D'OLIER STREET 11-12 THE TIMES BUILDING, DUBLIN D02 T449, Ireland, VAT number: IE8211082B, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('10')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**LUFTFARTSVERKET (LFV/COOPANS)**, established in **HOSPITALSGATAN 30, NORRKOPING 602 27, Sweden**, VAT number: SE202100079501, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary No ('11')**

**in Grant Agreement No 874464 ('the Agreement')**

**between DFS DEUTSCHE FLUGSICHERUNG GMBH and the Single European Sky ATM Research Joint Undertaking ('the JU'),**

**for the action entitled 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.**

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**NAVIAIR (Naviair/COOPANS)**, established in NAVIAIR ALLE 1, KASTRUP 2770, Denmark, VAT number: DK26059763, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('12')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**DIRECTION DES SERVICES DE LA NAVIGATION AERIENNE (DSNA)**, established in 50 RUE HENRY FARMAN, PARIS 75720, France, VAT number: FR29120064019, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('13')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**ENAIRE (ENAIRE)**, established in AVENIDA DE ARAGON S/N BLOQUE 330, PORTAL 2 PARQUE EMPRESARIAL LAS MERCEDES, MADRID 28022, Spain, VAT number: ESQ2822001J, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('14')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**ENAV SPA (ENAV)**, established in VIA SALARIA 716, ROMA 00138, Italy, VAT number: IT02152021008, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('15')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION (EUROCONTROL)**, established in Rue de la Fusée 96, BRUXELLES 1130, Belgium, VAT number: not applicable, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('16')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**FREQUENTIS AG (FRQ (FSP))**, established in Innovationsstrasse 1, WIEN 1100, Austria, VAT number: ATU14715600, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('17')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**HUNGAROCONTROL MAGYAR LEGIFORGALMISZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG (HC (FSP))**, established in IGLO UTCA 33 35, BUDAPEST 1185, Hungary, VAT number: HU13851325, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('18')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**INDRA SISTEMAS SA (INDRA)**, established in AVENIDA DE BRUSELAS 35, ALCOBENDAS MADRID 28108, Spain, VAT number: ESA28599033, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('19')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**LEONARDO - SOCIETA PER AZIONI (LDO)**, established in PIAZZA MONTE GRAPPA 4, ROMA 00195, Italy, VAT number: IT00881841001, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('20')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**SINTEF AS (SINTEF (NATMIG))**, established in STRINDVEGEN 4, TRONDHEIM 7034, Norway, VAT number: NO919303808MVA, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('21')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**NATS (EN ROUTE) PUBLIC LIMITED COMPANY (NATS)**, established in 4000 PARKWAY WHITELEY, FAREHAM PO15 7FL, United Kingdom, VAT number: GB440379456, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('22')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIENNE CIVILS ET MILITAIRES (SKYGUIDE)**, established in ROUTE DE PRE BOIS 15-17, GENEVA 1215, Switzerland, VAT number: CH514204, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('23')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**THALES LAS FRANCE SAS (THALES AIR SYS)**, established in AVENUE GAY LUSSAC 2, ELANCOURT 78990, France, VAT number: FR15319159877, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('24')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**AIRBUS (AIRBUS SAS)**, established in 2 ROND POINT EMILE DEWOITINE, BLAGNAC 31700, France, VAT number: FR89383474814, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('25')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**ATOS BELGIUM (ATOS (FSP))**, established in DA VINCILAAN 5, ZAVENTEM 1930, Belgium, VAT number: BE0401848135, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('26')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**AIRTEL ATN LIMITED (AIRTEL (NATMIG))**, established in 2 HARBOUR SQUARE CROFTON ROAD, DUN LOAGHAIRE DUBLIN A96D6R0, Ireland, VAT number: IE8287698U, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('27')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

## ANNEX 3

### ACCESSION FORM FOR BENEFICIARIES

**SAAB AKTIEBOLAG (SAAB (NATMIG))**, established in ., LINKOPING 581 88, Sweden, VAT number: SE556036079301, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

**hereby agrees**

**to become beneficiary** No ('28')

**in Grant Agreement No** 874464 ('the Agreement')

**between** DFS DEUTSCHE FLUGSICHERUNG GMBH **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

**for the action entitled** 'Separation Management and Controller Tools (PJ10-W2 PROSA)'.

**and mandates**

**the coordinator** to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

**ANNEX 3a**

**DECLARATION ON JOINT AND SEVERAL LIABILITY OF  
LINKED THIRD PARTIES**

**AGENTFLY TECHNOLOGIES SRO (AFT)**, established in KARLOVO NAMESTI 290/16, NOVE MESTO PRAHA 120 00, Czechia, VAT number: CZ24727679, ('the linked third party'), represented for the purpose of signing this Declaration on joint and several liability by its legal representative(s) [forename and surname, function of the legal representative(s) of the linked third party],

linked to beneficiary No 4 **RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK (ANS CR (B4))**, established in JENEC NAVIGACNI 787, JENEC 252 61, Czechia, VAT number: CZ699004742, ('the beneficiary'),

**hereby accepts joint and several liability with the beneficiary**

for any amount owed to the JU by the beneficiary under Grant Agreement No 874464 (PJ10-W2 PROSA), up to the maximum JU contribution indicated, for the linked third party, in the estimated budget (see Annex 2).

The linked third party irrevocably and unconditionally agrees to pay amounts requested under this Declaration to the JU, immediately and at first demand.

For the linked third party  
[forename/surname/function]

Done in English at [place], on [date]

**DECLARATION ON JOINT AND SEVERAL LIABILITY OF  
LINKED THIRD PARTIES**

**INTEGRA CONSULT AS (Integra)**, established in TRORODVEJ 63B, VEDBAEK 2950, Denmark, VAT number: DK12622678, ('the linked third party'), represented for the purpose of signing this Declaration on joint and several liability by its legal representative(s) [forename and surname, function of the legal representative(s) of the linked third party],

linked to beneficiary No 4 **RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK (ANS CR (B4))**, established in JENEC NAVIGACNI 787, JENEC 252 61, Czechia, VAT number: CZ699004742, ('the beneficiary'),

**hereby accepts joint and several liability with the beneficiary**

for any amount owed to the JU by the beneficiary under Grant Agreement No 874464 (PJ10-W2 PROSA), up to the maximum JU contribution indicated, for the linked third party, in the estimated budget (see Annex 2).

The linked third party irrevocably and unconditionally agrees to pay amounts requested under this Declaration to the JU, immediately and at first demand.

For the linked third party  
[forename/surname/function]

Done in English at [place], on [date]

**DECLARATION ON JOINT AND SEVERAL LIABILITY OF  
LINKED THIRD PARTIES**

**CENTRO DE REFERENCIA INVESTIGACION DESARROLLO E INNOVACION ATM, A.I.E. (CRIDA)**, established in AVDA DE ARAGON 402 4 EDIFICIO ALLENDE, MADRID 28022, Spain, VAT number: ESV85383578, ('the linked third party'), represented for the purpose of signing this Declaration on joint and several liability by its legal representative(s) [forename and surname, function of the legal representative(s) of the linked third party],

linked to beneficiary No 14 **ENAIRE (ENAIRE)**, established in AVENIDA DE ARAGON S/N BLOQUE 330, PORTAL 2 PARQUE EMPRESARIAL LAS MERCEDES, MADRID 28022, Spain, VAT number: ESQ2822001J, ('the beneficiary'),

**hereby accepts joint and several liability with the beneficiary**

for any amount owed to the JU by the beneficiary under Grant Agreement No 874464 (PJ10-W2 PROSA), up to the maximum JU contribution indicated, for the linked third party, in the estimated budget (see Annex 2).

The linked third party irrevocably and unconditionally agrees to pay amounts requested under this Declaration to the JU, immediately and at first demand.

For the linked third party  
[forename/surname/function]

Done in English at [place], on [date]

**DECLARATION ON JOINT AND SEVERAL LIABILITY OF  
LINKED THIRD PARTIES**

**TECHNO SKY S.R.L. (TECHNO SKY)**, established in VIA DEL CASALE CAVALLARI 200, ROMA 00156, Italy, VAT number: IT08428031002, ('the linked third party'), represented for the purpose of signing this Declaration on joint and several liability by its legal representative(s) [forename and surname, function of the legal representative(s) of the linked third party],

linked to beneficiary No 15 **ENAV SPA (ENAV)**, established in VIA SALARIA 716, ROMA 00138, Italy, VAT number: IT02152021008, ('the beneficiary'),

**hereby accepts joint and several liability with the beneficiary**

for any amount owed to the JU by the beneficiary under Grant Agreement No 874464 (PJ10-W2 PROSA), up to the maximum JU contribution indicated, for the linked third party, in the estimated budget (see Annex 2).

The linked third party irrevocably and unconditionally agrees to pay amounts requested under this Declaration to the JU, immediately and at first demand.

For the linked third party  
[forename/surname/function]

Done in English at [place], on [date]

**ANNEX 3a**

**DECLARATION ON JOINT AND SEVERAL LIABILITY OF  
LINKED THIRD PARTIES**

**PDTS GMBH (PDTS)**, established in MOERINGGASSE 20, WIEN 1150, Austria, VAT number: ATU15125308, ('the linked third party'), represented for the purpose of signing this Declaration on joint and several liability by its legal representative(s) [forename and surname, function of the legal representative(s) of the linked third party],

linked to beneficiary No 17 **FREQUENTIS AG (FRQ (FSP))**, established in Innovationsstrasse 1, WIEN 1100, Austria, VAT number: ATU14715600, ('the beneficiary'),

**hereby accepts joint and several liability with the beneficiary**

for any amount owed to the JU by the beneficiary under Grant Agreement No 874464 (PJ10-W2 PROSA), up to the maximum JU contribution indicated, for the linked third party, in the estimated budget (see Annex 2).

The linked third party irrevocably and unconditionally agrees to pay amounts requested under this Declaration to the JU, immediately and at first demand.

For the linked third party  
[forename/surname/function]

Done in English at [place], on [date]

**DECLARATION ON JOINT AND SEVERAL LIABILITY OF  
LINKED THIRD PARTIES**

**SKYSOFT-ATM SA (SKYSOFT)**, established in ROUTE DE PRE BOIS 15-17, GENEVE 1215, Switzerland, VAT number: CHE116313149TVA, ('the linked third party'), represented for the purpose of signing this Declaration on joint and several liability by its legal representative(s) [forename and surname, function of the legal representative(s) of the linked third party],

linked to beneficiary No 23 **SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIENNE CIVILS ET MILITAIRES (SKYGUIDE)**, established in ROUTE DE PRE BOIS 15-17, GENEVA 1215, Switzerland, VAT number: CH514204, ('the beneficiary'),

**hereby accepts joint and several liability with the beneficiary**

for any amount owed to the JU by the beneficiary under Grant Agreement No 874464 (PJ10-W2 PROSA), up to the maximum JU contribution indicated, for the linked third party, in the estimated budget (see Annex 2).

The linked third party irrevocably and unconditionally agrees to pay amounts requested under this Declaration to the JU, immediately and at first demand.

For the linked third party  
[forename/surname/function]

Done in English at [place], on [date]

FINANCIAL STATEMENT FOR *[BENEFICIARY [name]/ LINKED THIRD PARTY [name]]* FOR REPORTING PERIOD *[reporting period]*

	Eligible <sup>1</sup> costs (per budget category)													Receipts	EU contribution			Additional information	
	A. Direct personnel costs			B. Direct costs of subcontracting	[C. Direct costs of fin. support]	D. Other direct costs			E. Indirect costs <sup>2</sup>	[F. Costs of ... ]		Total costs	Receipts	Reimburse ment rate %	Maximum EU contribution <sup>3</sup>	Requested EU contribution	Information for indirect costs :		
	A.1 Employees (or equivalent)	A.2 Natural persons under direct contract	A.3 Seconded persons	A.4 SME owners without salary	A.5 Beneficiaries that are natural persons without salary	[C.1 Financial support]	[C.2 Prizes]	D.1 Travel	[D.4 Costs of large research infrastructure]	D.5 Costs of internally invoiced goods and services	[F.1 Costs of ...]	[F.2 Costs of ...]		Receipts of the action, to be reported in the last reporting period, according to Article 5.3.3				Costs of in-kind contributions not used on premises	
[A.6 Personnel for providing access to research infrastructure]							D.2 Equipment	D.3 Other goods and services											
Form of costs <sup>4</sup>	Actual	Unit	Unit		Actual	Actual	Actual	Actual	Unit	Flat-rate <sup>5</sup>		Unit	[Unit][Lump sum]						
										25%									
	a	Total b	No hours	Total c	d	[e]	f	[g]	Total h	i=0,25 x (a+b+c+f+[g] + h+ [j 1] <sup>6</sup> +[j2] <sup>6</sup> -p)	No units	Total [j1]	Total [j2]	k = a+b+c+d+[e] +f+ [g] +h+ i + [j1] +[j2]	l	m	n	o	p
[short name beneficiary/linked third party]																			

**The beneficiary/linked third party hereby confirms that:**  
The information provided is complete, reliable and true.  
The costs declared are eligible (see Article 6).  
The costs can be substantiated by adequate records and supporting documentation that will be produced upon request or in the context of checks, reviews, audits and investigations (see Articles 17, 18 and 22).  
For the last reporting period: that all the receipts have been declared (see Article 5.3.3).

📌 Please declare all eligible costs, even if they exceed the amounts indicated in the estimated budget (see Annex 2). Only amounts that were declared in your individual financial statements can be taken into account lateron, in order to replace other costs that are found to be ineligible.

<sup>1</sup> See Article 6 for the eligibility conditions

<sup>2</sup> The indirect costs claimed must be free of any amounts covered by an operating grant (received under any EU or Euratom funding programme; see Article 6.2.E). If you have received an operating grant during this reporting period, you cannot claim indirect costs unless you can demonstrate that the operating grant does not cover any costs of the action.

<sup>3</sup> This is the *theoretical* amount of EU contribution that the system calculates automatically (by multiplying the reimbursement rate by the total costs declared). The amount you request (in the column 'requested EU contribution') may be less,

<sup>4</sup> See Article 5 for the forms of costs

<sup>5</sup> Flat rate : 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs (see Article 6.2.E)

<sup>6</sup> Only specific unit costs that do not include indirect costs

## ANNEX 5

### MODEL FOR THE CERTIFICATE ON THE FINANCIAL STATEMENTS

- For options [*in italics in square brackets*]: choose the applicable option. Options not chosen should be deleted.
- For fields in [grey in square brackets]: enter the appropriate data

#### TABLE OF CONTENTS

TERMS OF REFERENCE FOR AN INDEPENDENT REPORT OF FACTUAL FINDINGS ON COSTS DECLARED UNDER A GRANT AGREEMENT FINANCED UNDER THE HORIZON 2020 RESEARCH FRAMEWORK PROGRAMME

INDEPENDENT REPORT OF FACTUAL FINDINGS ON COSTS DECLARED UNDER A GRANT AGREEMENT FINANCED UNDER THE HORIZON 2020 RESEARCH FRAMEWORK PROGRAMME

**Terms of Reference for an Independent Report of Factual Findings on costs declared under a Grant Agreement financed by [Clean Sky 2] [Bio Based Industries][ECSEL][Fuel Cells and Hydrogen 2][Innovative Medicines Initiative 2][Single European Sky Air Traffic Management Research (SESAR)][Shift2Rail] JU under the Horizon 2020 Research and Innovation Framework Programme**

This document sets out the ‘**Terms of Reference (ToR)**’ under which

[OPTION 1: *[insert name of the beneficiary]* (*‘the Beneficiary’*)] [OPTION 2: *[insert name of the linked third party]* (*‘the Linked Third Party’*), third party linked to the Beneficiary *[insert name of the beneficiary]* (*‘the Beneficiary’*)]

agrees to engage

**[insert legal name of the auditor]** (*‘the Auditor’*)

to produce an independent report of factual findings (*‘the Report’*) concerning the Financial Statement(s)<sup>1</sup> drawn up by the *[Beneficiary]* *[Linked Third Party]* for the Horizon 2020 grant agreement *[insert number of the grant agreement, title of the action, acronym and duration from/to]* (*‘the Agreement’*), and

to issue a Certificate on the Financial Statements’ (*‘CFS’*) referred to in Article 20.4 of the Agreement based on the compulsory reporting template stipulated by the European Commission (*‘the Commission’*).

The Agreement has been concluded under the Horizon 2020 Research and Innovation Framework Programme (H2020) between the Beneficiary and the *[Clean Sky 2][Bio Based Industries][ECSEL][Fuel Cells and Hydrogen 2][Innovative Medicines Initiative 2][Single European Sky Air Traffic Management Research (SESAR)][Shift2Rail]* Joint Undertaking (*“the JU”*).

The JU is mentioned as a signatory of the Agreement with the Beneficiary only. The JU is not a party to this engagement.

## **1.1 Subject of the engagement**

The coordinator must submit to the JU the final report within 60 days following the end of the last reporting period which should include, amongst other documents, a CFS for each beneficiary and for each linked third party that requests a total contribution of EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices (see Article 20.4 of the Agreement). The CFS must cover all reporting periods of the beneficiary or linked third party indicated above.

The Beneficiary must submit to the coordinator the CFS for itself and for its linked third party(ies), if the CFS must be included in the final report according to Article 20.4 of the Agreement.

The CFS is composed of two separate documents:

- The Terms of Reference (*‘the ToR’*) to be signed by the *[Beneficiary]* *[Linked Third Party]* and the Auditor;

---

<sup>1</sup> By which costs under the Agreement are declared (see template ‘Model Financial Statements’ in Annex 4 to the Grant Agreement).



- The Auditor's Independent Report of Factual Findings ('the Report') to be issued on the Auditor's letterhead, dated, stamped and signed by the Auditor (or the competent public officer) which includes the agreed-upon procedures ('the Procedures') to be performed by the Auditor, and the standard factual findings ('the Findings') to be confirmed by the Auditor.

If the CFS must be included in the final report according to Article 20.4 of the Agreement, the request for payment of the balance relating to the Agreement cannot be made without the CFS. However, the payment for reimbursement of costs covered by the CFS does not preclude the JU, the Commission, the European Anti-Fraud Office and the European Court of Auditors from carrying out checks, reviews, audits and investigations in accordance with Article 22 of the Agreement.

## 1.2 Responsibilities

The *[Beneficiary]* *[Linked Third Party]*:

- must draw up the Financial Statement(s) for the action financed by the Agreement in compliance with the obligations under the Agreement. The Financial Statement(s) must be drawn up according to the *[Beneficiary's]* *[Linked Third Party's]* accounting and book-keeping system and the underlying accounts and records;
- must send the Financial Statement(s) to the Auditor;
- is responsible and liable for the accuracy of the Financial Statement(s);
- is responsible for the completeness and accuracy of the information provided to enable the Auditor to carry out the Procedures. It must provide the Auditor with a written representation letter supporting these statements. The written representation letter must state the period covered by the statements and must be dated;
- accepts that the Auditor cannot carry out the Procedures unless it is given full access to the *[Beneficiary's]* *[Linked Third Party's]* staff and accounting as well as any other relevant records and documentation.

The Auditor:

- *[Option 1 by default: is qualified to carry out statutory audits of accounting documents in accordance with Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/660/EEC and 83/349/EEC and repealing Council Directive 84/253/EEC or similar national regulations].*
- *[Option 2 if the Beneficiary or Linked Third Party has an independent Public Officer: is a competent and independent Public Officer for which the relevant national authorities have established the legal capacity to audit the Beneficiary].*
- *[Option 3 if the Beneficiary or Linked Third Party is an international organisation: is an [internal] [external] auditor in accordance with the internal financial regulations and procedures of the international organisation].*

The Auditor:

- must be independent from the Beneficiary *[and the Linked Third Party]*, in particular, it must not have been involved in preparing the *[Beneficiary's]* *[Linked Third Party's]* Financial Statement(s);
- must plan work so that the Procedures may be carried out and the Findings may be assessed;
- must adhere to the Procedures laid down and the compulsory report format;
- must carry out the engagement in accordance with this ToR;
- must document matters which are important to support the Report;
- must base its Report on the evidence gathered;
- must submit the Report to the *[Beneficiary]* *[Linked Third Party]*.

The Commission sets out the Procedures to be carried out by the Auditor. The Auditor is not responsible for their suitability or pertinence. As this engagement is not an assurance engagement, the Auditor does not provide an audit opinion or a statement of assurance.

### 1.3 Applicable Standards

The Auditor must comply with these Terms of Reference and with<sup>2</sup>:

- the International Standard on Related Services ('ISRS') 4400 *Engagements to perform Agreed-upon Procedures regarding Financial Information* as issued by the International Auditing and Assurance Standards Board (IAASB);
- the *Code of Ethics for Professional Accountants* issued by the International Ethics Standards Board for Accountants (IESBA). Although ISRS 4400 states that independence is not a requirement for engagements to carry out agreed-upon procedures, the JU requires that the Auditor also complies with the Code's independence requirements.

The Auditor's Report must state that there is no conflict of interests in establishing this Report between the Auditor and the Beneficiary *[and the Linked Third Party]*, and must specify - if the service is invoiced - the total fee paid to the Auditor for providing the Report.

### 1.4 Reporting

The Report must be written in the language of the Agreement (see Article 20.7).

Under Article 22 of the Agreement, the JU, the Commission, the European Anti-Fraud Office and the Court of Auditors have the right to audit any work that is carried out under the action and for which costs are declared from the European Union budget. This includes work related to this engagement. The Auditor must provide access to all working papers (e.g. recalculation of hourly rates, verification of the time declared for the action) related to this assignment if the JU, the Commission, the European Anti-Fraud Office or the European Court of Auditors requests them.

### 1.5 Timing

The Report must be provided by [dd Month yyyy].

### 1.6 Other terms

*[The [Beneficiary] [Linked Third Party] and the Auditor can use this section to agree other specific terms, such as the Auditor's fees, liability, applicable law, etc. Those specific terms must not contradict the terms specified above.]*

[legal name of the Auditor]	[legal name of the [Beneficiary][Linked Third Party]]
[name & function of authorised representative]	[name & function of authorised representative]
[dd Month yyyy]	[dd Month yyyy]
Signature of the Auditor	Signature of the [Beneficiary][Linked Third Party]

<sup>2</sup> Supreme Audit Institutions applying INTOSAI-standards may carry out the Procedures according to the corresponding International Standards of Supreme Audit Institutions and code of ethics issued by INTOSAI instead of the International Standard on Related Services ('ISRS') 4400 and the Code of Ethics for Professional Accountants issued by the IAASB and the IESBA.

**Independent Report of Factual Findings on costs declared  
under a grant agreement financed by the [Clean Sky 2] [Bio Based Industries][ECSEL][Fuel  
Cells and Hydrogen 2][Innovative Medicines Initiative 2][Single European Sky Air Traffic  
Management Research (SESAR)][Shift2Rail] JU under the Horizon 2020 Research and  
Innovation Framework Programme**

*(To be printed on the Auditor's letterhead)*

To  
[ name of contact person(s)], [Position]  
[ [Beneficiary's] [Linked Third Party's] name ]  
[ Address]  
[ dd Month yyyy]

Dear [Name of contact person(s)],

As agreed under the terms of reference dated [dd Month yyyy]

with [OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of  
the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of  
the beneficiary] ('the Beneficiary')],

we

[name of the auditor] ('the Auditor'),  
established at  
[full address/city/state/province/country],  
represented by  
[name and function of an authorised representative],

have carried out the procedures agreed with you regarding the costs declared in the Financial  
Statement(s)<sup>3</sup> of the [Beneficiary] [Linked Third Party] concerning the grant agreement  
[insert grant agreement reference: number, title of the action and acronym] ('the Agreement'),

with a total cost declared of  
[total amount] EUR,

and a total of actual costs and unit costs calculated in accordance with the [Beneficiary's] [Linked  
Third Party's] usual cost accounting practices' declared of

[sum of total actual costs and total direct personnel costs declared as unit costs calculated in  
accordance with the [Beneficiary's] [Linked Third Party's] usual cost accounting practices] EUR

and **hereby provide our Independent Report of Factual Findings ('the Report')** using the  
compulsory report format agreed with you.

### **The Report**

---

<sup>3</sup> By which the Beneficiary declares costs under the Agreement (see template 'Model Financial Statement' in  
Annex 4 to the Agreement).



Our engagement was carried out in accordance with the terms of reference ('the ToR') appended to this Report. The Report includes the agreed-upon procedures ('the Procedures') carried out and the standard factual findings ('the Findings') examined.

The Procedures were carried out solely to assist the JU in evaluating whether the [Beneficiary's] [Linked Third Party's] costs in the accompanying Financial Statement(s) were declared in accordance with the Agreement. The JU draws its own conclusions from the Report and any additional information it may require.

The scope of the Procedures was defined by the European Commission ('the Commission'). Therefore, the Auditor is not responsible for their suitability or pertinence. Since the Procedures carried out constitute neither an audit nor a review made in accordance with International Standards on Auditing or International Standards on Review Engagements, the Auditor does not give a statement of assurance on the Financial Statements.

Had the Auditor carried out additional procedures or an audit of the [Beneficiary's] [Linked Third Party's] Financial Statements in accordance with International Standards on Auditing or International Standards on Review Engagements, other matters might have come to its attention and would have been included in the Report.

### **Not applicable Findings**

We examined the Financial Statement(s) stated above and considered the following Findings not applicable:

#### *Explanation (to be removed from the Report):*

*If a Finding was not applicable, it must be marked as 'N.A.' ('Not applicable') in the corresponding row on the right-hand column of the table and means that the Finding did not have to be corroborated by the Auditor and the related Procedure(s) did not have to be carried out.*

*The reasons of the non-application of a certain Finding must be obvious i.e.*

- i) if no cost was declared under a certain category then the related Finding(s) and Procedure(s) are not applicable;*
- ii) if the condition set to apply certain Procedure(s) are not met the related Finding(s) and those Procedure(s) are not applicable. For instance, for 'beneficiaries with accounts established in a currency other than euro' the Procedure and Finding related to 'beneficiaries with accounts established in euro' are not applicable. Similarly, if no additional remuneration is paid, the related Finding(s) and Procedure(s) for additional remuneration are not applicable.*

**List here all Findings considered not applicable for the present engagement and explain the reasons of the non-applicability.**

....

### **Exceptions**

Apart from the exceptions listed below, the [Beneficiary] [Linked Third Party] provided the Auditor all the documentation and accounting information needed by the Auditor to carry out the requested Procedures and evaluate the Findings.

#### *Explanation (to be removed from the Report):*

- If the Auditor was not able to successfully complete a procedure requested, it must be marked as 'E' ('Exception') in the corresponding row on the right-hand column of the table. The reason such as the inability to reconcile key information or the unavailability of data that prevents the Auditor from carrying out the Procedure must be indicated below.*
- If the Auditor cannot corroborate a standard finding after having carried out the corresponding procedure, it must also be marked as 'E' ('Exception') and, where possible, the reasons why the Finding was not fulfilled and its possible impact must be explained here below.*

**List here any exceptions and add any information on the cause and possible consequences of each exception, if known. If the exception is quantifiable, include the corresponding amount.**

....

*Example (to be removed from the Report):*

1. *The Beneficiary was unable to substantiate the Finding number 1 on ... because ....*
2. *Finding number 30 was not fulfilled because the methodology used by the Beneficiary to calculate unit costs was different from the one approved by the Commission. The differences were as follows: ...*
3. *After carrying out the agreed procedures to confirm the Finding number 31, the Auditor found a difference of \_\_\_\_\_ EUR. The difference can be explained by ...*

### **Further Remarks**

In addition to reporting on the results of the specific procedures carried out, the Auditor would like to make the following general remarks:

*Example (to be removed from the Report):*

1. *Regarding Finding number 8 the conditions for additional remuneration were considered as fulfilled because ...*
2. *In order to be able to confirm the Finding number 15 we carried out the following additional procedures: ....*

### **Use of this Report**

This Report may be used only for the purpose described in the above objective. It was prepared solely for the confidential use of the [Beneficiary] [Linked Third Party], the JU and the Commission, and only to be submitted to the JU in connection with the requirements set out in Article 20.4 of the Agreement. The Report may not be used by the [Beneficiary] [Linked Third Party], by the JU or the Commission for any other purpose, nor may it be distributed to any other parties. The JU or the Commission may only disclose the Report to authorised parties, in particular to the European Anti-Fraud Office (OLAF) and the European Court of Auditors.

This Report relates only to the Financial Statement(s) submitted to the JU by the [Beneficiary] [Linked Third Party] for the Agreement. Therefore, it does not extend to any other of the [Beneficiary's] [Linked Third Party's] Financial Statement(s).

There was no conflict of interest<sup>4</sup> between the Auditor and the Beneficiary [and Linked Third Party] in establishing this Report. The total fee paid to the Auditor for providing the Report was EUR \_\_\_\_\_ (including EUR \_\_\_\_\_ of deductible VAT).

We look forward to discussing our Report with you and would be pleased to provide any further information or assistance.

[legal name of the Auditor]

<sup>4</sup> A conflict of interest arises when the Auditor's objectivity to establish the certificate is compromised in fact or in appearance when the Auditor for instance:

- was involved in the preparation of the Financial Statements;
- stands to benefit directly should the certificate be accepted;
- has a close relationship with any person representing the beneficiary;
- is a director, trustee or partner of the beneficiary; or
- is in any other situation that compromises his or her independence or ability to establish the certificate impartially.

Grant Agreement number: [insert number] [insert acronym] [insert call identifier]  Associated with document Ref. Ares(2019)7261339 - 25/11/2019

[name and function of an authorised representative]

[dd Month yyyy]

Signature of the Auditor

**Agreed-upon procedures to be performed and standard factual findings to be confirmed by the Auditor**

The European Commission ('the Commission') reserves the right to i) provide the auditor with additional guidance regarding the procedures to be followed or the facts to be ascertained and the way in which to present them (this may include sample coverage and findings) or to ii) change the procedures, by notifying the Beneficiary in writing. The procedures carried out by the auditor to confirm the standard factual finding are listed in the table below.

If this certificate relates to a Linked Third Party, any reference here below to 'the Beneficiary' is to be considered as a reference to 'the Linked Third Party'.

The 'result' column has three different options: 'C', 'E' and 'N.A.':

- 'C' stands for 'confirmed' and means that the auditor can confirm the 'standard factual finding' and, therefore, there is no exception to be reported.
- 'E' stands for 'exception' and means that the Auditor carried out the procedures but cannot confirm the 'standard factual finding', or that the Auditor was not able to carry out a specific procedure (e.g. because it was impossible to reconcile key information or data were unavailable),
- 'N.A.' stands for 'not applicable' and means that the Finding did not have to be examined by the Auditor and the related Procedure(s) did not have to be carried out. The reasons of the non-application of a certain Finding must be obvious i.e. i) if no cost was declared under a certain category then the related Finding(s) and Procedure(s) are not applicable; ii) if the condition set to apply certain Procedure(s) are not met then the related Finding(s) and Procedure(s) are not applicable. For instance, for 'beneficiaries with accounts established in a currency other than the euro' the Procedure related to 'beneficiaries with accounts established in euro' is not applicable. Similarly, if no additional remuneration is paid, the related Finding(s) and Procedure(s) for additional remuneration are not applicable.

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A	<b>ACTUAL PERSONNEL COSTS AND UNIT COSTS CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICE</b>		
	<p>The Auditor draws a sample of persons whose costs were declared in the Financial Statement(s) to carry out the procedures indicated in the consecutive points of this section A.</p> <p><i>(The sample should be selected randomly so that it is representative. Full coverage is required if there are fewer than 10 people (including employees, natural persons working under a direct contract and personnel seconded by a third party), otherwise the sample should have a minimum of 10 people, or 10% of the total, whichever number is the highest)</i></p> <p>The Auditor sampled [ ] people out of the total of [ ] people.</p>		

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A.1	<p><b>PERSONNEL COSTS</b></p> <p><u>For the persons included in the sample and working under an employment contract or equivalent act (general procedures for individual actual personnel costs and personnel costs declared as unit costs)</u></p> <p>To confirm standard factual findings 1-5 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary:</p> <ul style="list-style-type: none"> <li>○ a list of the persons included in the sample indicating the period(s) during which they worked for the action, their position (classification or category) and type of contract;</li> <li>○ the payslips of the employees included in the sample;</li> <li>○ reconciliation of the personnel costs declared in the Financial Statement(s) with the accounting system (project accounting and general ledger) and payroll system;</li> <li>○ information concerning the employment status and employment conditions of personnel included in the sample, in particular their employment contracts or equivalent;</li> <li>○ the Beneficiary's usual policy regarding payroll matters (e.g. salary policy, overtime policy, variable pay);</li> <li>○ applicable national law on taxes, labour and social security and</li> <li>○ any other document that supports the personnel costs declared.</li> </ul> <p>The Auditor also verified the eligibility of all components of the retribution (see Article 6 GA) and recalculated the personnel costs for employees included in the sample.</p>	1) The employees were i) directly hired by the Beneficiary in accordance with its national legislation, ii) under the Beneficiary's sole technical supervision and responsibility and iii) remunerated in accordance with the Beneficiary's usual practices.	
		2) Personnel costs were recorded in the Beneficiary's accounts/payroll system.	
		3) Costs were adequately supported and reconciled with the accounts and payroll records.	
		4) Personnel costs did not contain any ineligible elements.	
		5) There were no discrepancies between the personnel costs charged to the action and the costs recalculated by the Auditor.	
	<p><i>Further procedures if 'additional remuneration' is paid</i></p> <p>To confirm standard factual findings 6-9 listed in the next column, the Auditor:</p> <ul style="list-style-type: none"> <li>○ reviewed relevant documents provided by the Beneficiary (legal form, legal/statutory</li> </ul>	6) The Beneficiary paying "additional remuneration" was a non-profit legal entity.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<p>obligations, the Beneficiary's usual policy on additional remuneration, criteria used for its calculation, the Beneficiary's usual remuneration practice for projects funded under national funding schemes ...);</p> <ul style="list-style-type: none"> <li>recalculated the amount of additional remuneration eligible for the action based on the supporting documents received (full-time or part-time work, exclusive or non-exclusive dedication to the action, usual remuneration paid for projects funded by national schemes) to arrive at the applicable FTE/year and pro-rata rate (see data collected in the course of carrying out the procedures under A.2 'Productive hours' and A.4 'Time recording system').</li> </ul> <p><i>'ADDITIONAL REMUNERATION' MEANS ANY PART OF THE REMUNERATION WHICH EXCEEDS WHAT THE PERSON WOULD BE PAID FOR TIME WORKED IN PROJECTS FUNDED BY NATIONAL SCHEMES.</i></p> <p><i>IF ANY PART OF THE REMUNERATION PAID TO THE EMPLOYEE IS QUALIFIED AS "ADDITIONAL REMUNERATION" AND IS ELIGIBLE UNDER THE PROVISIONS OF ARTICLE 6.2.A.1, THIS CAN BE CHARGED AS ELIGIBLE COST TO THE ACTION UP TO THE FOLLOWING AMOUNT:</i></p> <p>(A) <i>IF THE PERSON WORKS FULL TIME AND EXCLUSIVELY ON THE ACTION DURING THE FULL YEAR: UP TO EUR 8 000/YEAR;</i></p> <p>(B) <i>IF THE PERSON WORKS EXCLUSIVELY ON THE ACTION BUT NOT FULL-TIME OR NOT FOR THE FULL YEAR: UP TO THE CORRESPONDING PRO-RATA AMOUNT OF EUR 8 000, OR</i></p> <p>(C) <i>IF THE PERSON DOES NOT WORK EXCLUSIVELY ON THE ACTION: UP TO A PRO-RATA AMOUNT CALCULATED IN ACCORDANCE TO ARTICLE 6.2.A.1.</i></p>	7) The amount of additional remuneration paid corresponded to the Beneficiary's usual remuneration practices and was consistently paid whenever the same kind of work or expertise was required.	
		8) The criteria used to calculate the additional remuneration were objective and generally applied by the Beneficiary regardless of the source of funding used.	
		9) The amount of additional remuneration included in the personnel costs charged to the action was capped at EUR 8,000 per FTE/year (up to the equivalent pro-rata amount if the person did not work on the action full-time during the year or did not work exclusively on the action).	
	<p><i>Additional procedures in case "unit costs calculated by the Beneficiary in accordance with its usual cost accounting practices" is applied:</i></p> <p>Apart from carrying out the procedures indicated above to confirm standard factual findings 1-5 and, if applicable, also 6-9, the Auditor carried out following procedures to confirm standard</p>	10) The personnel costs included in the Financial Statement were calculated in accordance with the Beneficiary's usual cost accounting practice. This methodology was consistently	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<p>factual findings 10-13 listed in the next column:</p> <ul style="list-style-type: none"> <li>obtained a description of the Beneficiary's usual cost accounting practice to calculate unit costs;</li> <li>reviewed whether the Beneficiary's usual cost accounting practice was applied for the Financial Statements subject of the present CFS;</li> <li>verified the employees included in the sample were charged under the correct category (in accordance with the criteria used by the Beneficiary to establish personnel categories) by reviewing the contract/HR-record or analytical accounting records;</li> <li>verified that there is no difference between the total amount of personnel costs used in calculating the cost per unit and the total amount of personnel costs recorded in the statutory accounts;</li> <li>verified whether actual personnel costs were adjusted on the basis of budgeted or estimated elements and, if so, verified whether those elements used are actually relevant for the calculation, objective and supported by documents.</li> </ul>	used in all H2020 actions.	
		11) The employees were charged under the correct category.	
		12) Total personnel costs used in calculating the unit costs were consistent with the expenses recorded in the statutory accounts.	
		13) Any estimated or budgeted element used by the Beneficiary in its unit-cost calculation were relevant for calculating personnel costs and corresponded to objective and verifiable information.	
	<p><u>For natural persons included in the sample and working with the Beneficiary under a direct contract other than an employment contract, such as consultants (no subcontractors).</u></p> <p>To confirm standard factual findings 14-17 listed in the next column the Auditor reviewed following information/documents provided by the Beneficiary:</p> <ul style="list-style-type: none"> <li>the contracts, especially the cost, contract duration, work description, place of work, ownership of the results and reporting obligations to the Beneficiary;</li> <li>the employment conditions of staff in the same category to compare costs and;</li> <li>any other document that supports the costs declared and its registration (e.g. invoices, accounting records, etc.).</li> </ul>	14) The natural persons worked under conditions similar to those of an employee, in particular regarding the way the work is organised, the tasks that are performed and the premises where they are performed.	
		15) The results of work carried out belong to the Beneficiary, or, if not, the Beneficiary has obtained all necessary rights to fulfil its obligations as if those	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
		results were generated by itself.	
		16) Their costs were not significantly different from those for staff who performed similar tasks under an employment contract with the Beneficiary.	
		17) The costs were supported by audit evidence and registered in the accounts.	
	<u>For personnel seconded by a third party and included in the sample (not subcontractors)</u> To confirm standard factual findings 18-21 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary: <ul style="list-style-type: none"> <li>○ their secondment contract(s) notably regarding costs, duration, work description, place of work and ownership of the results;</li> <li>○ if there is reimbursement by the Beneficiary to the third party for the resource made available (in-kind contribution against payment): any documentation that supports the costs declared (e.g. contract, invoice, bank payment, and proof of registration in its accounting/payroll, etc.) and reconciliation of the Financial Statement(s) with the accounting system (project accounting and general ledger) as well as any proof that the amount invoiced by the third party did not include any profit;</li> <li>○ if there is no reimbursement by the Beneficiary to the third party for the resource made available (in-kind contribution free of charge): a proof of the actual cost borne by the Third Party for the resource made available free of charge to the Beneficiary such as a statement of costs incurred by the Third Party and proof of the registration in the Third Party's accounting/payroll;</li> </ul>	18) Seconded personnel reported to the Beneficiary and worked on the Beneficiary's premises (unless otherwise agreed with the Beneficiary).	
		19) The results of work carried out belong to the Beneficiary, or, if not, the Beneficiary has obtained all necessary rights to fulfil its obligations as if those results were generated by itself.	
		<i>If personnel is seconded against payment:</i>	
		20) The costs declared were supported with documentation and recorded in the Beneficiary's accounts. The	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<ul style="list-style-type: none"> <li>any other document that supports the costs declared (e.g. invoices, etc.).</li> </ul>	third party did not include any profit.	
		<i>If personnel is seconded free of charge:</i> 21) The costs declared did not exceed the third party's cost as recorded in the accounts of the third party and were supported with documentation.	
A.2	<b>PRODUCTIVE HOURS</b>  To confirm standard factual findings 22-27 listed in the next column, the Auditor reviewed relevant documents, especially national legislation, labour agreements and contracts and time records of the persons included in the sample, to verify that: <ul style="list-style-type: none"> <li>the annual productive hours applied were calculated in accordance with one of the methods described below,</li> <li>the full-time equivalent (FTEs) ratios for employees not working full-time were correctly calculated.</li> </ul> If the Beneficiary applied method B, the auditor verified that the correctness in which the total number of hours worked was calculated and that the contracts specified the annual workable hours.  If the Beneficiary applied method C, the auditor verified that the 'annual productive hours' applied when calculating the hourly rate were equivalent to at least 90 % of the 'standard annual workable hours'. The Auditor can only do this if the calculation of the standard annual workable	22) The Beneficiary applied method [ <i>choose one option and delete the others</i> ] [A: 1720 hours] [B: the 'total number of hours worked'] [C: 'standard annual productive hours' used correspond to usual accounting practices]	
		23) Productive hours were calculated annually.	
		24) For employees not working full-time the full-time equivalent (FTE) ratio was correctly applied.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<p>hours can be supported by records, such as national legislation, labour agreements, and contracts.</p> <p><i>BENEFICIARY'S PRODUCTIVE HOURS' FOR PERSONS WORKING FULL TIME SHALL BE ONE OF THE FOLLOWING METHODS:</i></p> <p><i>A. 1720 ANNUAL PRODUCTIVE HOURS (PRO-RATA FOR PERSONS NOT WORKING FULL-TIME)</i></p> <p><i>B. THE TOTAL NUMBER OF HOURS WORKED BY THE PERSON FOR THE BENEFICIARY IN THE YEAR (THIS METHOD IS ALSO REFERRED TO AS 'TOTAL NUMBER OF HOURS WORKED' IN THE NEXT COLUMN). THE CALCULATION OF THE TOTAL NUMBER OF HOURS WORKED WAS DONE AS FOLLOWS: ANNUAL WORKABLE HOURS OF THE PERSON ACCORDING TO THE EMPLOYMENT CONTRACT, APPLICABLE LABOUR AGREEMENT OR NATIONAL LAW PLUS OVERTIME WORKED MINUS ABSENCES (SUCH AS SICK LEAVE OR SPECIAL LEAVE).</i></p> <p><i>C. THE STANDARD NUMBER OF ANNUAL HOURS GENERALLY APPLIED BY THE BENEFICIARY FOR ITS PERSONNEL IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICES (THIS METHOD IS ALSO REFERRED TO AS 'STANDARD ANNUAL PRODUCTIVE HOURS' IN THE NEXT COLUMN). THIS NUMBER MUST BE AT LEAST 90% OF THE STANDARD ANNUAL WORKABLE HOURS.</i></p> <p><i>'ANNUAL WORKABLE HOURS' MEANS THE PERIOD DURING WHICH THE PERSONNEL MUST BE WORKING, AT THE EMPLOYER'S DISPOSAL AND CARRYING OUT HIS/HER ACTIVITY OR DUTIES UNDER THE EMPLOYMENT CONTRACT, APPLICABLE COLLECTIVE LABOUR AGREEMENT OR NATIONAL WORKING TIME LEGISLATION.</i></p>	<p><i>If the Beneficiary applied method B.</i></p> <p>25) The calculation of the number of 'annual workable hours', overtime and absences was verifiable based on the documents provided by the Beneficiary.</p> <p>25.1) The Beneficiary calculates the hourly rates per full financial year following procedure A.3 (method B is not allowed for beneficiaries calculating hourly rates per month).</p>	
		<p><i>If the Beneficiary applied method C.</i></p> <p>26) The calculation of the number of 'standard annual workable hours' was verifiable based on the documents provided by the Beneficiary.</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
		27) The 'annual productive hours' used for calculating the hourly rate were consistent with the usual cost accounting practices of the Beneficiary and were equivalent to at least 90 % of the 'annual workable hours'.	
A.3	<p><b>HOURLY PERSONNEL RATES</b></p> <p><u>I) For unit costs calculated in accordance to the Beneficiary's usual cost accounting practice (unit costs):</u></p> <p>If the Beneficiary has a "Certificate on Methodology to calculate unit costs " (CoMUC) approved by the Commission, the Beneficiary provides the Auditor with a description of the approved methodology and the Commission's letter of acceptance. The Auditor verified that the Beneficiary has indeed used the methodology approved. If so, no further verification is necessary.</p> <p>If the Beneficiary does not have a "Certificate on Methodology" (CoMUC) approved by the Commission, or if the methodology approved was not applied, then the Auditor:</p> <ul style="list-style-type: none"> <li>○ reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates;</li> <li>○ recalculated the unit costs (hourly rates) of staff included in the sample following the results of the procedures carried out in A.1 and A.2.</li> </ul> <p><u>II) For individual hourly rates:</u></p> <p>The Auditor:</p> <ul style="list-style-type: none"> <li>○ reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates;</li> <li>○ recalculated the hourly rates of staff included in the sample (recalculation of all hourly</li> </ul>	<p>28) The Beneficiary applied [<i>choose one option and delete the other</i>]:</p> <p>[Option I: "Unit costs (hourly rates) were calculated in accordance with the Beneficiary's usual cost accounting practices"]</p> <p>[Option II: Individual hourly rates were applied]</p> <p><i>For option I concerning unit costs and if the Beneficiary applies the methodology approved by the Commission (CoMUC):</i></p> <p>29) The Beneficiary used the Commission-approved methodology to calculate hourly rates. It corresponded to the organisation's usual cost accounting practices and was applied consistently for all</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<p>rates if the Beneficiary uses annual rates, recalculation of three months selected randomly for every year and person if the Beneficiary uses monthly rates) following the results of the procedures carried out in A.1 and A.2;</p> <ul style="list-style-type: none"> <li>○ (only in case of monthly rates) confirmed that the time spent on parental leave is not deducted, and that, if parts of the basic remuneration are generated over a period longer than a month, the Beneficiary has included only the share which is generated in the month.</li> </ul> <p><u>“UNIT COSTS CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICES”:</u>  <i>IT IS CALCULATED BY DIVIDING THE TOTAL AMOUNT OF PERSONNEL COSTS OF THE CATEGORY TO WHICH THE EMPLOYEE BELONGS VERIFIED IN LINE WITH PROCEDURE A.1 BY THE NUMBER OF FTE AND THE ANNUAL TOTAL PRODUCTIVE HOURS OF THE SAME CATEGORY CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH PROCEDURE A.2.</i>  <u>HOURLY RATE FOR INDIVIDUAL ACTUAL PERSONAL COSTS:</u>  <i>IT IS CALCULATED FOLLOWING ONE OF THE TWO OPTIONS BELOW:</i></p> <p><i>A) [OPTION BY DEFAULT] BY DIVIDING THE ACTUAL ANNUAL AMOUNT OF PERSONNEL COSTS OF AN EMPLOYEE VERIFIED IN LINE WITH PROCEDURE A.1 BY THE NUMBER OF ANNUAL PRODUCTIVE HOURS VERIFIED IN LINE WITH PROCEDURE A.2 (FULL FINANCIAL YEAR HOURLY RATE);</i></p> <p><i>B) BY DIVIDING THE ACTUAL MONTHLY AMOUNT OF PERSONNEL COSTS OF AN EMPLOYEE VERIFIED IN LINE WITH PROCEDURE A.1 BY 1/12 OF THE NUMBER OF ANNUAL PRODUCTIVE HOURS VERIFIED IN LINE WITH PROCEDURE A.2.(MONTHLY HOURLY RATE).</i></p>	<p>activities irrespective of the source of funding.</p> <p><i>For option I concerning unit costs and if the Beneficiary applies a methodology not approved by the Commission:</i></p> <p>30) The unit costs re-calculated by the Auditor were the same as the rates applied by the Beneficiary.</p> <p><i>For option II concerning individual hourly rates:</i></p> <p>31) The individual rates re-calculated by the Auditor were the same as the rates applied by the Beneficiary.</p> <p>31.1) The Beneficiary used only one option (per full financial year or per month) throughout each financial year examined.</p> <p>31.2) The hourly rates do not include additional remuneration.</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A.4	<b>TIME RECORDING SYSTEM</b> To verify that the time recording system ensures the fulfilment of all minimum requirements and that the hours declared for the action were correct, accurate and properly authorised and supported by documentation, the Auditor made the following checks for the persons included in the sample that declare time as worked for the action on the basis of time records: <ul style="list-style-type: none"> <li>○ description of the time recording system provided by the Beneficiary (registration, authorisation, processing in the HR-system);</li> <li>○ its actual implementation;</li> <li>○ time records were signed at least monthly by the employees (on paper or electronically) and authorised by the project manager or another manager;</li> <li>○ the hours declared were worked within the project period;</li> <li>○ there were no hours declared as worked for the action if HR-records showed absence due to holidays or sickness (further cross-checks with travels are carried out in B.1 below) ;</li> <li>○ the hours charged to the action matched those in the time recording system.</li> </ul>	32) All persons recorded their time dedicated to the action on a <b>daily/ weekly/ monthly</b> basis using a <b>paper/computer-based</b> system. <i>(delete the answers that are not applicable)</i>	
		33) Their time-records were authorised at least monthly by the project manager or other superior.	
		34) Hours declared were worked within the project period and were consistent with the presences/absences recorded in HR-records.	
		35) There were no discrepancies between the number of hours charged to the action and the number of hours recorded.	
	<p><i>ONLY THE HOURS WORKED ON THE ACTION CAN BE CHARGED. ALL WORKING TIME TO BE CHARGED SHOULD BE RECORDED THROUGHOUT THE DURATION OF THE PROJECT, ADEQUATELY SUPPORTED BY EVIDENCE OF THEIR REALITY AND RELIABILITY (SEE SPECIFIC PROVISIONS BELOW FOR PERSONS WORKING EXCLUSIVELY FOR THE ACTION WITHOUT TIME RECORDS).</i></p> <p><u>If the persons are working exclusively for the action and without time records</u></p> <p>For the persons selected that worked exclusively for the action without time records, the Auditor verified evidence available demonstrating that they were in reality exclusively dedicated to the action and that the Beneficiary signed a declaration confirming that they have worked exclusively for the action.</p>	36) The exclusive dedication is supported by a declaration signed by the Beneficiary and by any other evidence gathered.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
<b>B</b>	<b>COSTS OF SUBCONTRACTING</b>		
<b>B.1</b>	<p><b>The Auditor obtained the detail/breakdown of subcontracting costs and sampled cost items selected randomly</b> (full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest).</p> <p>To confirm standard factual findings 37-41 listed in the next column, the Auditor reviewed the following for the items included in the sample:</p> <ul style="list-style-type: none"> <li>the use of subcontractors was foreseen in Annex 1;</li> <li>subcontracting costs were declared in the subcontracting category of the Financial Statement;</li> <li>supporting documents on the selection and award procedure were followed;</li> <li>the Beneficiary ensured best value for money (key elements to appreciate the respect of this principle are the award of the subcontract to the bid offering best price-quality ratio, under conditions of transparency and equal treatment. In case an existing framework contract was used the Beneficiary ensured it was established on the basis of the principle of best value for money under conditions of transparency and equal treatment).</li> </ul> <p>In particular,</p> <ol style="list-style-type: none"> <li>if the Beneficiary acted as a contracting authority within the meaning of Directive 2004/18/EC (or 2014/24/EU) or of Directive 2004/17/EC (or 2014/25/EU), the Auditor verified that the applicable national law on public procurement was followed and that the subcontracting complied with the Terms and Conditions of the Agreement.</li> <li>if the Beneficiary did not fall under the above-mentioned category the Auditor verified that the Beneficiary followed their usual procurement rules and respected the Terms and Conditions of the Agreement..</li> </ol>	<p>37) The use of claimed subcontracting costs was foreseen in Annex 1 and costs were declared in the Financial Statements under the subcontracting category.</p> <p>38) There were documents of requests to different providers, different offers and assessment of the offers before selection of the provider in line with internal procedures and procurement rules. Subcontracts were awarded in accordance with the principle of best value for money.</p> <p><i>(When different offers were not collected the Auditor explains the reasons provided by the Beneficiary under the caption “Exceptions” of the Report. The JU will analyse this information to evaluate whether these costs might be accepted as eligible)</i></p> <p>39) The subcontracts were not awarded to other Beneficiaries</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	For the items included in the sample the Auditor also verified that: <ul style="list-style-type: none"> <li>○ the subcontracts were not awarded to other Beneficiaries in the consortium;</li> <li>○ there were signed agreements between the Beneficiary and the subcontractor;</li> <li>○ there was evidence that the services were provided by subcontractor;</li> </ul>	of the consortium.	
		40) All subcontracts were supported by signed agreements between the Beneficiary and the subcontractor.	
		41) There was evidence that the services were provided by the subcontractors.	
<b>C</b>	<b>COSTS OF PROVIDING FINANCIAL SUPPORT TO THIRD PARTIES</b>		
<b>C.1</b>	<p><b>The Auditor obtained the detail/breakdown of the costs of providing financial support to third parties and sampled [ ] cost items selected randomly</b> <i>(full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest).</i></p> <p>The Auditor verified that the following minimum conditions were met:</p> <ul style="list-style-type: none"> <li>a) the maximum amount of financial support for each third party did not exceed EUR 60 000, unless explicitly mentioned in Annex 1;</li> <li>b) the financial support to third parties was agreed in Annex 1 of the Agreement and the other provisions on financial support to third parties included in Annex 1 were respected.</li> </ul>	42) All minimum conditions were met	

D	OTHER ACTUAL DIRECT COSTS		
D.1	<b>COSTS OF TRAVEL AND RELATED SUBSISTENCE ALLOWANCES</b>  <b>The Auditor sampled [ ] cost items selected randomly</b> <i>(full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is the highest).</i>  The Auditor inspected the sample and verified that: <ul style="list-style-type: none"> <li>○ travel and subsistence costs were consistent with the Beneficiary's usual policy for travel. In this context, the Beneficiary provided evidence of its normal policy for travel costs (e.g. use of first class tickets, reimbursement by the Beneficiary on the basis of actual costs, a lump sum or per diem) to enable the Auditor to compare the travel costs charged with this policy;</li> <li>○ travel costs are correctly identified and allocated to the action (e.g. trips are directly linked to the action) by reviewing relevant supporting documents such as minutes of meetings, workshops or conferences, their registration in the correct project account, their consistency with time records or with the dates/duration of the workshop/conference;</li> <li>○ no ineligible costs or excessive or reckless expenditure was declared (see Article 6.5 MGA).</li> </ul>	43) Costs were incurred, approved and reimbursed in line with the Beneficiary's usual policy for travels.	
		44) There was a link between the trip and the action.	
		45) The supporting documents were consistent with each other regarding subject of the trip, dates, duration and reconciled with time records and accounting.	
		46) No ineligible costs or excessive or reckless expenditure was declared.	
D.2	<b>DEPRECIATION COSTS FOR EQUIPMENT, INFRASTRUCTURE OR OTHER ASSETS</b>  <b>The Auditor sampled [ ] cost items selected randomly</b> <i>(full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is the highest).</i>  For “equipment, infrastructure or other assets” [from now on called “asset(s)”] selected in the sample the Auditor verified that: <ul style="list-style-type: none"> <li>○ the assets were acquired in conformity with the Beneficiary's internal guidelines and procedures;</li> <li>○ they were correctly allocated to the action (with supporting documents such as delivery</li> </ul>	47) Procurement rules, principles and guides were followed.	
		48) There was a link between the grant agreement and the asset charged to the action.	
		49) The asset charged to the action was traceable to the accounting records and the underlying documents.	

	<p>note invoice or any other proof demonstrating the link to the action)</p> <ul style="list-style-type: none"> <li>○ they were entered in the accounting system;</li> <li>○ the extent to which the assets were used for the action (as a percentage) was supported by reliable documentation (e.g. usage overview table);</li> </ul> <p>The Auditor recalculated the depreciation costs and verified that they were in line with the applicable rules in the Beneficiary's country and with the Beneficiary's usual accounting policy (e.g. depreciation calculated on the acquisition value).</p> <p>The Auditor verified that no ineligible costs such as deductible VAT, exchange rate losses, excessive or reckless expenditure were declared (see Article 6.5 GA).</p>	<p>50) The depreciation method used to charge the asset to the action was in line with the applicable rules of the Beneficiary's country and the Beneficiary's usual accounting policy.</p>	
		<p>51) The amount charged corresponded to the actual usage for the action.</p>	
		<p>52) No ineligible costs or excessive or reckless expenditure were declared.</p>	
<b>D.3</b>	<p><b>COSTS OF OTHER GOODS AND SERVICES</b></p> <p><b>The Auditor sampled [ ] cost items selected randomly</b> (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest</i>).</p> <p>For the purchase of goods, works or services included in the sample the Auditor verified that:</p> <ul style="list-style-type: none"> <li>○ the contracts did not cover tasks described in Annex 1;</li> <li>○ they were correctly identified, allocated to the proper action, entered in the accounting system (traceable to underlying documents such as purchase orders, invoices and accounting);</li> <li>○ the goods were not placed in the inventory of durable equipment;</li> <li>○ the costs charged to the action were accounted in line with the Beneficiary's usual accounting practices;</li> <li>○ no ineligible costs or excessive or reckless expenditure were declared (see Article 6 GA).</li> </ul> <p>In addition, the Auditor verified that these goods and services were acquired in conformity with the Beneficiary's internal guidelines and procedures, in particular:</p> <ul style="list-style-type: none"> <li>○ if Beneficiary acted as a contracting authority within the meaning of Directive</li> </ul>	<p>53) Contracts for works or services did not cover tasks described in Annex 1.</p>	
		<p>54) Costs were allocated to the correct action and the goods were not placed in the inventory of durable equipment.</p>	
		<p>55) The costs were charged in line with the Beneficiary's accounting policy and were adequately supported.</p>	
		<p>56) No ineligible costs or excessive or reckless expenditure were declared. For internal invoices/charges only the cost element was charged, without any mark-ups.</p>	

	<p>2004/18/EC (or 2014/24/EU) or of Directive 2004/17/EC (or 2014/25/EU), the Auditor verified that the applicable national law on public procurement was followed and that the procurement contract complied with the Terms and Conditions of the Agreement.</p> <ul style="list-style-type: none"> <li>○ if the Beneficiary did not fall into the category above, the Auditor verified that the Beneficiary followed their usual procurement rules and respected the Terms and Conditions of the Agreement.</li> </ul> <p>For the items included in the sample the Auditor also verified that:</p> <ul style="list-style-type: none"> <li>○ the Beneficiary ensured best value for money (key elements to appreciate the respect of this principle are the award of the contract to the bid offering best price-quality ratio, under conditions of transparency and equal treatment. In case an existing framework contract was used the Auditor also verified that the Beneficiary ensured it was established on the basis of the principle of best value for money under conditions of transparency and equal treatment);</li> </ul> <p><i>SUCH GOODS AND SERVICES INCLUDE, FOR INSTANCE, CONSUMABLES AND SUPPLIES, DISSEMINATION (INCLUDING OPEN ACCESS), PROTECTION OF RESULTS, SPECIFIC EVALUATION OF THE ACTION IF IT IS REQUIRED BY THE AGREEMENT, CERTIFICATES ON THE FINANCIAL STATEMENTS IF THEY ARE REQUIRED BY THE AGREEMENT AND CERTIFICATES ON THE METHODOLOGY, TRANSLATIONS, REPRODUCTION.</i></p>	<p>57) Procurement rules, principles and guides were followed. There were documents of requests to different providers, different offers and assessment of the offers before selection of the provider in line with internal procedures and procurement rules. The purchases were made in accordance with the principle of best value for money.</p> <p><i>(When different offers were not collected the Auditor explains the reasons provided by the Beneficiary under the caption "Exceptions" of the Report. The JU will analyse this information to evaluate whether these costs might be accepted as eligible)</i></p>	
<b>D.4</b>	<p><b>AGGREGATED CAPITALISED AND OPERATING COSTS OF RESEARCH INFRASTRUCTURE</b></p> <p>The Auditor ensured the existence of a positive ex-ante assessment (issued by the EC Services) of the cost accounting methodology of the Beneficiary allowing it to apply the guidelines on direct costing for large research infrastructures in Horizon 2020.</p> <p><i>In the cases that a positive ex-ante assessment has been issued (see the standard factual findings 58-59 on the next column),</i></p>	<p>58) The costs declared as direct costs for Large Research Infrastructures (in the appropriate line of the Financial Statement) comply with the methodology described in the positive ex-ante assessment report.</p>	

	<p>The Auditor ensured that the beneficiary has applied consistently the methodology that is explained and approved in the positive ex ante assessment;</p> <p><b><i>In the cases that a positive ex-ante assessment has NOT been issued (see the standard factual findings 60 on the next column),</i></b></p> <p>The Auditor verified that no costs of Large Research Infrastructure have been charged as direct costs in any costs category;</p> <p><b><i>In the cases that a draft ex-ante assessment report has been issued with recommendation for further changes (see the standard factual findings 60 on the next column),</i></b></p> <ul style="list-style-type: none"> <li>The Auditor followed the same procedure as above (when a positive ex-ante assessment has NOT yet been issued) and paid particular attention (testing reinforced) to the cost items for which the draft ex-ante assessment either rejected the inclusion as direct costs for Large Research Infrastructures or issued recommendations.</li> </ul>	59) Any difference between the methodology applied and the one positively assessed was extensively described and adjusted accordingly.	
		60) The direct costs declared were free from any indirect costs items related to the Large Research Infrastructure.	
<b>D.5</b>	<p><b>Costs of internally invoiced goods and services</b></p> <p><b>The Auditor sampled cost items selected randomly</b> (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest</i>).</p> <p>To confirm standard factual findings 61-65 listed in the next column, the Auditor:</p> <ul style="list-style-type: none"> <li>obtained a description of the Beneficiary's usual cost accounting practice to calculate costs of internally invoiced goods and services (unit costs);</li> <li>reviewed whether the Beneficiary's usual cost accounting practice was applied for the Financial Statements subject of the present CFS;</li> <li>ensured that the methodology to calculate unit costs is being used in a consistent manner, based on objective criteria, regardless of the source of funding;</li> <li>verified that any ineligible items or any costs claimed under other budget categories, in particular indirect costs, have not been taken into account when calculating the costs of internally invoiced goods and services (see Article 6 GA);</li> <li>verified whether actual costs of internally invoiced goods and services were adjusted on</li> </ul>	<p>61) The costs of internally invoiced goods and services included in the Financial Statement were calculated in accordance with the Beneficiary's usual cost accounting practice.</p> <p>62) The cost accounting practices used to calculate the costs of internally invoiced goods and services were applied by the Beneficiary in a consistent manner based on objective criteria regardless of the source of funding.</p> <p>63) The unit cost is calculated using the actual costs for the good or service recorded in the Beneficiary's accounts, excluding any ineligible cost or</p>	

	<p>the basis of budgeted or estimated elements and, if so, verified whether those elements used are actually relevant for the calculation, and correspond to objective and verifiable information.</p> <ul style="list-style-type: none"> <li>o verified that any costs of items which are not directly linked to the production of the invoiced goods or service (e.g. supporting services like cleaning, general accountancy, administrative support, etc. not directly used for production of the good or service) have not been taken into account when calculating the costs of internally invoiced goods and services.</li> <li>o verified that any costs of items used for calculating the costs internally invoiced goods and services are supported by audit evidence and registered in the accounts.</li> <li>o</li> </ul>	<p>costs included in other budget categories.</p> <p>64) The unit cost excludes any costs of items which are not directly linked to the production of the invoiced goods or service.</p> <p>65) The costs items used for calculating the actual costs of internally invoiced goods and services were relevant, reasonable and correspond to objective and verifiable information.</p>	
<b>E</b>	<b>USE OF EXCHANGE RATES</b>		
<b>E.1</b>	<p>a) For Beneficiaries with accounts established in a currency other than euros</p> <p><b>The Auditor sampled [ ] cost items selected randomly and verified that the exchange rates used for converting other currencies into euros were in accordance with the following rules established in the Agreement</b> (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest</i>):</p> <p><i>COSTS RECORDED IN THE ACCOUNTS IN A CURRENCY OTHER THAN EURO SHALL BE CONVERTED INTO EURO AT THE AVERAGE OF THE DAILY EXCHANGE RATES PUBLISHED IN THE C SERIES OF OFFICIAL JOURNAL OF THE EUROPEAN UNION (<a href="https://www.ecb.int/stats/exchange/eurofxref/html/index.en.html">https://www.ecb.int/stats/exchange/eurofxref/html/index.en.html</a> ), DETERMINED OVER THE CORRESPONDING REPORTING PERIOD.</i></p> <p><i>IF NO DAILY EURO EXCHANGE RATE IS PUBLISHED IN THE OFFICIAL JOURNAL OF THE EUROPEAN UNION FOR THE CURRENCY IN QUESTION, CONVERSION SHALL BE MADE AT THE AVERAGE OF THE MONTHLY ACCOUNTING RATES ESTABLISHED BY THE COMMISSION AND PUBLISHED ON ITS WEBSITE (<a href="http://ec.europa.eu/budget/contracts_grants/info_contracts/inforeuro/inforeuro_en.cfm">http://ec.europa.eu/budget/contracts_grants/info_contracts/inforeuro/inforeuro_en.cfm</a> ),</i></p>	<p>66) The exchange rates used to convert other currencies into Euros were in accordance with the rules established of the Grant Agreement and there was no difference in the final figures.</p>	

	<i>DETERMINED OVER THE CORRESPONDING REPORTING PERIOD.</i>		
	<p><u>b) For Beneficiaries with accounts established in euros</u></p> <p><b>The Auditor sampled [ ] cost items selected randomly and verified that the exchange rates used for converting other currencies into euros were in accordance with the following rules established in the Agreement</b> (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest</i>):</p> <p><i>COSTS INCURRED IN ANOTHER CURRENCY SHALL BE CONVERTED INTO EURO BY APPLYING THE BENEFICIARY'S USUAL ACCOUNTING PRACTICES.</i></p>	67) The Beneficiary applied its usual accounting practices.	

[legal name of the audit firm]

[name and function of an authorised representative]

[dd Month yyyy]

&lt;Signature of the Auditor&gt;

## ANNEX 6

### MODEL FOR THE CERTIFICATE ON THE METHODOLOGY

- For options [*in italics in square brackets*]: choose the applicable option. Options not chosen should be deleted.
- For fields in [grey in square brackets]: enter the appropriate data.

#### TABLE OF CONTENTS

TERMS OF REFERENCE FOR AN AUDIT ENGAGEMENT FOR A METHODOLOGY CERTIFICATE IN CONNECTION WITH ONE OR MORE GRANT AGREEMENTS FINANCED UNDER THE HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME

INDEPENDENT REPORT OF FACTUAL FINDINGS ON THE METHODOLOGY CONCERNING GRANT AGREEMENTS FINANCED UNDER THE HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME

**Terms of reference for an audit engagement for a methodology certificate  
in connection with one or more grant agreements financed  
by [Clean Sky 2] [Bio Based Industries][ECSEL][Fuel Cells and Hydrogen 2][Innovative  
Medicines Initiative 2][Single European Sky Air Traffic Management Research  
(SESAR)][Shift2Rail] JU under the Horizon 2020 Research and Innovation Framework  
Programme**

This document sets out the ‘**Terms of Reference (ToR)**’ under which

[OPTION 1: *[insert name of the beneficiary]* (*‘the Beneficiary’*)] [OPTION 2: *[insert name of the linked third party]* (*‘the Linked Third Party’*), third party linked to the Beneficiary *[insert name of the beneficiary]* (*‘the Beneficiary’*)]

agrees to engage

**[insert legal name of the auditor]** (*‘the Auditor’*)

to produce an independent report of factual findings (*‘the Report’*) concerning the *[Beneficiary’s]* *[Linked Third Party’s]* usual accounting practices for calculating and claiming direct personnel costs declared as unit costs (*‘the Methodology’*) in connection with grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme.

The procedures to be carried out for the assessment of the methodology will be based on the grant agreement(s) detailed below:

**[title and number of the grant agreement(s)]** (*‘the Agreement(s)’*)

The Agreement(s) has(have) been concluded between the Beneficiary and the *[Clean Sky 2][Bio Based Industries][ECSEL][Fuel Cells and Hydrogen 2][Innovative Medicines Initiative 2][Single European Sky Air Traffic Management Research (SESAR)][Shift2Rail]* Joint Undertaking (*‘the JU’*).

The JU is mentioned as a signatory of the Agreement with the Beneficiary only. The JU is not a party to this engagement.

## **1.1 Subject of the engagement**

According to Article 18.1.2 of the Agreement, beneficiaries *[and linked third parties]* that declare direct personnel costs as unit costs calculated in accordance with their usual cost accounting practices may submit to the JU, for approval by the European Commission (*‘the Commission’*), a certificate on the methodology (*‘CoMUC’*) stating that there are adequate records and documentation to prove that their cost accounting practices used comply with the conditions set out in Point A of Article 6.2.

The subject of this engagement is the CoMUC which is composed of two separate documents:

- the Terms of Reference (*‘the ToR’*) to be signed by the *[Beneficiary]* *[Linked Third Party]* and the Auditor;
- the Auditor’s Independent Report of Factual Findings (*‘the Report’*) issued on the Auditor’s letterhead, dated, stamped and signed by the Auditor which includes; the standard statements (*‘the Statements’*) evaluated and signed by the *[Beneficiary]* *[Linked Third Party]*, the agreed-upon procedures (*‘the Procedures’*) performed by the Auditor and the standard factual findings (*‘the Findings’*) assessed by the Auditor. The Statements, Procedures and Findings are summarised in the table that forms part of the Report.

The information provided through the Statements, the Procedures and the Findings will enable the Commission to draw conclusions regarding the existence of the *[Beneficiary's] [Linked Third Party's]* usual cost accounting practice and its suitability to ensure that direct personnel costs claimed on that basis comply with the provisions of the Agreement. The Commission draws its own conclusions from the Report and any additional information it may require.

## 1.2 Responsibilities

The parties to this agreement are the *[Beneficiary] [Linked Third Party]* and the Auditor.

The *[Beneficiary] [Linked Third Party]*:

- is responsible for preparing financial statements for the Agreement(s) ('the Financial Statements') in compliance with those Agreements;
- is responsible for providing the Financial Statement(s) to the Auditor and enabling the Auditor to reconcile them with the *[Beneficiary's] [Linked Third Party's]* accounting and bookkeeping system and the underlying accounts and records. The Financial Statement(s) will be used as a basis for the procedures which the Auditor will carry out under this ToR;
- is responsible for its Methodology and liable for the accuracy of the Financial Statement(s);
- is responsible for endorsing or refuting the Statements indicated under the heading 'Statements to be made by the Beneficiary/ Linked Third Party' in the first column of the table that forms part of the Report;
- must provide the Auditor with a signed and dated representation letter;
- accepts that the ability of the Auditor to carry out the Procedures effectively depends upon the *[Beneficiary] [Linked Third Party]* providing full and free access to the *[Beneficiary's] [Linked Third Party's]* staff and to its accounting and other relevant records.

The Auditor:

- *[Option 1 by default: is qualified to carry out statutory audits of accounting documents in accordance with Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/660/EEC and 83/349/EEC and repealing Council Directive 84/253/EEC or similar national regulations].*
- *[Option 2 if the Beneficiary or Linked Third Party has an independent Public Officer: is a competent and independent Public Officer for which the relevant national authorities have established the legal capacity to audit the Beneficiary].*
- *[Option 3 if the Beneficiary or Linked Third Party is an international organisation: is an [internal] [external] auditor in accordance with the internal financial regulations and procedures of the international organisation].*

The Auditor:

- must be independent from the Beneficiary *[and the Linked Third Party]*, in particular, it must not have been involved in preparing the Beneficiary's *[and Linked Third Party's]* Financial Statement(s);
- must plan work so that the Procedures may be carried out and the Findings may be assessed;
- must adhere to the Procedures laid down and the compulsory report format;
- must carry out the engagement in accordance with these ToR;
- must document matters which are important to support the Report;
- must base its Report on the evidence gathered;
- must submit the Report to the *[Beneficiary] [Linked Third Party]*.

The Commission sets out the Procedures to be carried out and the Findings to be endorsed by the Auditor. The Auditor is not responsible for their suitability or pertinence. As this engagement is not an assurance engagement the Auditor does not provide an audit opinion or a statement of assurance.

### 1.3 Applicable Standards

The Auditor must comply with these Terms of Reference and with<sup>1</sup>:

- the International Standard on Related Services ('ISRS') 4400 *Engagements to perform Agreed-upon Procedures regarding Financial Information* as issued by the International Auditing and Assurance Standards Board (IAASB);
- the *Code of Ethics for Professional Accountants* issued by the International Ethics Standards Board for Accountants (IESBA). Although ISRS 4400 states that independence is not a requirement for engagements to carry out agreed-upon procedures, the Commission requires that the Auditor also complies with the Code's independence requirements.

The Auditor's Report must state that there was no conflict of interests in establishing this Report between the Auditor and the Beneficiary *[and the Linked Third Party]* that could have a bearing on the Report, and must specify – if the service is invoiced - the total fee paid to the Auditor for providing the Report.

### 1.4 Reporting

The Report must be written in the language of the Agreement (see Article 20.7 of the Agreement).

Under Article 22 of the Agreement, the JU, the Commission, the European Anti-Fraud Office and the Court of Auditors have the right to audit any work that is carried out under the action and for which costs are declared from the European Union budget. This includes work related to this engagement. The Auditor must provide access to all working papers related to this assignment if the JU, the Commission, the European Anti-Fraud Office or the European Court of Auditors requests them.

### 1.5 Timing

The Report must be provided by [dd Month yyyy].

### 1.6 Other Terms

*[The [Beneficiary] [Linked Third Party] and the Auditor can use this section to agree other specific terms, such as the Auditor's fees, liability, applicable law, etc. Those specific terms must not contradict the terms specified above.]*

[legal name of the Auditor]  
[name & title of authorised representative]  
[dd Month yyyy]  
Signature of the Auditor

[legal name of the [Beneficiary] [Linked Third Party]]  
[name & title of authorised representative]  
[dd Month yyyy]  
Signature of the [Beneficiary] [Linked Third Party]

---

<sup>1</sup> Supreme Audit Institutions applying INTOSAI-standards may carry out the Procedures according to the corresponding International Standards of Supreme Audit Institutions and code of ethics issued by INTOSAI instead of the International Standard on Related Services ('ISRS') 4400 and the Code of Ethics for Professional Accountants issued by the IAASB and the IESBA.

**Independent report of factual findings on the methodology concerning grant agreements  
financed by *[Clean Sky 2] [Bio Based Industries][ECSEL][Fuel Cells and Hydrogen  
2][Innovative Medicines Initiative 2][Single European Sky Air Traffic Management Research  
(SESAR)][Shift2Rail] JU*  
under the Horizon 2020 Research and Innovation Framework Programme**

*(To be printed on letterhead paper of the auditor)*

To  
[ name of contact person(s)], [Position]  
[[Beneficiary's] [Linked Third Party's] name]  
[ Address]  
[ dd Month yyyy]

Dear [Name of contact person(s)],

As agreed under the terms of reference dated [dd Month yyyy]

with [OPTION 1: *[insert name of the beneficiary]* ('the Beneficiary')] [OPTION 2: *[insert name of the linked third party]* ('the Linked Third Party'), third party linked to the Beneficiary *[insert name of the beneficiary]* ('the Beneficiary')],

we

[ name of the auditor] ('the Auditor'),  
established at  
[full address/city/state/province/country],  
represented by  
[name and function of an authorised representative],

have carried out the agreed-upon procedures ('the Procedures') and provide hereby our Independent Report of Factual Findings ('the Report'), concerning the *[Beneficiary's] [Linked Third Party's]* usual accounting practices for calculating and declaring direct personnel costs declared as unit costs ('the Methodology').

You requested certain procedures to be carried out in connection with the grant(s)

[title and number of the grant agreement(s)] ('the Agreement(s)').

## **The Report**

Our engagement was carried out in accordance with the terms of reference ('the ToR') appended to this Report. The Report includes: the standard statements ('the Statements') made by the *[Beneficiary] [Linked Third Party]*, the agreed-upon procedures ('the Procedures') carried out and the standard factual findings ('the Findings') confirmed by us.

The engagement involved carrying out the Procedures and assessing the Findings and the documentation requested appended to this Report, the results of which the European Commission ('the Commission') uses to draw conclusions regarding the acceptability of the Methodology applied by the *[Beneficiary] [Linked Third Party]*.

The Report covers the methodology used from [dd Month yyyy]. In the event that the [Beneficiary] [Linked Third Party] changes this methodology, the Report will not be applicable to any Financial Statement<sup>1</sup> submitted thereafter.

The scope of the Procedures and the definition of the standard statements and findings were determined solely by the Commission. Therefore, the Auditor is not responsible for their suitability or pertinence.

Since the Procedures carried out constitute neither an audit nor a review made in accordance with International Standards on Auditing or International Standards on Review Engagements, we do not give a statement of assurance on the costs declared on the basis of the [Beneficiary's] [Linked Third Party's] Methodology. Had we carried out additional procedures or had we performed an audit or review in accordance with these standards, other matters might have come to its attention and would have been included in the Report.

## Exceptions

Apart from the exceptions listed below, the [Beneficiary] [Linked Third Party] agreed with the standard Statements and provided the Auditor all the documentation and accounting information needed by the Auditor to carry out the requested Procedures and corroborate the standard Findings.

**List here any exception and add any information on the cause and possible consequences of each exception, if known. If the exception is quantifiable, also indicate the corresponding amount.**

.....

*Explanation of possible exceptions in the form of examples (to be removed from the Report):*

- i. the [Beneficiary] [Linked Third Party] did not agree with the standard Statement number ... because...;
- ii. the Auditor could not carry out the procedure ... established because .... (e.g. due to the inability to reconcile key information or the unavailability or inconsistency of data);
- iii. the Auditor could not confirm or corroborate the standard Finding number ... because ....

## Remarks

We would like to add the following remarks relevant for the proper understanding of the Methodology applied by the [Beneficiary] [Linked Third Party] or the results reported:

*Example (to be removed from the Report):*

*Regarding the methodology applied to calculate hourly rates ...*

*Regarding standard Finding 15 it has to be noted that ...*

*The [Beneficiary] [Linked Third Party] explained the deviation from the benchmark statement XXIV concerning time recording for personnel with no exclusive dedication to the action in the following manner:*

...

## Annexes

Please provide the following documents to the auditor and annex them to the report when submitting this CoMUC to the JU:

<sup>1</sup> Financial Statement in this context refers solely to Annex 4 of the Agreement by which the Beneficiary declares costs under the Agreement.

1. Brief description of the methodology for calculating personnel costs, productive hours and hourly rates;
2. Brief description of the time recording system in place;
3. An example of the time records used by the [Beneficiary] [Linked Third Party];
4. Description of any budgeted or estimated elements applied, together with an explanation as to why they are relevant for calculating the personnel costs and how they are based on objective and verifiable information;
5. A summary sheet with the hourly rate for direct personnel declared by the [Beneficiary] [Linked Third Party] and recalculated by the Auditor for each staff member included in the sample (the names do not need to be reported);
6. A comparative table summarising for each person selected in the sample a) the time claimed by the [Beneficiary] [Linked Third Party] in the Financial Statement(s) and b) the time according to the time record verified by the Auditor;
7. A copy of the letter of representation provided to the Auditor.

### Use of this Report

This Report has been drawn up solely for the purpose given under Point 1.1 Reasons for the engagement.

#### The Report:

- is confidential and is intended to be submitted to the JU by the [Beneficiary] [Linked Third Party] in connection with Article 18.1.2 of the Agreement;
- may not be used by the [Beneficiary] [Linked Third Party], by the JU or by the Commission for any other purpose, nor distributed to any other parties;
- may be disclosed by the JU or by the Commission only to authorised parties, in particular the European Anti-Fraud Office (OLAF) and the European Court of Auditors.
- relates only to the usual cost accounting practices specified above and does not constitute a report on the Financial Statements of the [Beneficiary] [Linked Third Party].

No conflict of interest<sup>2</sup> exists between the Auditor and the Beneficiary [and the Linked Third Party] that could have a bearing on the Report. The total fee paid to the Auditor for producing the Report was EUR [ ] (including EUR [ ] of deductible VAT).

We look forward to discussing our Report with you and would be pleased to provide any further information or assistance which may be required.

Yours sincerely

[legal name of the Auditor]

[name and title of the authorised representative]

[dd Month yyyy]

Signature of the Auditor

---

<sup>2</sup> A conflict of interest arises when the Auditor's objectivity to establish the certificate is compromised in fact or in appearance when the Auditor for instance:

- was involved in the preparation of the Financial Statements;
- stands to benefit directly should the certificate be accepted;
- has a close relationship with any person representing the beneficiary;
- is a director, trustee or partner of the beneficiary; or
- is in any other situation that compromises his or her independence or ability to establish the certificate impartially.

**Statements to be made by the Beneficiary/Linked Third Party ('the Statements') and Procedures to be carried out by the Auditor ('the Procedures') and standard factual findings ('the Findings') to be confirmed by the Auditor**

The European Commission ('the Commission') reserves the right to provide the auditor with guidance regarding the Statements to be made, the Procedures to be carried out or the Findings to be ascertained and the way in which to present them. The Commission reserves the right to vary the Statements, Procedures or Findings by written notification to the Beneficiary/Linked Third Party to adapt the procedures to changes in the grant agreement(s) or to any other circumstances.

If this methodology certificate relates to the Linked Third Party's usual accounting practices for calculating and claiming direct personnel costs declared as unit costs any reference here below to 'the Beneficiary' is to be considered as a reference to 'the Linked Third Party'.

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<b>A. Use of the Methodology</b>  I. The cost accounting practice described below has been in use since [dd Month yyyy].  II. The next planned alteration to the methodology used by the Beneficiary will be from [dd Month yyyy].	<b>Procedure:</b>  ✓ The Auditor checked these dates against the documentation the Beneficiary has provided.  <b>Factual finding:</b>  1. The dates provided by the Beneficiary were consistent with the documentation.
<b>B. Description of the Methodology</b>  III. The methodology to calculate unit costs is being used in a consistent manner and is reflected in the relevant procedures.  <i>[Please describe the methodology your entity uses to calculate <u>personnel</u> costs, productive hours and hourly rates, present your description to the Auditor and annex it to this certificate]</i>  <i>[If the statement of section "B. Description of the methodology" cannot be endorsed by the Beneficiary or there is no written methodology to calculate unit costs it should be listed here below and reported as exception by the Auditor in the main Report of Factual Findings: - ...]</i>	<b>Procedure:</b>  ✓ The Auditor reviewed the description, the relevant manuals and/or internal guidance documents describing the methodology.  <b>Factual finding:</b>  2. The brief description was consistent with the relevant manuals, internal guidance and/or other documentary evidence the Auditor has reviewed.  3. The methodology was generally applied by the Beneficiary as part of its usual costs accounting practices.
<b>C. Personnel costs</b>	<b>Procedure:</b>

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<u>General</u>	
IV. The unit costs (hourly rates) are limited to salaries including during parental leave, social security contributions, taxes and other costs included in the remuneration required under national law and the employment contract or equivalent appointing act;	<p><i>The Auditor draws a sample of employees to carry out the procedures indicated in this section C and the following sections D to F.</i>  <i>[The Auditor has drawn a random sample of 10 employees assigned to Horizon 2020 action(s). If fewer than 10 employees are assigned to the Horizon 2020 action(s), the Auditor has selected all employees assigned to the Horizon 2020 action(s), complemented by other employees irrespective of their assignments until he has reached 10 employees.]. For this sample:</i></p> <ul style="list-style-type: none"> <li>✓ the Auditor reviewed all documents relating to personnel costs such as employment contracts, payslips, payroll policy (e.g. salary policy, overtime policy, variable pay policy), accounting and payroll records, applicable national tax, labour and social security law and any other documents corroborating the personnel costs claimed;</li> <li>✓ in particular, the Auditor reviewed the employment contracts of the employees in the sample to verify that: <ul style="list-style-type: none"> <li>i. they were employed directly by the Beneficiary in accordance with applicable national legislation;</li> <li>ii. they were working under the sole technical supervision and responsibility of the latter;</li> <li>iii. they were remunerated in accordance with the Beneficiary's usual practices;</li> <li>iv. they were allocated to the correct group/category/cost centre for the purposes of calculating the unit cost in line with the Beneficiary's usual cost accounting practices;</li> </ul> </li> <li>✓ the Auditor verified that any ineligible items or any costs claimed under other costs categories or costs covered by other types of grant or by other grants financed from the European Union budget have not been taken into account when calculating the personnel costs;</li> <li>✓ the Auditor numerically reconciled the total amount of personnel costs used to calculate the unit cost with the total amount of personnel costs recorded in the statutory accounts and the payroll system.</li> <li>✓ to the extent that actual personnel costs were adjusted on the basis of budgeted or estimated elements, the Auditor carefully examined those elements and checked the information source to confirm that they correspond to objective and verifiable information;</li> </ul>
V. Employees are hired directly by the Beneficiary in accordance with national law, and work under its sole supervision and responsibility;	
VI. The Beneficiary remunerates its employees in accordance with its usual practices. This means that personnel costs are charged in line with the Beneficiary's usual payroll policy (e.g. salary policy, overtime policy, variable pay) and no special conditions exist for employees assigned to tasks relating to the European Union or Euratom, unless explicitly provided for in the grant agreement(s);	
VII. The Beneficiary allocates its employees to the relevant group/category/cost centre for the purpose of the unit cost calculation in line with the usual cost accounting practice;	
VIII. Personnel costs are based on the payroll system and accounting system.	
IX. Any exceptional adjustments of actual personnel costs resulted from relevant budgeted or estimated elements and were based on objective and verifiable information. <i>[Please describe the 'budgeted or estimated elements' and their relevance to personnel costs, and explain how they were reasonable and based on objective and verifiable information, present your explanation to the Auditor and annex it to this certificate].</i>	
X. Personnel costs claimed do not contain any of the following ineligible costs: costs related to return on capital; debt and debt service charges; provisions for future losses or debts; interest owed; doubtful debts; currency exchange losses; bank costs charged by the Beneficiary's bank for transfers from the JU; excessive or reckless expenditure; deductible VAT or costs incurred during suspension of the implementation of the action.	
XI. Personnel costs were not declared under another EU or Euratom grant (including grants awarded by a Member State and financed by the EU budget and grants awarded by bodies other than the JU for the purpose of implementing the EU or Euratom budget in the same period, unless the Beneficiary can demonstrate that the operating grant does not cover any costs of the action).	

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<p><u>If additional remuneration as referred to in the grant agreement(s) is paid</u></p> <p>XII. The Beneficiary is a non-profit legal entity;</p> <p>XIII. The additional remuneration is part of the beneficiary's usual remuneration practices and paid consistently whenever the relevant work or expertise is required;</p> <p>XIV. The criteria used to calculate the additional remuneration are objective and generally applied regardless of the source of funding;</p> <p>XV. The additional remuneration included in the personnel costs used to calculate the hourly rates for the grant agreement(s) is capped at EUR 8 000 per full-time equivalent (reduced proportionately if the employee is not assigned exclusively to the action).</p> <p><i>[If certain statement(s) of section "C. Personnel costs" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor in the main Report of Factual Findings:</i>  - ...]</p>	<p>✓ if additional remuneration has been claimed, the Auditor verified that the Beneficiary was a non-profit legal entity, that the amount was capped at EUR 8 000 per full-time equivalent and that it was reduced proportionately for employees not assigned exclusively to the action(s).</p> <p>✓ the Auditor recalculated the personnel costs for the employees in the sample.</p> <p><b>Factual finding:</b></p> <ol style="list-style-type: none"> <li>All the components of the remuneration that have been claimed as personnel costs are supported by underlying documentation.</li> <li>The employees in the sample were employed directly by the Beneficiary in accordance with applicable national law and were working under its sole supervision and responsibility.</li> <li>Their employment contracts were in line with the Beneficiary's usual policy;</li> <li>Personnel costs were duly documented and consisted solely of salaries, social security contributions (pension contributions, health insurance, unemployment fund contributions, etc.), taxes and other statutory costs included in the remuneration (holiday pay, thirteenth month's pay, etc.);</li> <li>The totals used to calculate the personnel unit costs are consistent with those registered in the payroll and accounting records;</li> <li>To the extent that actual personnel costs were adjusted on the basis of budgeted or estimated elements, those elements were relevant for calculating the personnel costs and correspond to objective and verifiable information. The budgeted or estimated elements used are: — (indicate the elements and their values).</li> <li>Personnel costs contained no ineligible elements;</li> <li>Specific conditions for eligibility were fulfilled when additional remuneration was paid: a) the Beneficiary is registered in the grant agreements as a non-profit legal entity; b) it was paid according to objective criteria generally applied regardless of the source of funding used and c) remuneration was capped at EUR 8 000 per full-time equivalent (or up to up to the equivalent pro-rata amount if the person did not work on the action full-time during the year or did not work</li> </ol>

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
	exclusively on the action).
<p><b>D. Productive hours</b></p> <p>XVI. The number of productive hours per full-time employee applied is <i>[delete as appropriate]</i>:</p> <p>A. 1720 productive hours per year for a person working full-time (corresponding pro-rata for persons not working full time).</p> <p>B. the total number of hours worked in the year by a person for the Beneficiary</p> <p>C. the standard number of annual hours generally applied by the beneficiary for its personnel in accordance with its usual cost accounting practices. This number must be at least 90% of the standard annual workable hours.</p> <p><u>If method B is applied</u></p> <p>XVII. The calculation of the total number of hours worked was done as follows: annual workable hours of the person according to the employment contract, applicable labour agreement or national law plus overtime worked minus absences (such as sick leave and special leave).</p> <p>XVIII. ‘Annual workable hours’ are hours during which the personnel must be working, at the employer’s disposal and carrying out his/her activity or duties under the employment contract, applicable collective labour agreement or national working time legislation.</p> <p>XIX. The contract (applicable collective labour agreement or national working time legislation) do specify the working time enabling to calculate the annual workable hours.</p> <p><u>If method C is applied</u></p> <p>XX. The standard number of productive hours per year is that of a full-time equivalent.</p> <p>XXI. The number of productive hours per year on which the hourly rate is based i) corresponds to the Beneficiary’s usual accounting practices; ii) is at least 90% of the standard number of workable (working) hours per year.</p>	<p><b>Procedure (same sample basis as for Section C: Personnel costs):</b></p> <ul style="list-style-type: none"> <li>✓ The Auditor verified that the number of productive hours applied is in accordance with method A, B or C.</li> <li>✓ The Auditor checked that the number of productive hours per full-time employee is correct.</li> <li>✓ If method B is applied the Auditor verified i) the manner in which the total number of hours worked was done and ii) that the contract specified the annual workable hours by inspecting all the relevant documents, national legislation, labour agreements and contracts.</li> <li>✓ If method C is applied the Auditor reviewed the manner in which the standard number of working hours per year has been calculated by inspecting all the relevant documents, national legislation, labour agreements and contracts and verified that the number of productive hours per year used for these calculations was at least 90% of the standard number of working hours per year.</li> </ul> <p><b>Factual finding:</b></p> <p><u>General</u></p> <p>12. The Beneficiary applied a number of productive hours consistent with method A, B or C detailed in the left-hand column.</p> <p>13. The number of productive hours per year per full-time employee was accurate.</p> <p><u>If method B is applied</u></p> <p>14. The number of ‘annual workable hours’, overtime and absences was verifiable based on the documents provided by the Beneficiary and the calculation of the total number of hours worked was accurate.</p> <p>15. The contract specified the working time enabling to calculate the annual workable hours.</p> <p><u>If method C is applied</u></p> <p>16. The calculation of the number of productive hours per year corresponded</p>

<b>Please explain any discrepancies in the body of the Report.</b>	
<b>Statements to be made by Beneficiary</b>	<b>Procedures to be carried out and Findings to be confirmed by the Auditor</b>
<p>XXII. Standard workable (working) hours are hours during which personnel are at the Beneficiary's disposal performing the duties described in the relevant employment contract, collective labour agreement or national labour legislation. The number of standard annual workable (working) hours that the Beneficiary claims is supported by labour contracts, national legislation and other documentary evidence.</p> <p><i>[If certain statement(s) of section "D. Productive hours" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor: - ...]</i></p>	<p>to the usual costs accounting practice of the Beneficiary.</p> <p>17. The calculation of the standard number of workable (working) hours per year was corroborated by the documents presented by the Beneficiary.</p> <p>18. The number of productive hours per year used for the calculation of the hourly rate was at least 90 % of the number of workable (working) hours per year.</p>
<p><b>E. Hourly rates</b></p> <p>The hourly rates are correct because:</p> <p>XXIII. Hourly rates are correctly calculated since they result from dividing annual personnel costs by the productive hours of a given year and group (e.g. staff category or department or cost centre depending on the methodology applied) and they are in line with the statements made in section C. and D. above.</p> <p><i>[If the statement of section 'E. Hourly rates' cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor: - ...]</i></p>	<p><b>Procedure</b></p> <ul style="list-style-type: none"> <li>✓ The Auditor has obtained a list of all personnel rates calculated by the Beneficiary in accordance with the methodology used.</li> <li>✓ The Auditor has obtained a list of all the relevant employees, based on which the personnel rate(s) are calculated.</li> </ul> <p>For 10 employees selected at random (same sample basis as Section C: Personnel costs):</p> <ul style="list-style-type: none"> <li>✓ The Auditor recalculated the hourly rates.</li> <li>✓ The Auditor verified that the methodology applied corresponds to the usual accounting practices of the organisation and is applied consistently for all activities of the organisation on the basis of objective criteria irrespective of the source of funding.</li> </ul> <p><b>Factual finding:</b></p> <p>19. No differences arose from the recalculation of the hourly rate for the employees included in the sample.</p>
<p><b>F. Time recording</b></p> <p>XXIV. Time recording is in place for all persons with no exclusive dedication to one Horizon 2020 action. At least all hours worked in connection with the grant agreement(s) are registered on a <b>daily/weekly/monthly</b> basis <i>[delete as appropriate]</i> using a <b>paper/computer-based system</b> <i>[delete as appropriate]</i>;</p> <p>XXV. For persons exclusively assigned to one Horizon 2020 activity the Beneficiary has either signed a declaration to that effect or has put</p>	<p><b>Procedure</b></p> <ul style="list-style-type: none"> <li>✓ The Auditor reviewed the brief description, all relevant manuals and/or internal guidance describing the methodology used to record time.</li> </ul> <p>The Auditor reviewed the time records of the random sample of 10 employees referred to under Section C: Personnel costs, and verified in particular:</p>

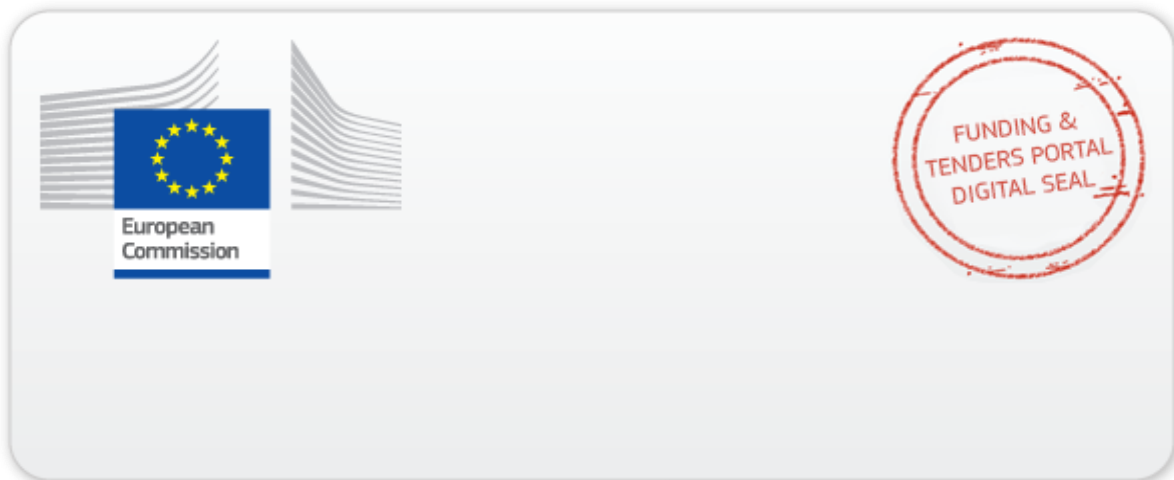
<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<p>arrangements in place to record their working time;</p> <p>XXVI. Records of time worked have been signed by the person concerned (on paper or electronically) and approved by the action manager or line manager at least monthly;</p> <p>XXVII. Measures are in place to prevent staff from:</p> <ul style="list-style-type: none"> <li>i. recording the same hours twice,</li> <li>ii. recording working hours during absence periods (e.g. holidays, sick leave),</li> <li>iii. recording more than the number of productive hours per year used to calculate the hourly rates, and</li> <li>iv. recording hours worked outside the action period.</li> </ul> <p>XXVIII. No working time was recorded outside the action period;</p> <p>XXIX. No more hours were claimed than the productive hours used to calculate the hourly personnel rates.</p> <p><i>[Please provide a brief description of the <u>time recording system</u> in place together with the measures applied to ensure its reliability to the Auditor and annex it to the present certificate<sup>1</sup>].</i></p> <p><i>[If certain statement(s) of section “F. Time recording” cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor: - ...]</i></p>	<ul style="list-style-type: none"> <li>✓ that time records were available for all persons with not exclusive assignment to the action;</li> <li>✓ that time records were available for persons working exclusively for a Horizon 2020 action, or, alternatively, that a declaration signed by the Beneficiary was available for them certifying that they were working exclusively for a Horizon 2020 action;</li> <li>✓ that time records were signed and approved in due time and that all minimum requirements were fulfilled;</li> <li>✓ that the persons worked for the action in the periods claimed;</li> <li>✓ that no more hours were claimed than the productive hours used to calculate the hourly personnel rates;</li> <li>✓ that internal controls were in place to prevent that time is recorded twice, during absences for holidays or sick leave; that more hours are claimed per person per year for Horizon 2020 actions than the number of productive hours per year used to calculate the hourly rates; that working time is recorded outside the action period;</li> <li>✓ the Auditor cross-checked the information with human-resources records to verify consistency and to ensure that the internal controls have been effective. In addition, the Auditor has verified that no more hours were charged to Horizon 2020 actions per person per year than the number of productive hours per year used to calculate the hourly rates, and verified that no time worked outside the action period was charged to the action.</li> </ul> <p><b>Factual finding:</b></p> <p>20. The brief description, manuals and/or internal guidance on time recording provided by the Beneficiary were consistent with management</p>

<sup>1</sup> The description of the time recording system must state among others information on the content of the time records, its coverage (full or action time-recording, for all personnel or only for personnel involved in H2020 actions), its degree of detail (whether there is a reference to the particular tasks accomplished), its form, periodicity of the time registration and authorisation (paper or a computer-based system; on a daily, weekly or monthly basis; signed and countersigned by whom), controls applied to prevent double-charging of time or ensure consistency with HR-records such as absences and travels as well as its information flow up to its use for the preparation of the Financial Statements.

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
	<p>reports/records and other documents reviewed and were generally applied by the Beneficiary to produce the financial statements.</p> <p>21. For the random sample time was recorded or, in the case of employees working exclusively for the action, either a signed declaration or time records were available;</p> <p>22. For the random sample the time records were signed by the employee and the action manager/line manager, at least monthly.</p> <p>23. Working time claimed for the action occurred in the periods claimed;</p> <p>24. No more hours were claimed than the number productive hours used to calculate the hourly personnel rates;</p> <p>25. There is proof that the Beneficiary has checked that working time has not been claimed twice, that it is consistent with absence records and the number of productive hours per year, and that no working time has been claimed outside the action period.</p> <p>26. Working time claimed is consistent with that on record at the human-resources department.</p>

*[official name of the [Beneficiary] [Linked Third Party]]*  
*[name and title of authorised representative]*  
*[dd Month yyyy]*  
*<Signature of the [Beneficiary] [Linked Third Party]>*

*[official name of the Auditor]*  
*[name and title of authorised representative]*  
*[dd Month yyyy]*  
*<Signature of the Auditor>*



This document is digitally sealed. The digital sealing mechanism uniquely binds the document to the modules of the Funding & Tenders Portal of the European Commission, to the transaction for which it was generated and ensures its integrity and authenticity.

Any attempt to modify the content will lead to a breach of the electronic seal, which can be verified at any time by clicking on the digital seal validation symbol.