GRANT AGREEMENT

FOR MEMBERS [2] NUMBER — 734141 — PJ16 CWP HMI

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

on the one part,

The Single European Sky ATM (Air Trafic Management) Research Joint Undertaking ('the JU'), a joint undertaking within the meaning of Article 187 of the Treaty on the Functioning of the European Union[1], set-up by Council Regulation (EC) No 219/2007 of 27 February 2007 on the establishment of a Joint Undertaking to develop the new generation European air traffic management system[2], as amended by Council Regulation (EC) No 1361/2008 of 16 December 2008[3] and by Council Regulation (EU) No 721/2014 of 16 June 2014[4]

represented for the purposes of signature of this Framework Partnership Agreement by its Executive Director M. Florian GUILLERMET,

and

on the other part,

1. 'the coordinator ':

THALES AIR SYSTEMS SAS (THALES AIR SYS) SAS, 319159877, established in AVENUE CHARLES LINDBERGH 3, RUNGIS 94150, France, FR15319159877 represented for the purposes of signing the Agreement by PMO SESAR Director, Luc LALLOUETTE

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

2. **RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK (ANS CR (B4))** SP, 49710371, established in Navigacni 787, Jenec 25261, Czech Republic, CZ49710371

3. **LETOVE PREVADZKOVE SLUZBY SLOVENSKEJ REPUBLIKY, STATNY PODNIK (LPS SR (B4))** SK9, 35778458, established in IVANSKA CESTA 93, BRATISLAVA 823 07, Slovakia, SK2020244699

4. **AUSTRO CONTROL OSTERREICHISCHE GESELLSCHAFT FUR ZIVILLUFTFAHRT MBH (ACG/COOPANS)** GMBH, FN71000M, established in WAGRAMER STRASSE 19, WIEN 1220, Austria, ATU37259408

5. **CROATIA CONTROL, CROATIAN AIR NAVIGATION SERVICES LTD (CCL/ COOPANS)** DOO, 080328617, established in RUDOLFA FIZIRA 2, VELIKA GORICA 10410, Croatia, HR33052761319

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2 '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.

1 OJ C 326, 26.10.2012, p. 47–390.

2 OJ L 64, 2.3.2007, p. 1–11.

3 OJ L 352, 31.12.2008, p. 12–17.

4 OJ L 192, 1.7.2014, p. 1–8.

6. **UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY (IAA/ COOPANS)** LTD, 211082, established in D'OLIER STREET 11-12 THE TIMES BUILDING, DUBLIN D02 T449, Ireland, IE8211082B

7. **LUFTFARTSVERKET (LFV/COOPANS)**, 2021000795, established in HOSPITALSGATAN 30, NORRKOPING 602 27, Sweden, SE202100079501

8. **NAVIAIR (Naviair/COOPANS)** DK18, 26059763, established in NAVIAIR ALLE 1, KASTRUP 2770, Denmark, DK26059763

9. **DFS DEUTSCHE FLUGSICHERUNG GMBH (DFS)** GMBH, HRB34977, established in AM DFS CAMPUS 10, LANGEN 63225, Germany, DE114110232

10. **DIRECTION DES SERVICES DE LA NAVIGATION AERIENNE (DSNA)**, 120064019, established in 50 RUE HENRY FARMAN, PARIS 75720, France, FR29120064019

11. **ENTIDAD PUBLICA EMPRESARIAL ENAIRE (ENAIRE)**, established in CALLE ARTURO SORIA 109, MADRID 28043, Spain, ESQ2822001J

12. **ENAV SPA (ENAV)** SPA, 965162/CF97016000586, established in VIA SALARIA 716, ROMA 00138, Italy, IT02152021008

13. **NATS (EN ROUTE) PUBLIC LIMITED COMPANY (NATS)** LTD, 04129273, established in 4000 PARKWAY WHITELEY, FAREHAM PO15 7FL, United Kingdom, GB440379456

14. **SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIENNE CIVILS ET MILITAIRES (SKYGUIDE)** SA, CH03530005515, established in ROUTE DE PRE BOIS 15-17, GENEVA 1215, Switzerland, CH514204

*15. **EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION (EUROCONTROL)**, N/A, established in Rue de la Fusée 96, BRUXELLES 1130, Belgium, not applicable* as 'beneficiary not receiving JU funding' (see Article 9),

16. **DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV (DLR (AT-One))** EV, VR2780, established in Linder Hoehe, KOELN 51147, Germany, DE121965658

17. **FREQUENTIS AG (FRQ (FSP))** AG, FN72115B, established in Innovationsstrasse 1, WIEN 1100, Austria, ATU14715600

18. **HUNGAROCONTROL MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG (HC (FSP))** RT, 0110045570, established in IGLO UTCA 33 35, BUDAPEST 1185, Hungary, HU13851325

19. **STIFTELSEN SINTEF (SINTEF (NATMIG))** NO1, 948007029, established in STRINDVEIEN 4, TRONDHEIM 7034, Norway, NO948007029MVA

20. **INDRA SISTEMAS SA (INDRA)** SA, M11339, established in AVENIDA DE BRUSELAS 35, ALCOBENDAS MADRID 28108, Spain, ESA28599033

21. **LEONARDO - FINMECCANICA SPA (FINMECCANICA)** SPA, 7031/CF00401990585, established in PIAZZA MONTE GRAPPA 4, ROMA 00195, Italy, IT00881841001

22. **VALSTYBES IMONE ORO NAVIGACIJA (ON (B4))** LT7, 210060460, established in RODUNIOS KEL 2, VILNIAUS 02188, Lithuania, LT100604610

23. **POLSKA AGENCJA ZEGLUGI POWIETRZNEJ (PANSA (B4))**, 140886771, established in UL. WIEZOWA 8, WARSZAWA 02 147, Poland, PL5222838321

24. **STICHTING NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM (NLR (AT-One))** NL6, 41150373, established in Anthony Fokkerweg 2, AMSTERDAM 1059CM, Netherlands, NL002760551B01

25. **ATOS BELGIUM (ATOS (FSP))** NV, 401848135, established in DA VINCILAAN 5, ZAVENTEM 1930, Belgium, BE0401848135

26. **AIRTEL ATN LIMITED (AIRTEL (NATMIG))** LTD, 287698, established in 2 HARBOUR SQUARE CROFTON ROAD, DUN LOAGHAIRE DUBLIN A96D6R0, Ireland, IE8287698U

27. **SAAB AKTIEBOLAG (SAAB (NATMIG))** AB, 5560360793, established in ., LINKOPING 58188, Sweden, SE556036079301

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

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

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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 '**Controller Working Position / Human Machine Interface - CWP/HMI — PJ16 CWP HMI ' ('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-2015-2.

ARTICLE 3 — DURATION AND STARTING DATE OF THE ACTION

The duration of the action will be **38 months** as of the first day of the month following the date the Agreement enters into force (see Article 58) ('**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 contains 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 by transfers of amounts between beneficiaries or between budget categories (or both). This does not require an amendment according to Article 55, 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 2,608,680.16** (two million six hundred and eight thousand six hundred and eighty EURO and sixteen 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 **18,373,934.50** (eighteen million three hundred and seventy three thousand nine hundred and thirty four EURO and fifty 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 2 (**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**: 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 improper implementation or breach of other 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 improper implementation or breach of other 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 improper implementation of the action or to the seriousness of the 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 its improper implementation of the action or to the seriousness of its 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 2 or calculated by the beneficiary in accordance with its usual cost accounting practices (see Article 6.2, Point A)

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[5] 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 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:

{{EUR 8 000

divided by

the number of annual productive hours (see below)},

multiplied by

the number of hours that the person has worked on the action during the year}.

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 the beneficiary's instructions and, unless otherwise agreed with the beneficiary, on the beneficiary's premises;

(b) the result of the work carried out belongs to the beneficiary, and

[5] 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 2 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 2 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 is:

{the 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:** the hourly rate is the amount calculated as follows:

{actual annual personnel costs (excluding additional remuneration) for the person

divided by

number of annual productive hours}.

The beneficiaries must use the annual personnel costs and the number of annual productive hours for each financial year covered by the reporting period. 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;

(b) for personnel costs declared on the basis of **unit costs**: 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 2 (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'**[6] directly used for the action are eligible, if:

(a) the value of the large research infrastructure represents at least 75% of the total fixed assets (at historical value 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[7]);

(b) the beneficiary's methodology for declaring the costs for large research infrastructure has been positively assessed by the Commission ('**ex-ante assessment**');

(c) the beneficiary declares as direct eligible costs only the portion which corresponds to the duration of the action and the rate of actual use for the purposes of the action, and

(d) they comply with the conditions as further detailed in the annotations to the H2020 grant agreements.

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.

[6] '**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.

[7] For the definition, see Article 2(6) of Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) (OJ L 347, 20.12.2013 p.104)-('**Horizon 2020 Framework Programme Regulation No 1291/2013**'): '**Research infrastructure**' are facilities, resources and services that are used by the research communities to conduct research and foster innovation in their fields. Where relevant, they may be used beyond research, e.g. for education or public services. They include: major scientific equipment (or sets of instruments); knowledge-based resources such as collections, archives or scientific data; e-infrastructures such as data and computing systems and communication networks; and any other infrastructure of a unique nature essential to achieve excellence in research and innovation. Such infrastructures may be 'single-sited', 'virtual' or 'distributed'.

Beneficiaries receiving an operating grant[8] financed by the EU or Euratom budget cannot declare indirect costs for the period covered by the operating grant.

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;

(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

[8] 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 (OJ L 218, 26.10.2012, p.1) ('**Financial Regulation No 966/2012**'): '**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.

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.

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).

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 not receiving JU funding must implement the action tasks attributed to them in Annex 1 according to 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 (with the exception of additional exploitation obligations), 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.

9.2 Consequences of non-compliance

If a beneficiary not receiving JU funding breaches any of its obligations under this Article, its participation of 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[9] or 'contracting entities' within the meaning of Directive 2004/17/EC[10] must comply with the applicable national law on public procurement.

[9] 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).

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.

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.

[10] 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).

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 'contracting entities' within the meaning of Directive 2004/17/EC 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**[12] and **third parties with a legal link to a beneficiary**[13] ('**linked third parties**') may implement the action tasks attributed to them in Annex 1:

- INTEGRA CONSULT AS (Integra), affiliated or linked to ANS CR (B4)
- 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)
- CONSORZIO SICTA SISTEMI INNOVATIVIPER IL CONTROLLO DELTRAFFICO AEREO (SICTA), affiliated or linked to ENAV, if it has accepted joint and several liability with the beneficiary (see Annex 3a)
- DARJAVNO PREDPRIYATIE RAKOVODSTVO NA VAZDUSHNOTO DVIJENIE TPP (Bulatsa), affiliated or linked to ENAV
- NEXTANT APPLICATIONS & INNOVATIVE SOLUTION SRL (NAIS), affiliated or linked to ENAV

[12] For the definition, see Article 2.1(2) of the 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.

[13] '**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.

- AVINOR FLYSIKRING AS (Avinor ANS), affiliated or linked to NATS

- SKYSOFT-ATM SA (SKYSOFTATM), affiliated or linked to SKYGUIDE, if it has accepted joint and several liability with the beneficiary (see Annex 3a)

- PDTS GMBH (PDTS), affiliated or linked to FRQ (FSP)

- ADMINISTRATIA ROMANA A SERVICIILOR DE TRAFIC AERIAN (ROMATSA), affiliated or linked to INDRA, 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) 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 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 '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 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 Articles 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 direct personnel costs declared as 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, Point A.

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 14
- RP2: from month 15 to month 26
- RP3: from month 27 to month 38

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 also 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**';

(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 key performance indicators and monitoring requirements of Horizon 2020 and the JU;

(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**' (see Annex 4), 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**' (see Annex 4), 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, Point A).

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 — Suspension of the payment deadline — Termination

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 sent by the JU, the Agreement may be terminated (see Article 50).

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 **2,086,948.01** (two million eighty six thousand nine hundred and forty eight EURO and one 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 **130,434.01** (one hundred and thirty thousand four hundred and thirty four EURO and one 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:

{90% of the maximum grant amount (see Article 5.1)

minus

{pre-financing and previous interim payments}}.

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:

{final grant amount (see Article 5.3)

minus

{pre-financing and interim payments (if any) made}}.

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 beneficiary's consent — against any other amount owed by the 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: BNP PARIBAS
Address of branch: 83, AV CHARLES DE GAULLE PARIS, France
Full name of the account holder: THALES AIR SYSTEMS SA
Full account number (including bank codes):
IBAN code: FR7630004008130001066651851

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[18] and No 2185/96[19], Article 110 of the Financial Rules of the JU[20] (and in accordance with their provisions and procedures), 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 Financial Rules of the JU, 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).

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[18] 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).

[19] 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).

[20] The SESAR JU Financial Rules are made publicly available on the SESAR JU official website.

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**’).

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 amounts to be rejected will be determined on the basis of the revised financial statements, subject to their approval.

If the JU or the Commission 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, it will formally notify the beneficiary concerned the application of the initially notified correction rate for extrapolation.

If the JU or the Commission accepts the alternative correction method proposed by the beneficiary concerned, it will formally notify the application of the accepted alternative correction method.

22.5.3.2 If the findings concern **improper implementation** or a **breach of another obligation**: 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.

If the JU or the Commission does not receive any observations or does not accept the observations or the proposed alternative flat-rate, it will formally notify the beneficiary concerned the application of the initially notified flat-rate.

If the JU or the Commission accepts the alternative flat-rate proposed by the beneficiary concerned, it will formally notify the application of the accepted 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[21].

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.

[21] 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.

24.2 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 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[22] established in an EU Member State or '**associated country**'[23], 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

The beneficiaries must give - under the conditions set out in Article 25.2 - access to their background to the complementary beneficiary[24] (see Article 2).

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:

[22] For the definition, see 'affiliated entity' footnote (Article 14.1).

[23] 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.

[24] '**Complementary beneficiary**' means a beneficiary of the complementary grant agreement.

(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).

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 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 FUNDING

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 funding

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 under grant agreement No 734141 under European Union's Horizon 2020 research and innovation programme"* .

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.

In addition, the beneficiaries must — up to four years after the period set out in Article 3 — comply with the additional exploitation obligations set out in Annex 1.

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 funding

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 under grant agreement No 734141 under European Union's Horizon 2020 research and innovation programme"* .

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 FUNDING

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).

In addition, the beneficiaries must comply with the additional dissemination obligations set out in Annex 1.

Moreover, the beneficiaries must — up to four years after the period set out in Article 3 — disseminate any technical specifications of the results that are needed for interoperability.

Moreover, the beneficiaries must — up to four years after the period set out in Article 3 — disseminate the deliverables relating to cross-border interoperability (see Annex 1) and any results needed for cross-border interoperability (in particular common technical specifications and software components).

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 funding — 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;

(b) display the EU emblem and

(c) include the following text:

"This project has received funding from the SESAR Joint Undertaking under grant agreement No 734141 under European Union's Horizon 2020 research and innovation programme" .

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 or 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 rights under Article 31 and

(b) the beneficiary complies with its additional exploitation obligations (see Article 28.1 and Annex 1).

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

The JU may — up to four years after the period set out in Article 3 — object to a transfer of ownership or the exclusive licensing of results, if:

(a) it is to a third party established in a non-EU country not associated with Horizon 2020 and

(b) the JU considers that the transfer or licence is not in line with EU interests regarding competitiveness or is inconsistent with ethical principles or security considerations.

A beneficiary that intends to transfer ownership or grant an exclusive licence must formally notify the JU before the intended transfer or licensing takes place and:

- identify the specific results concerned;

- describe in detail the new owner or licensee and the planned or potential exploitation of the results, and

- include a reasoned assessment of the likely impact of the transfer or licence on EU competitiveness and its consistency with ethical principles and security considerations.

The JU may request additional information.

If the JU decides to object to a transfer or exclusive licence, it must formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information it has requested).

No transfer or licensing may take place in the following cases:

- pending the JU decision, within the period set out above;

- if the JU objects;

- until the conditions are complied with, if the JU objection comes with conditions.

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, EU institutions, bodies, offices or agencies and EU Member States

The beneficiaries must give access to their results — on a royalty-free basis — to EU institutions, 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 and 31.3 — access to their results to complementary beneficiaries[24], for the purposes of the complementary grant agreement(s) (see Article 2).

The beneficiaries must give third parties — up to four years after the period set out in Article 3 and under fair and reasonable conditions (see Article 25.3) — access to their results needed for interoperability.

The beneficiaries must give third parties — up to four years after the period set out in Article 3 and on a royalty-free basis —access to their results needed for interoperability, in particular for implementing the results in EU Member States or associated countries that are not participating in the action.

[24] '**Complementary beneficiary**' means a beneficiary of a complementary grant agreement.

Beneficiaries must give access to software components under an EU public licence (or compatible licences) and must comply with any additional requirements set out in in Annex 1.

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

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[25], 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.

[25] 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).

ARTICLE 34 — ETHICS

34.1 Obligation to comply with ethical principles

The beneficiaries must carry out the action in compliance with:

(a) ethical principles (including the highest standards of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity[26] — and including, in particular, avoiding fabrication, falsification, plagiarism or other research misconduct) and

(b) applicable international, EU and national law.

Funding will not be granted for activities carried out outside the EU if they are prohibited in all Member States.

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.

34.2 Activities raising ethical issues

Activities raising ethical issues must comply with the '**ethics requirements**' set out in Annex 1.

Before the beginning of an activity raising an ethical issue, the coordinator must submit (see Article 52) to the JU copy of:

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

(b) any notification or authorisation for activities raising ethical issues required under national law.

If these documents are not in English, the coordinator must also submit an English summary of the submitted opinions, notifications and authorisations (containing, if available, the conclusions of the committee or authority concerned).

If these documents are specifically requested for the action, the request must contain an explicit reference to the action title. The coordinator must submit a declaration by each beneficiary concerned that all the submitted documents cover the action tasks.

[26] The European Code of Conduct for Research Integrity of ALLEA (All European Academies) and ESF (European Science Foundation) of March 2011.
http://www.esf.org/fileadmin/Public_documents/Publications/Code_Conduct_ResearchIntegrity.pdf

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 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 or 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 results

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 FUNDING

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 funding — 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;

(b) display the EU emblem and

(c) include the following text:

> For communication activities: *"This project has received funding from the SESAR Joint Undertaking under grant agreement No 734141 under European Union's Horizon 2020 research and innovation programme"* .
>
> 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 under grant agreement No 734141 under European Union's Horizon 2020 research and innovation programme"* .

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 or 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 that it receives 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.

However, 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[27], 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.

[27] 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.

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[28] 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).

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 (see above), before transmitting their data to the JU or the Commission.

[28] 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).

39.3 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 responsibilities 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 Articles 44, 45 and 46.

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 '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 the above-mentioned tasks to any other beneficiary or subcontract them to any third party.

41.3 Internal arrangements between beneficiaries — Consortium agreement

Not applicable

41.4 Relationship with complementary beneficiaries — Collaboration agreement

Not applicable

41.5 Relationship with partners of a joint action — Coordination agreement

Not applicable

CHAPTER 6 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — PENALTIES — DAMAGES — SUSPENSION — TERMINATION — FORCE MAJEURE

SECTION 1 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — PENALTIES

ARTICLE 42 — REJECTION OF INELIGIBLE COSTS

42.1 Conditions

42.1.1 The JU will — 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).

42.1.2 The rejection may also be based on the **extension of findings from other grants to this grant**, under the conditions set out in Article 22.5.2.

42.2 Ineligible costs to be rejected — Calculation — Procedure

Ineligible costs will be rejected in full.

If the JU rejects costs **without reduction of the grant** (see Article 43) or **recovery of undue amounts** (see Article 44), it will formally notify the coordinator or beneficiary concerned 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 JU rejects costs **with reduction of the grant** or **recovery of undue amounts**, it will formally notify the rejection in the '**pre-information letter**' on reduction or recovery set out in Articles 43 and 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 — **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

43.1.1 The JU may — **at the payment of the balance** or **afterwards** — reduce the maximum grant amount (see Article 5.1), if the action has not been implemented properly as described in Annex 1 or another obligation under the Agreement has been breached.

43.1.2 The JU may also reduce the maximum grant amount on the basis of the **extension of findings from other grants to this grant**, under the conditions set out in Article 22.5.2.

43.2 Amount to be reduced — Calculation — Procedure

The amount of the reduction will be proportionate to the improper implementation of the action or to the seriousness of the breach.

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 at the time of **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[29] 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:

[29] 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).

- 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 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:

{{{{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:

{{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:

{{{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)}.

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 AND FINANCIAL PENALTIES

45.1 Conditions

Under Articles 84 and 89 of the Financial Rules of the JU (read in conjunction with Articles 109 and 131(5) of the Financial Regulation No 966/2012) the JU may impose **administrative** and **financial penalties** if a beneficiary:

(a) has committed substantial errors, irregularities or fraud or is in serious breach of its obligations under the Agreement or

(b) has made false declarations about information required under the Agreement or for the submission of the proposal (or has not supplied such information).

Each beneficiary is responsible for paying the financial penalties imposed on it.

Under Articles 84 and 89 of the Financial Rules of the JU (read in conjunction with Article 109(3) of the Financial Regulation No 966/2012), the JU may — under certain conditions and limits — publish decisions imposing administrative or financial penalties.

45.2 Duration — Amount of penalty — Calculation

Administrative penalties exclude the beneficiary from all JU contracts and grants for a maximum of five years from the date the infringement is established by the JU.

If the beneficiary commits another infringement within five years of the date the first infringement is established, the JU may extend the exclusion period up to 10 years.

Financial penalties will be between 2% and 10% of the maximum JU contribution indicated, for the beneficiary concerned, in the estimated budget (see Annex 2).

If the beneficiary commits another infringement within five years of the date the first infringement is established, the JU may increase the rate of financial penalties to between 4% and 20%.

45.3 Procedure

Before applying a penalty, the JU will formally notify the beneficiary concerned:

- informing it of its intention to impose a penalty, its duration or amount and the reasons why and

- inviting it to submit observations within 30 days.

If the JU does not receive any observations or decides to impose the penalty despite of observations it has received, it will formally notify **confirmation** of the penalty to the beneficiary concerned and — in case of financial penalties — deduct the penalty from the payment of the balance or formally notify a **debit note**, specifying 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 may **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 **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.

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

46.2.1 Conditions

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.

Each beneficiary is responsible for paying the damages claimed from it.

46.2.2 Amount of damages - Calculation

The amount the JU can claim from a beneficiary will correspond to the damage caused by that beneficiary.

46.2.3 Procedure

Before claiming damages, the JU will formally notify the beneficiary concerned:

- informing it of its intention to claim damages, the amount and the reasons why and
- inviting it to submit observations within 30 days.

If the JU does not receive any observations or decides to claim damages despite the observations it has received, it will formally notify **confirmation** of the claim for damages and a **debit note**, specifying 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 may **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 **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.

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 reports 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(l)).

ARTICLE 48 — SUSPENSION OF PAYMENTS

48.1 Conditions

The JU may — at any moment — suspend, in whole or in part, the pre-financing payment and interim payments for one or more beneficiaries or the payment of the balance for all beneficiaries, if a beneficiary:

(a) has committed or is suspected of having committed substantial errors, irregularities, fraud or serious breach of obligations in the award procedure or under this Agreement or

(b) 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).

48.2 Procedure

Before suspending payments, the JU will formally notify the coordinator:

- 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.

During the suspension, the periodic report(s) (see Article 20.3) must not contain any individual financial statements from the beneficiary concerned and its linked third parties. When the JU resumes payments, the coordinator may include them in the next 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:

(a) if a beneficiary has committed or is suspected of having committed substantial errors, irregularities, fraud or serious breach of obligations in the award procedure or under this Agreement;

(b) if a beneficiary 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) if 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:

- 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 by the coordinator (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 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 and 40) 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 **calculate** — on the basis of the periodic reports, the termination report and the report on the distribution of payments — if the (pre-financing and interim) payments received by the beneficiary concerned exceed the beneficiary's JU contribution (calculated by applying the reimbursement rate(s)

to the eligible costs declared by the beneficiary and its linked third parties 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.

- 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 is 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 and 40) 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 affecting the EU's or JU's financial interests;

(l) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has — in the award procedure or under the Agreement — committed:

(i) substantial errors, irregularities, fraud or

(ii) serious breach of obligations, including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles;

(m) a beneficiary 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**').

50.3.2 Procedure

Before terminating the Agreement or participation of one or more beneficiaries, the JU will formally notify the coordinator:

- 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 **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), and (l.ii) 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 by the coordinator.

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 the 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 and financial penalties (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 and 40) 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 **calculate** — on the basis of the periodic reports, the termination report and the report on the distribution of payments — if the (pre-financing and interim) payments received by the beneficiary concerned exceed the beneficiary's JU contribution (calculated by applying the reimbursement rate(s) to the eligible costs declared by the beneficiary and its linked third parties 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.

- 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 the amount unduly received, 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 and 40) 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.

Until the payment of the balance: all communication must be made through the electronic exchange system and using the forms and templates provided there.

After the payment of the balance: formal notifications must be made by registered post with proof of delivery ('formal notification on paper').

Communications in the electronic exchange system must be made by persons authorised according to the 'Terms and Conditions of Use of the electronic exchange system'. 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 Terms and Conditions of Use of the electronic exchange system).

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 following address:

SESAR Joint Undertaking
B-1049 Brussels Belgium

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 '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[30], periods expressed in days, months or years are calculated from the moment the triggering event occurs.

[30] 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).

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.

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;
- 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 SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIENNE CIVILS ET MILITAIRES, STIFTELSEN SINTEF, 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.

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 or financial penalties 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

Luc LALLOUETTE with ECAS id nlallolu signed in the Participant Portal on 26/10/2016 at 09:26:29 (transaction id SigId-54776-ampzNAQzRszlpzmeVMUzmySKm3jq4btxyjGf2OKnWiZclSdZZJCm6cDyrHiisZJzMzOveSxUV8KxzovN3Cf1C0k8-Jj71zxYb8yrkmoAceBIUCa-XECzgzmMZqgPeCuMvF8X0QARzcNcbUtDgXsn8wmmEF6G).
Timestamp by third party at
Wed Oct 26 10:26:40 CEST 2016

For the JU

Signed by Peter HOTHAM with ECAS id ihothape as an authorised representative on 26-10-2016 23:21:56 (transaction id SigId-66360-DyQjrFo62UuxDQ1EwCJyctK1IHxDwEySTxZant3IosJMpdKQzRzj9klYDoImlF99UWHCkfby05JyEHmTB5D4L5-Jj71zxYb8yrkmoAceBIUCa-DVwB0XxBzeWzGDSCG8BcezpoOI8m5gKdvARQbWq0UrYK)
Wed Oct 26 23:22:01 CEST 2016

ANNEX 1 (part A)

Research and Innovation action

NUMBER — 734141 — PJ16 CWP HMI

Table of Contents

1.1. The project summary

Project Number [1]	734141	Project Acronym [2]	PJ16 CWP HMI

One form per project

General information	
Project title [3]	Controller Working Position / Human Machine Interface - CWP/HMI
Starting date [4]	The first day of the month after the signature by the JU
Duration in months [5]	38
Call (part) identifier [6]	H2020-SESAR-2015-2
Topic	SESAR.IR-VLD.Wave1-19-2015 CWP - HMI
Fixed EC Keywords	
Free keywords	Air Traffic Controller Productivity, Virtual Centre, Controller Working Position, DataCenter, Human Machine Interface

Abstract [7]

PJ.16 project aims to reduce development and operating costs of Air Navigation Service Providers (ANSP). These savings will ultimately benefit airlines and their customers. It achieves this by delivering the ATM Master Plan goals (defined by the European Air Traffic Management (ATM) community) for a more efficient deployment of human resources, a progressive increase in automation support, the implementation of virtualisation technologies and the use of standardised and interoperable systems whilst increasing the safety level.
Within the PJ16 proposal, there are two innovative solutions:
The first solution develops a concept for separating the Controller Working Position (CWP) from the datacentre where the data is produced. This lean and efficient use of ANSP infrastructure tackles the issues presented by fragmented European ATM systems and country-specific architectures, enabling Europe to move to an interoperable, cost-effective and flexible service provision infrastructure. Decoupling of the CWPs should enable a more efficient use of the most valuable and expensive resource, the human. By enabling increased flexibility the ANSPs should better manage staffing for prevailing traffic conditions and assure service continuity.
The second solution deals with new methods of controller interaction with the Human Machine Interface (HMI), applying mature technologies from other domains to ATM. This will increase controller productivity, reduce workload, stress level and enable the use of SESAR advanced tools, safely facilitating performance based operations. Furthermore, the use of modern thin client technology and the processes for developing HMI solutions are investigated, aiming at more efficient CWP development and operation.
PJ16 has expertise from most of the ANSPs in Europe, the major European industrial partners, the leaders of research domains in the previous ATM R&D phase and has an expanded knowledge pool including new participants from Eastern Europe.

1.2. List of Beneficiaries

Project Number [1]	734141	Project Acronym [2]	PJ16 CWP HMI

List of Beneficiaries

No	Name	Short name	Country	Project entry month[8]	Project exit month
1	THALES AIR SYSTEMS SAS	THALES AIR SYS	France	1	38
2	RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK	ANS CR (B4)	Czech Republic	1	38
3	LETOVE PREVADZKOVE SLUZBY SLOVENSKEJ REPUBLIKY, STATNY PODNIK	LPS SR (B4)	Slovakia	1	38
4	AUSTRO CONTROL OSTERREICHISCHE GESELLSCHAFT FUR ZIVILLUFTFAHRT MBH	ACG/COOPANS	Austria	1	38
5	CROATIA CONTROL, CROATIAN AIR NAVIGATION SERVICES LTD	CCL/COOPANS	Croatia	1	38
6	UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY	IAA/COOPANS	Ireland	1	38
7	LUFTFARTSVERKET	LFV/COOPANS	Sweden	1	38
8	NAVIAIR	Naviair/COOPANS	Denmark	1	38
9	DFS DEUTSCHE FLUGSICHERUNG GMBH	DFS	Germany	1	38
10	DIRECTION DES SERVICES DE LA NAVIGATION AERIENNE	DSNA	France	1	38
11	ENTIDAD PUBLICA EMPRESARIAL ENAIRE	ENAIRE	Spain	1	38
12	ENAV SPA	ENAV	Italy	1	38
13	NATS (EN ROUTE) PUBLIC LIMITED COMPANY	NATS	United Kingdom	1	38
14	SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIENNE CIVILS ET MILITAIRES	SKYGUIDE	Switzerland	1	38
15	EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION	EUROCONTROL	Belgium	1	38
16	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	DLR (AT-One)	Germany	1	38
17	FREQUENTIS AG	FRQ (FSP)	Austria	1	38
18	HUNGAROCONTROL MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG	HC (FSP)	Hungary	1	38
19	STIFTELSEN SINTEF	SINTEF (NATMIG)	Norway	1	38
20	INDRA SISTEMAS SA	INDRA	Spain	1	38

1.2. List of Beneficiaries

No	Name	Short name	Country	Project entry month[8]	Project exit month
21	LEONARDO - FINMECCANICA SPA	FINMECCANICA	Italy	1	38
22	VALSTYBES IMONE ORO NAVIGACIJA	ON (B4)	Lithuania	1	38
23	POLSKA AGENCJA ZEGLUGI POWIETRZNEJ	PANSA (B4)	Poland	1	38
24	STICHTING NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM	NLR (AT-One)	Netherlands	1	38
25	ATOS BELGIUM	ATOS (FSP)	Belgium	1	38
26	AIRTEL ATN LIMITED	AIRTEL (NATMIG)	Ireland	1	38
27	SAAB AKTIEBOLAG	SAAB (NATMIG)	Sweden	1	38

1.3. Workplan Tables - Detailed implementation

1.3.1. WT1 List of work packages

WP Number[9]	WP Title	Lead beneficiary[10]	Person-months[11]	Start month[12]	End month[13]
WP1	Project Management	1 - THALES AIR SYS	28.20	1	38
WP2	Solution PJ.16-03 Workstation, Service Interface Definition & Virtual Centre Concept	1 - THALES AIR SYS	1,343.77	1	38
WP3	Solution PJ.16-04: PJ.16-04 solution Workstation, Controller Productivity	13 - NATS	508.27	1	38
WP4	Ethics requirements	1 - THALES AIR SYS	N/A	1	38
		Total	1,880.24		

1.3.2. WT2 list of deliverables

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.1	Project Management Plan	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	5
D1.2	Final Project Report	WP1	1 - THALES AIR SYS	Report	Public	36
D1.3	Q4 2016	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	3
D1.4	Q1 2017	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D1.5	Q2 2017	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	9
D1.6	Q3 2017	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	12
D1.7	Q4 2017	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	15
D1.8	Q1 2018	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	18
D1.9	Q2 2018	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the	21

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
					Commission Services)	
D1.10	Q3 2018	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	24
D1.11	Q4 2018	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	27
D1.12	Q1 2019	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	30
D1.13	Q2 2019	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	33
D1.14	Q3 2019	WP1	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	36
D2.1	Solution PJ.16-03: V1 Data Pack	WP2	1 - THALES AIR SYS	Other	Confidential, only for members of the consortium (including the Commission Services)	13
D2.2	Solution PJ.16-03: V2 Data Pack	WP2	1 - THALES AIR SYS	Other	Confidential, only for members of the consortium (including the Commission Services)	25
D2.3	Solution PJ.16-03: V3 Data Pack	WP2	1 - THALES AIR SYS	Other	Confidential, only for members of the consortium (including the Commission Services)	36

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D3.1	Solution PJ.16-04: V1 Data Pack	WP3	13 - NATS	Other	Confidential, only for members of the consortium (including the Commission Services)	13
D3.2	Solution PJ.16-04: V2 Data Pack	WP3	13 - NATS	Other	Confidential, only for members of the consortium (including the Commission Services)	25
D3.3	Solution PJ.16-04: V3 Data Pack	WP3	13 - NATS	Other	Confidential, only for members of the consortium (including the Commission Services)	36
D4.1	H - Requirement No. 1	WP4	1 - THALES AIR SYS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	5
D4.2	POPD - Requirement No. 2	WP4	1 - THALES AIR SYS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	5
D4.3	NEC - Requirement No. 3	WP4	1 - THALES AIR SYS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	5
D4.4	M - Requirement No. 4	WP4	1 - THALES AIR SYS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	5

1.3.3. WT3 Work package descriptions

Work package number [9]	WP1	**Lead beneficiary** [10]	1 - THALES AIR SYS
Work package title	Project Management		
Start month	1	**End month**	38

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 - Project Management [Months: 1-38]
THALES AIR SYS, DFS, SKYGUIDE
Project Management and Coordination (Lead Thales Air Systems): At the beginning of the Project, a Project Management Plan (PMP) is issued at T0+3 months. This PMP describes all the relevant process in the project.
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 including ethics/personal data collection and the reporting process, and assure timed delivery. Meetings to be organized: Review meeting with SJU (annual), PMB (monthly TelCo or Face to Face, on demand), EPMB (annual and on demand, Face to Face). The Project Manager (PM), together with the PMB and EPMB, acts as project steering committee. Change requests are handled by the committee to allow flexibility. A management report is produced every 3 months to document project progress.
A final project report is delivered at the end of the project to summarise the goals and achievements of the projects.
Project Quality Management and Standardisation (Lead Thales Air Systems): The coordinator is ISO – 9001 standard certified and will ensure the quality of the project. A project management handbook is produced to establish a project quality plan.
Reporting and Communication with the SJU (Lead Thales Air Systems). In cooperation with all involved partners, the Project Manager is responsible to provide the required periodic and final reports to the SJU/EC.
Communication with ATM community (Lead skyguide): In cooperation with all involved partners, the POC of communication ensures the correct dissemination of the results of the project in the ATM community and outside, on request by SJU (and in accordance to the Communication plan).
Technical and Scientific Coordination (Lead DFS). The Project Content Integration Leader (PCIL) organises 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.
Contribution to the SESAR 2020 Program Management (Lead Thales Air Systems) i.e. Programme Committee and its sub-committees.
Administration (Lead Thales Air Systems) of the project according to the grant agreement.

Participation per Partner

Partner number and short name	WP1 effort
1 - THALES AIR SYS	23.60
9 - DFS	2.00
14 - SKYGUIDE	2.60
Total	28.20

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.1	Project Management Plan	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	5
D1.2	Final Project Report	1 - THALES AIR SYS	Report	Public	36
D1.3	Q4 2016	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	3
D1.4	Q1 2017	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D1.5	Q2 2017	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	9
D1.6	Q3 2017	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	12
D1.7	Q4 2017	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	15
D1.8	Q1 2018	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	18
D1.9	Q2 2018	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	21
D1.10	Q3 2018	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	24

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.11	Q4 2018	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	27
D1.12	Q1 2019	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	30
D1.13	Q2 2019	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	33
D1.14	Q3 2019	1 - THALES AIR SYS	Report	Confidential, only for members of the consortium (including the Commission Services)	36

Description of deliverables

D1.1 : Project Management Plan [5]
Project Management Plan

D1.2 : Final Project Report [36]
Final Project Report

D1.3 : Q4 2016 [3]
Q4 2016 quarterly report

D1.4 : Q1 2017 [6]
Q1 2017 quarterly report

D1.5 : Q2 2017 [9]
Q2 2017 quarterly report

D1.6 : Q3 2017 [12]
Q3 2017 quarterly report

D1.7 : Q4 2017 [15]
Q4 2017 quarterly report

D1.8 : Q1 2018 [18]
Q1 2018 quarterly report

D1.9 : Q2 2018 [21]
Q2 2018 quarterly report

D1.10 : Q3 2018 [24]
Q3 2018 quarterly report

D1.11 : Q4 2018 [27]
Q4 2018 quarterly report
D1.12 : Q1 2019 [30]
Q1 2019 quarterly report
D1.13 : Q2 2019 [33]
Q2 2019 quarterly report
D1.14 : Q3 2019 [36]
Q3 2019 quarterly report

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification

Work package number [9]	WP2	Lead beneficiary [10]	1 - THALES AIR SYS
Work package title	Solution PJ.16-03 Workstation, Service Interface Definition & Virtual Centre Concept		
Start month	1	End month	38

Objectives

The objective of this Work Package (Solution PJ.16-03) is to define exactly what is the Virtual concept and after to go through the maturity process to reach a V3 maturity for technical perspective by the end of Wave 1.

Description of work and role of partners

WP2 - Solution PJ.16-03 Workstation, Service Interface Definition & Virtual Centre Concept [Months: 1-38]
THALES AIR SYS, ANS CR (B4), LPS SR (B4), ACG/COOPANS, CCL/COOPANS, IAA/COOPANS, LFV/COOPANS, Naviair/COOPANS, DFS, DSNA, ENAIRE, ENAV, NATS, SKYGUIDE, EUROCONTROL, FRQ (FSP), HC (FSP), SINTEF (NATMIG), INDRA, FINMECCANICA
Operational activity (Lead THALES AIR SYS): The objective of this activity is firstly to define for an operational point of view what the Virtual Centre concept is. Based on this definition, all possible users stories have to be identified and a selection of the most interesting ones have to be done with the entire community.
Based on this selection, the maturity process is done by defining an OSED during the maturity phase V1 and during V2 maturity phase, validations are conducted based on this OSED. Showstoppers (linked to safety, security, regulation, …) are also identified, studied and if necessary, mitigated to ensure the feasibility of the implementation.
Based on the process described in Part B chapter1.3 and under the lead of THALES AIR SYS, the contributing partners are ANS CR (B4), Integra A/S, LPS SR (B4), ACG/COOPANS, CCL/COOPANS, IAA/COOPANS, LFV/COOPANS, Naviair/COOPANS, DFS, DSNA, ENAV, NATS, skyguide, Eurocontrol, FRQ (FSP), HC (FSP), SINTEF (NATMIG), Indra and Finmeccanica bring their expertise for operational domain and showstoppers identification and mitigation.

Technical activity (Lead DSNA): The objective of this activity is to provide the platforms to conduct verification activities and support the validations. Based on the selection issued from the operational activity and based also on already identified and partially modelled services coming from SESAR 1 B04.04, this activity model a selection of services and go through a verification process for a V2 and later on a V3 maturity levels.
Based on the process described in chapter1.3 and under the lead of DSNA, the contributing partners are ANS CR (B4), Integra A/S, LPS SR (B4), ACG/COOPANS, CCL/COOPANS, IAA/COOPANS, LFV/COOPANS, Naviair/COOPANS, DFS, DSNA, ENAV, NATS, skyguide, Skysoft-ATM, Eurocontrol, FRQ (FSP), PDTS GmbH, SINTEF (NATMIG), Indra, THALES AIR SYS and Finmeccanica bring their expertise for technical domain and platform management.

Participation per Partner

Partner number and short name	WP2 effort
1 - THALES AIR SYS	218.00
2 - ANS CR (B4)	15.82
Integra	3.05
3 - LPS SR (B4)	5.90
4 - ACG/COOPANS	2.10
5 - CCL/COOPANS	4.60
6 - IAA/COOPANS	7.40
7 - LFV/COOPANS	3.00
8 - Naviair/COOPANS	11.40
9 - DFS	28.00

Partner number and short name	WP2 effort
10 - DSNA	38.00
11 - ENAIRE	11.50
12 - ENAV	11.05
SICTA	16.46
Bulatsa	10.52
NAIS	13.27
13 - NATS	32.40
14 - SKYGUIDE	22.74
SKYSOFTATM	17.46
15 - EUROCONTROL	84.60
17 - FRQ (FSP)	71.00
PDTS	20.00
18 - HC (FSP)	79.00
19 - SINTEF (NATMIG)	9.10
20 - INDRA	421.80
21 - FINMECCANICA	185.60
Total	1,343.77

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D2.1	Solution PJ.16-03: V1 Data Pack	1 - THALES AIR SYS	Other	Confidential, only for members of the consortium (including the Commission Services)	13
D2.2	Solution PJ.16-03: V2 Data Pack	1 - THALES AIR SYS	Other	Confidential, only for members of the consortium (including the Commission Services)	25
D2.3	Solution PJ.16-03: V3 Data Pack	1 - THALES AIR SYS	Other	Confidential, only for members of the consortium (including the Commission Services)	36

Description of deliverables

D.16-03.V.1.1 Virtual Centre Operation concept (12/17): The objective of this document is to provide the OSED of the Virtual Centre Concept.

D.16-03.V.1.2 ADSP / CWP interfaces services and data models V1 (12/17): These models described the interfaces between CWP and ADSP
D.16-03.V.1.3 Validation report (VALR) (12/17): this report is the validation report of the V1 maturity level
D.16-03.V.1.4 Validation Plan (VALP)(12/17): this plan shows the validation activities for V2 maturity level

D.16-03.V.2.1 TS-IRS (V2) (09/18): Description of the Solution, purpose, context, interfaces with other Solutions and services needed. Functional and non-functional requirements for the final system (not prototype related).
D.16-03.V.2.2 ADSP / CWP interfaces services and data models V2 (09/18): These models described the interfaces between CWP and ADSP
D.16-03.V.2.3 Virtual Centre Operation concept (06/19): The objective of this document is to provide an update of the OSED of the Virtual Centre Concept.
D.16-03.V.2.3 Verification report (09/18): this report is the verification report of the V2 maturity level
D.16-03.V.2.4 Verification Plan (09/18): this report is the verification plan of the V3 maturity level
D.16-03.V.2.5 Validation report (06/19): this report is the validation report of the V2 maturity level

D.16-03.V.3.1 TS-IRS (V3) (06/19): Description of the Solution, purpose, context, interfaces with other Solutions and services needed. Functional and non-functional requirements for the final system (not prototype related).
D.16-03.V.3.2 ADSP / CWP interfaces services and data models V2 (06/19): These models described the interfaces between CWP and ADSP
D.16-03.V.3.3 Verification report (06/19): this report is the verification report of the V3 maturity level

D2.1 : Solution PJ.16-03: V1 Data Pack [13]

Solution PJ.16-03: V1 Data Pack

D2.2 : Solution PJ.16-03: V2 Data Pack [25]

Solution PJ.16-03: V2 Data Pack

D2.3 : Solution PJ.16-03: V3 Data Pack [36]

Solution PJ.16-03: V3 Data Pack

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	V1 Gate for Solution PJ.16-03	1 - THALES AIR SYS	15	Gate review
MS2	V2 Gate for solution PJ.16-03	1 - THALES AIR SYS	27	Gate review
MS3	V3 Gate for solution PJ.16-03	1 - THALES AIR SYS	37	Gate Review

Work package number [9]	WP3	Lead beneficiary [10]	13 - NATS
Work package title	Solution PJ.16-04: PJ.16-04 solution Workstation, Controller Productivity		
Start month	1	End month	38

Objectives

• Select an appropriate set of touch/ Multi-Touch gestures for ATM to define a suitable "gesture language" and determine how productivity should be measured.
• Determine how mature speech recognition technologies may be applied to ATM to reduce controller workload.
• Examine effective methods to guide the attention of the controller to priority tasks
• Verify and Validate proof-of-concept of each solution.
• Survey of available user identification systems / products
• Survey of available rapid development /agile products in use in SESAR 1
• Feasibility study of Efficient Process in ATM context
• Application to SESAR Solution Projects or PJ.16-04 Activities
• To look at the "Thin Client" to define and prove, in coordination with Solution Projects, KPIs in the area of performance and safety for a usage in a productive system of a virtual centre concept (CWP).

Description of work and role of partners

WP3 - Solution PJ.16-04: PJ.16-04 solution Workstation, Controller Productivity [Months: 1-38]
NATS, THALES AIR SYS, ANS CR (B4), LPS SR (B4), ACG/COOPANS, LFV/COOPANS, DFS, ENAIRE, SKYGUIDE, EUROCONTROL, DLR (AT-One), FRQ (FSP), HC (FSP), SINTEF (NATMIG), INDRA, FINMECCANICA
1) Multi Touch Inputs (Lead THALES AIR SYS):
Multi-Touch input devices are widely used today and in the ATC world and they have been subject of several prototypical implementations tested in simulation studies (see, e.g. SESAR 1 P10.10.02). The results indicate that Multi-Touch systems are in general suitable to overcome mental bottlenecks in the human-system interaction. In this work package, a proof-of-concept of the proposed Multi-Touch solutions will be verified and validated in a simple "mock up", across a number of positions, to select the appropriate set of gestures to form an efficient "language" for ATM applications within an example operating concept (TRL 3). These examinations shall also include Human Performance measurements in a relevant environment, against existing input methods to build a case for implementation (above TRL 3).
Based on the process described in Part B and under the lead of THALES AIR SYS, the contributing partners are ANS CR (B4), Integra A/S, LFV/COOPANS, DFS, ENAIRE, NATS, Avinor ANS, SINTEF (NATMIG), INDRA and Romatsa.

2) Automatic Speech Recognition (Lead DLR (AT-one))
Enormous progress with ASR technology in the ATM environment has been made over a past number of years. ANSPs and system providers are very interested in integrating assistant based ASR in supporting them in their tasks and integrating this controller productivity solution into their CWP equipment. Hence, most decision support systems, like DMAN, SMAN and many other new systems can be upgraded by assistant based ASR. In this WP, the area of usage in control rooms will be investigated and it will be analysed where Speech Recognition shall support the controllers in their daily operational work so that controllers can focus more on traffic, release scarce mental capacities and thereby increase the overall safety
Based on the process described in Part B and under the lead of DLR (AT-one), the contributing partners are THALES AIR SYS, ANS CR (B4), Integra A/S, ACG/COOPANS, LFV/COOPANS, DFS, ENAIRE, CRIDA, NATS, Avinor ANS, skyguide, Skysoft, FRQ (FPS), SINTEF (NATMIG), Indra, Romatsa and Finmeccanica

3) Attention Guidance (Lead DLR (AT-one))
In SESAR 1 WP 10.10.02 (P10.10.02-D02 Available Technology Screening Document) work started to develop a prototype using eye tracking as an enabling interaction technology. This WP will undertake to bring this technology past TRL3 to V2 Maturity as part of this activity.
This Attention Guidance concept is based on analysing the current situation and the planned sequence of tasks in the next few minutes. The analysis delivers the identification of the next most important task. The area of interest is determined where the controllers should look at when fulfilling their task; this is the area of the required attention. Afterwards the area of current attention, the eye gaze focus, is gathered from eye gaze data. The concept in the end develops means to direct the attention of controllers as required.

Based on the process described in Part B and under the lead of DLR (AT-one), the contributing partners are THALES AIR SYS, LFV/COOPANS, DFS, ENAIRE, NATS, Indra and Romatsa.

4) User Profile Management Systems (Lead LPS SR (B4))
This WP will Investigate a number of validation technologies to enable efficient, reliable and secure controller logon to be coupled with profile management. 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.
Based on the process described in Part B and under the lead of LPS SR (B4), the contributing partners are ANS CR (B4), Integra A/S, DLR (AT-one), ENAIRE, NATS, Indra and Romatsa and Finmeccanica

5) Efficient Process (Lead NATS)
This WP will assess any Efficient Processes in use in SESAR 1 projects or planned for SESAR 2020. This activity will start slightly ahead of the other activities in this work package, to provide guidance on requirements elicitation and efficiency for the other activities where necessary. It is expected that V2 validations will be achieved by applying the process and evaluating its effectiveness on PJ.16 activities, with V3 validation coming from its application on one or more Solution Projects.
Based on the process described in Part B and under the lead of NATS, the contributing partners are LFV/COOPANS, ENAIRE, DLR (AT-one) and SINTEF (NATMIG), Indra and Romatsa.

6) Qualification of CWP Virtualisation (Lead FRQ (FSP))
This part of the WP will look at the "Thin Client" to define and prove KPIs, in coordination with solution projects, in the area of performance and safety for a usage in a productive system of a virtual centre concept (CWP). The main objective within the qualification of CWP virtualisation is to investigate the application of thin clients and lightweight user applications for controller working positions. As thin client a lightweight computer is understood connected to a server component to fulfil the computational role. This is different from the traditional desktop PC (fat client), which is a computer designed to take on these roles by itself.
Based on the process described in Part B and under the lead of FRQ (FSP) and partnered by NATS, Eurocontrol, Indra and Romatsa.

Participation per Partner

Partner number and short name	WP3 effort
1 - THALES AIR SYS	53.00
2 - ANS CR (B4)	12.42
Integra	3.05
3 - LPS SR (B4)	47.00
4 - ACG/COOPANS	4.40
7 - LFV/COOPANS	3.30
9 - DFS	41.00
11 - ENAIRE	12.90
CRIDA	31.00
13 - NATS	35.10
Avinor ANS	9.10
14 - SKYGUIDE	1.09
SKYSOFTATM	8.91
15 - EUROCONTROL	7.20

Partner number and short name	WP3 effort
16 - DLR (AT-One)	62.00
17 - FRQ (FSP)	28.00
18 - HC (FSP)	9.00
19 - SINTEF (NATMIG)	13.80
20 - INDRA	65.40
ROMATSA	40.00
21 - FINMECCANICA	20.60
Total	508.27

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D3.1	Solution PJ.16-04: V1 Data Pack	13 - NATS	Other	Confidential, only for members of the consortium (including the Commission Services)	13
D3.2	Solution PJ.16-04: V2 Data Pack	13 - NATS	Other	Confidential, only for members of the consortium (including the Commission Services)	25
D3.3	Solution PJ.16-04: V3 Data Pack	13 - NATS	Other	Confidential, only for members of the consortium (including the Commission Services)	36

Description of deliverables

D.16-04.V.1.1 PJ.16-04 Validation Plan (12/16): Plan for Validation of the PJ.16-04 Activities. In this case refers to necessary validations in solution projects. Sections relevant to PJ.16-04 Activities will be defined in PMP
D.16-04.V.1.2 PJ.16-04 Verification Objectives of the HMI Technical Enablers (12/16) : Definition of overall objectives of PJ.16-04 integrating the details of objectives done for MT, ASR, AG, UPM, CWP VI, Efficient Development Process.
D.16-04.V.1.3 PJ.16-04 Technical Specification for the HMI Technical Enablers (04/17) Technical Specification split into sub chapters MT, ASR, AG, UPM, CWP VI. Analysis of possible candidate processes (Efficient Development Process)
D.16-04.V.1.4 PJ.16-04 Verification Plan for the Technical Specifications of the HMI Technical Enablers (04/17) Overall Verification Plan describing the verifications performed within Solution PJ.16-04. Including stakeholders, tracing of objectives, metric and measurement process & evaluation method definition. The verification will be done in an agile process, therefore only a summary of availability notes are provided for the different work-packages.

D.16-04.V.2.1 PJ.16-04 Activity 01 Availability Note - Multi-Touch (09/17): Availability/Release Note - Multi-Touch Prototype. Content to be defined in PMP, expected to contain release and delivery information, platform compatibility, functionality description.

D.16-04.V.2.2 PJ.16-04 Activity 02 Availability Note - Automatic Speech Recognition (09/17): Availability/Release Note - Automatic Speech Recognition Prototype. Content to be defined in PMP, expected to contain release and delivery information, platform compatibility, functionality description.
D.16-04.V.2.3 PJ.16-04 Activity 03 Availability Note - Attention Guidance (09/17): Availability/Release Note - Attention Guidance Prototype. Content to be defined in PMP, expected to contain release and delivery information, platform compatibility, functionality description.
D.16-04.V.2.4 PJ.16-04 Activity 04 Availability Note - User Profile Management (09/17): Availability/Release Note - User Profile Management Prototype. Content to be defined in PMP, expected to contain release and delivery information, platform compatibility, functionality description.
D.16-04.V.2.5 PJ.16-04 Activity 06 Availability Note - CWP Virtualisation (09/17): Availability/Release Note - CWP Virtualisation Prototype. Content to be defined in PMP, expected to contain release and delivery information, platform compatibility, functionality description
D.16-04.V.2.6 PJ.16-04 Consolidated Verification Report for the HMI Technical Enablers (06/19) Integration of all verification reports into one consolidated one addressing the HMI Technical Enablers addressed within PJ.16-04.

D.16-04.V.3.1 PJ.16-04 Requirements Consolidation (06/19) Integration of resulting requirements, describing enabling solutions to allow them to be progressed by projects to V3 and beyond.
D.16-04.V.3.2 PJ.16-04 Validation Report (June 19) Overall work package Validation Report, summarising validations of PJ.16-04 from other solution projects, references to other validation reports as necessary. Sections relevant to PJ.16-04 Activities will be defined in PMP.

D3.1 : Solution PJ.16-04: V1 Data Pack [13]

Solution PJ.16-04: V1 Data Pack

D3.2 : Solution PJ.16-04: V2 Data Pack [25]

Solution PJ.16-04: V2 Data Pack

D3.3 : Solution PJ.16-04: V3 Data Pack [36]

Solution PJ.16-04: V3 Data Pack

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS4	V1 Gate for solution PJ.16-04	13 - NATS	15	Gate Review
MS5	V2 Gate for solution PJ.16-04	13 - NATS	27	Gate review
MS6	V3 Gate for solution PJ.16-04	13 - NATS	37	Gate review

Work package number [9]	WP4	Lead beneficiary [10]	1 - THALES AIR SYS
Work package title	Ethics requirements		
Start month	1	End month	38

Objectives

The objective is to ensure compliance with the 'ethics requirements' set out in this work package.

Description of work and role of partners

WP4 - Ethics requirements [Months: 1-38]
THALES AIR SYS
This work package sets out the 'ethics requirements' that the project must comply with.

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D4.1	H - Requirement No. 1	1 - THALES AIR SYS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	5
D4.2	POPD - Requirement No. 2	1 - THALES AIR SYS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	5
D4.3	NEC - Requirement No. 3	1 - THALES AIR SYS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	5
D4.4	M - Requirement No. 4	1 - THALES AIR SYS	Ethics	Confidential, only for members of the consortium (including the Commission Services)	5

Description of deliverables

The 'ethics requirements' that the project must comply with are included as deliverables in this work package.

D4.1 : H - Requirement No. 1 [5]

2.1. Details on the procedures and criteria that will be used to identify/recruit research participants must be provided. 2.2. Detailed information must be provided on the informed consent procedures that will be implemented for the participation of humans. 2.3. Templates of the informed consent forms and information sheet must be submitted on request. 2.9. Copies of ethics approvals for the research with humans must be submitted.

D4.2 : POPD - Requirement No. 2 [5]

4.1. Copies of opinion or confirmation by the competent Institutional Data Protection Officer and/or authorization or notification by the National Data Protection Authority must be submitted (which ever applies according to the Data

Protection Directive (EC Directive 95/46, currently under revision, and the national law). 4.4. Detailed information must be provided on the procedures that will be implemented for data collection, storage, protection, retention and destruction and confirmation that they comply with national and EU legislation.

D4.3 : NEC - Requirement No. 3 [5]

6.1. The applicant must confirm that the ethical standards and guidelines of Horizon2020 will be rigorously applied, regardless of the country in which the research is carried out. 6.3. The applicant must provide details on the material which will be imported to/exported from EU and provide the adequate authorisations.

D4.4 : M - Requirement No. 4 [5]

9.1. Details on measures to prevent malevolent/criminal/terrorist abuse of research findings must be provided.

Schedule of relevant Milestones

Milestone number[18]	**Milestone title**	**Lead beneficiary**	**Due Date (in months)**	**Means of verification**

1.3.4. WT4 List of milestones

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
MS1	V1 Gate for Solution PJ.16-03	WP2	1 - THALES AIR SYS	15	Gate review
MS2	V2 Gate for solution PJ.16-03	WP2	1 - THALES AIR SYS	27	Gate review
MS3	V3 Gate for solution PJ.16-03	WP2	1 - THALES AIR SYS	37	Gate Review
MS4	V1 Gate for solution PJ.16-04	WP3	13 - NATS	15	Gate Review
MS5	V2 Gate for solution PJ.16-04	WP3	13 - NATS	27	Gate review
MS6	V3 Gate for solution PJ.16-04	WP3	13 - NATS	37	Gate review

1.3.5. WT5 Critical Implementation risks and mitigation actions

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
1	PJ.16-03 V3 maturity level cannot be reached before the end of wave 1 (High / Medium)	WP1, WP2	• The project management is schedule driven oriented to ensure the V3 maturity level completion which is a contractual deliverable. • Validation plans for V1, V2 and V3 maturity level have be realistic in term of completion of the services and schedule. • The stepwise approach by defining set of services is able to manage the schedule
2	PJ.15-09 could work on same services than PJ.16-03 (High / Low)	WP2	• Monthly coordination between the 2 project leaders will identify potential overlaps, and if any, adjust respective project validation plan in order to ensure consistent and complementary activities.
3	The level of definition of the services is not sufficient (Low/High)	WP2	• The stepwise approach by defining set of services is able to manage the maturity of the services • The objective is to deliver sufficient material for a complete standardisation in the Eurocae Working group.
4	PJ.16-04 unable to prove productivity gains as no standard metrics exist (High/ Low)	WP3	• PJ.16-04 will begin by defining methods of collecting evaluation data and determining appropriate metrics, in coordination with Solution Projects when relevant.
5	Solution projects PJ.XX, where PJ.16-04 prototypes are embedded, do not reach their intended maturity level in Wave 1 PJ.XX are PJ.01-02, PJ.01-03, PJ.05-02, PJ.05-03, PJ.09-01, PJ.10-01B, PJ.10-01C, PJ.10-02A, PJ.10-02B, PJ.10-05, PJ.03a, PJ.08 and PJ.16-03 (Low/Low)	WP3	• Put more effort on testing the prototypes on their own in a reduced environment when the risk is likely to arise
6	The prototype produced in PJ.16-04 cannot be integrated in the validation environment of PJ.XX. PJ.XX are PJ.01-02, PJ.01-03, PJ.05-02, PJ.05-03, PJ.09-01, PJ.10-01B, PJ.10-01C, PJ.10-02A, PJ.10-02B, PJ.10-05, PJ.03a, PJ.08 and PJ.16-03. (Medium/Medium)	WP3	• PJ.16-04 and the PJ.XX work together on an interface document when PJ.XX starts to plan its validation environment • The prototype should be designed in a way that a proof-of-concept evaluation can be executed in reference to the PJ.XX validation platform, but also be run autonomously by PJ.16-04 in reduced environment • PJ.16-04 and PJ.XX work together on a validation plan document when PJ.XX starts to plan its validation runs in order to have the right scenarios, set-ups, participants etc. to be able to properly plan the PJ.16-04 solution validation part
7	Detailed HMI needs of PJ.XX are not available in time for the prototype provided by PJ.16-04. PJ.XX are PJ.01-02, PJ.01-03,	WP3	• PJ.16-04 and PJ.XX work together on a communication plan for required inputs such as HMI needs • PJ.16-04 actively collects HMI requirements for the prototype

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
	PJ.05-02, PJ.05-03, PJ.09-01, PJ.10-01B, PJ.10-01C, PJ.10-02A, PJ.10-02B, PJ.10-05, PJ.03a, PJ.08 and PJ.16-03 (Medium/Low)		

1.3.6. WT6 Summary of project effort in person-months

	WP1	WP2	WP3	WP4	Total Person/Months per Participant
1 - THALES AIR SYS	23.60	218	53		294.60
2 - ANS CR (B4)	0	15.82	12.42		28.24
· Integra	0	3.05	3.05	0	6.10
3 - LPS SR (B4)	0	5.90	47		52.90
4 - ACG/COOPANS	0	2.10	4.40		6.50
5 - CCL/COOPANS	0	4.60	0		4.60
6 - IAA/COOPANS	0	7.40	0		7.40
7 - LFV/COOPANS	0	3	3.30		6.30
8 - Naviair/COOPANS	0	11.40	0		11.40
9 - DFS	2	28	41		71
10 - DSNA	0	38	0		38
11 - ENAIRE	0	11.50	12.90		24.40
· CRIDA	0	0	31	0	31
12 - ENAV	0	11.05	0		11.05
· SICTA	0	16.46	0	0	16.46
· Bulatsa	0	10.52	0	0	10.52
· NAIS	0	13.27	0	0	13.27
13 - NATS	0	32.40	35.10		67.50
· Avinor ANS	0	0	9.10	0	9.10
14 - SKYGUIDE	2.60	22.74	1.09		26.43
· SKYSOFTATM	0	17.46	8.91	0	26.37
15 - EUROCONTROL	0	84.60	7.20		91.80
16 - DLR (AT-One)	0	0	62		62
17 - FRQ (FSP)	0	71	28		99

	WP1	WP2	WP3	WP4	Total Person/Months per Participant
· PDTS	0	20	0	0	20
18 - HC (FSP)	0	79	9		88
19 - SINTEF (NATMIG)	0	9.10	13.80		22.90
20 - INDRA	0	421.80	65.40		487.20
· ROMATSA	0	0	40	0	40
21 - FINMECCANICA	0	185.60	20.60		206.20
22 - ON (B4)	0	0	0		0
23 - PANSA (B4)	0	0	0		0
24 - NLR (AT-One)	0	0	0		0
25 - ATOS (FSP)	0	0	0		0
26 - AIRTEL (NATMIG)	0	0	0		0
27 - SAAB (NATMIG)	0	0	0		0
Total Person/Months	28.20	1343.77	508.27		1880.24

1.3.7. WT7 Tentative schedule of project reviews

Review number [19]	Tentative timing	Planned venue of review	Comments, if any
RV1	14	TBD	First Project Control Gate
RV2	26	TBD	Second Project Control Gate
RV3	37	Brussels	Project Close Out Gate

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 Commission). 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 fillings, videos, etc.
OTHER	
ETHICS	Ethics requirement

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.

Part B

Table of Changes

Version	Change reason
00.01	From the proposal, removal of tables as requested. Chapter 4.2.7, For LFV partner, when drafting the proposal it was expected to involve Linköping University as Linked Third Party. It has later been clarified, that involvement will be limited in size and that the legal demands for being a linked third party might be difficult to fulfill as this would require contractual agreements. Therefore there is a need to change the type to Third Party.
00.02	As suggested by SJU in the Q&A, the sentence "A further Ethics Deliverables Work package has been introduced to address the handling of ethics requirements" in chapter 3.1. Change WP numbering to be consistent with the portal (impact on Fig.12)
00.03	• Project acronym changed to PJ16 CWP HMI, as SJU comment • Reference to Commission in chapter 5.1.3 and 5.1.4 have been modified to SESAR JU. • Q3 2016 deliverable have been deleted as it is no longer useful • Use of correct short names for COOPANS members • Use of correct names and short names for Frequentis SESAR partners • Use of THALES AIR SYS as a short name for Thales Air Systems
00.04	• Details on the THALES AIR SYS subcontracting part (4.2.1) • Details on the EUROCONTROL subcontracting part (4.2.15) • Details on Skysoft-ATM LTP (4.2.14) • Removal of Frequentis (FRQ (FSP)) subcontractor (declared as potential in the proposal) (4.2.17) with justifications • Change in Table 6 skyguide task participation (error in the proposal)
00.05	• Modification of SINTEF (NATMIG), SAAB (NATMIG) and AIRTEL (NATMIG) short names. • Add ANS after Avinor when missing • Integration of details about "other direct costs" for FRQ (FSP) and ANS CR (B4) • Modification of chapter 4.2.11 in line with SJU comment • Removal of LiU as LTP for LFV (chapter 4.2.7)
00.06	• Updates on legal names to be consistent with other grants. • Change in Table 17 DLR (AT-One) in not participating to touch input devices (error in the proposal) • Paragraph 4.2.11: details on ENAIRE's premises work.

Table of Contents

1. Excellence

This project is part of the SESAR 2020 Multi Annual Work Program (MAWP) for the period 2016-2019. It is part of the Industrial Research & Validation phase, developed under the SJU Private Public Partnership.
The industrial research and validation of the SESAR 2020 Multi-Annual Work Programme identifies 2 main key features which are:

- Virtual Centre Definition
- Human Machine Interface of the CWP

PJ.16 – Controller Working Position / Human Machine Interface - CWP/HMI stands within the "Enabling Aviation Infrastructure" feature.
CWPs provide the human machine interface to the air traffic controller at the Air Traffic Service Units (ATSUs) for operating SESAR 1 and SESAR 2020 solutions.

This document constitutes the SESAR 2020 Consortium Members' response to the Industrial Research project 'Controller Working Position / Human Machine Interface - CWP/HMI' as defined in SESAR 2020 Work Programme.

1.1 Objectives

The project CWP/HMI (PJ.16) deals with operational and technical objectives of the Controller Working Position. PJ.16 is comprised of two solutions that shall both provide significant improvements at the Controller Working Position (CWP) considering technical, economic and user performance.

PJ.16-03 concentrates on the concept of Virtual Centres where the CWP (the service consumer) is decoupled from the ATM Data Service Providers (ADSP) (the service providers). The objectives of solution PJ.16-03 are:

- The definition of the Virtual Centre (VC)

Objective 1 - The exact definition of a Virtual Centre shall be agreed among PJ.16-03 members and with SJU

Objective 2 – The list of Virtual Centre Uses Case shall be identified and a list of criteria shall be defined to establish the most valuable Use Cases for the ATM community

Objective 3 - The architectural model of the Virtual Centre shall be defined

- The definition of services

Objective 4 - Service interfaces shall be defined among CWPs and ADSPs. These service interfaces shall be, as a target, based on SWIM standards and be ready for standardisation.

- The development of prototypes

Objective 5 – The defined service interfaces shall be prototypically implemented in order to verify the developed architectural model of the Virtual Centre.

- The verification and validation

Objective 6 – A technical verification of the geographical separation of CWPs and ADSPs shall be demonstrated.

Objective 7 – A verification shall combine prototypes irrespective of the industrial supplier and therefore cross-validate different providers.

Objective 8 – The technical maturity of the prototypes shall be
- V1 in 2017 for a set of services
- V2 in 2018 for a set of services
- V3 in 2019 for a set of services

Objective 9– The operational validation of the prototypes shall be
- V1 in 2017 for a set Use Cases
- V2 in 2019 for a set Use Cases

These objectives are crucial to enable the Virtual Centre approach and achieve its main benefits: cost reduction and flexibility to support load-balancing between ATSUs.

PJ.16-04 focusses on the Human Machine Interface of the CWP. The project solution is driven by operational requirements for innovative HMI needs captured from interactions with the ATM Solution Projects. The project will develop guidance and assessment methods regarding HMI, will investigate new HMI needs and interaction modes in relation with SESAR solutions (including new user interface technologies such as speech recognition, multi-touch, and gaze detection). The project will focus on technologies and interaction modes that are regarded as sufficiently mature.

Relevant preconditions of solution PJ.16-04 are:

- The project addresses a predefined set of technologies:
  Precondition 1: The PJ.16-04 Controller Productivity Solution activities address innovative interaction technologies such as multi-touch input devices, automatic speech recognition, attention monitoring and guidance, user profile management, and thin client technologies
  Precondition 2: Innovative interaction technologies are selected that are already beyond maturity level V1 / TRL 2.
- The project considers relevant results that are available as input from previous projects:
  Precondition 3: The PJ.16-04 Controller Productivity Solution activities identify related work performed in SESAR 1 and use relevant input from those projects.
- The projects uses quality criteria as outlined in the PJ.16-04 DoW:
  Precondition 4: The project activities take human factors, safety, productivity improvements against current interaction means, and workload reduction as quality criteria into consideration.

The objectives of solution PJ.16-04 are:

- The project follows the required process objectives outlined in the PJ.16-04 DoW:

  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 with coordination with the Solution projects.

- Controller Productivity Solution HMI enablers

Objective 3: PJ.16-04 Controller Productivity Solution HMI user requirements, HMI technology concept of use and HMI technology specifications shall be available in time per activity (Multi Touch Inputs, Attention Guidance, Automatic Speech Recognition, User Profile Management Systems, Efficient Process, Qualification of CWP Virtualisation).

Objective 4: PJ.16-04 Controller Productivity Solution 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.16-04 Controller Productivity Solution prototypes shall be integrated in time into validation platforms that are related to SESAR 2020 ATM solution projects V2 / V3 activities.

Objective 6: PJ.16-04 Controller Productivity Solution transversal enablers shall be addressed and documented including empirical evidence collected from operational users.

Civil RPAS (Remotely Piloted Aircraft Systems)
Considering the latest knowledge about RPAS, for every solution, an assessment will be performed to identify any impacts, in order to integrate safely and transparently Civil RPAS in non-segregated airspace, multi-aircraft and manned flight environment.

General Aviation / Rotorcraft
Considering General aviation / rotorcraft operational procedures, for every solution, an assessment will be performed to identify any impacts, in order to integrate safely and transparently General Aviation / Rotorcraft.

Cybersecurity
As the solution 16-03 described below is based on new interfaces, it is important to consider how potential cyber-threats could affect these interfaces so that can be effectively mitigated.
An assessment will be undertaken as part of the OSED / SPR / Interop production task.

1.2 Relation to the SESAR 2020 Work programme

The project CWP/HMI (PJ.16) responds to the call H2020-SESAR-2015-2 launched under Societal Challenges of the Horizon 2020 Research Framework Programme and related to the SESAR Joint Undertaking (SJU) first main programme call for proposals - Wave 1, related to the Industrial Research & Validation.

Particularly Controller Working Position / Human Machine Interface – CWP / HMI / PJ.16 addresses the Topic SESAR.IR-VLD.Wave1-19-2015: CWP-HMI. The specific challenges are to:

- 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.
- Challenge the current European ATM system where very few information services and infrastructure elements are shared between the different centres.
- Increase efficiency of CWPs HMIs by exploiting the latest mature technologies.

The scope of the proposed research topic focuses on two SESAR Solutions as described in the Multi-annual Work Programme (MAWP), under the Enabling Aviation Infrastructure Feature:

- SESAR Solution PJ.16-03, the Workstation, Service Interface Definition & Virtual Centre Concept, and
- SESAR Solution PJ.16-04 the Workstation, Controller Productivity.

PJ.16 addresses the Programme Challenge by

- Analysing the separation of the ATM information services from the geographical controller working position.
- Focusing on the technical services and common interfaces for the CWP to achieve an operational environment where different Air Traffic Services Units, even across different ANSPs, appear as a single unit.
- Addressing both the technical and the operational aspects that will be needed to ensure interoperability between the participating units in a Virtual Centre.
- 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.
- Analysing the controller's productivity increase produced by the introduction of new tools and processes, as Multi-Touch Input devices, Automatic Speech Recognition, Attention Guidance, User Profile Management Systems, Efficient Development process and thin client technologies.

The project covers both local and large geographical spread: several ANSPs could benefit from one Virtual Centre, while CWPs in just one centre could incorporate the new interaction modes. The operational context under study will focus on the En-route phase to concentrate efforts, although expansion of the outcomes from both solutions to the Terminal Manoeuvring Area (TMA) should not have a big impact.

1.3 Concept and methodology

PJ.16-03 solution Workstation, Service Interface Definition & Virtual Centre Concept

Concept:

The Virtual Centre Concept refers to the geographical decoupling of the ATM Data Service Providers (ADSPs) from the Air Traffic Service Units (ATSUs) in order to enable the consolidation of today's highly fragmented ATM systems.

In SESAR projects, the objective is to decouple these entities through open and 'ready-to-standardize' service interfaces based on an open service-oriented architecture (SOA). This decoupling takes into account the flexibility and performance aspects of the services to ensure the ability of the virtual centre solution to support the same operational performance.

The ADSPs provide ATM data services, such as flight data management & distribution, voice communication and surveillance and for ATFCM (Air Traffic Flow and Capacity Management), En-Route, Approach and Tower domains.

Methodology:

Solution 16-03 partners have chosen to approach the Virtual Centre (VC) as described by Figure 1: Virtual Centre Approach.

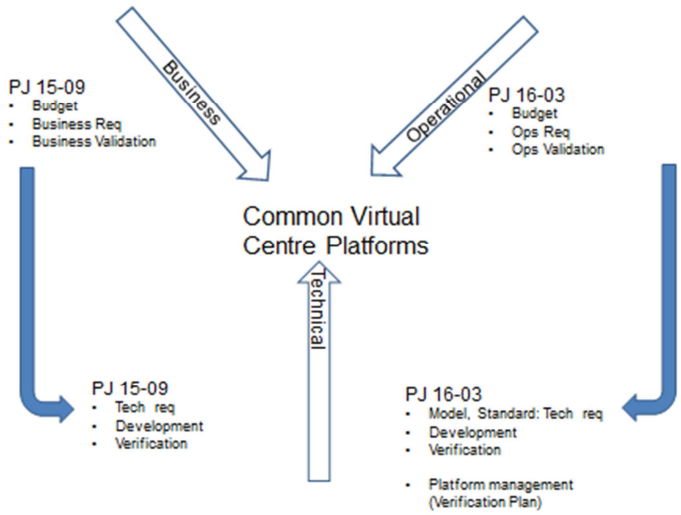

Figure 1: Virtual Centre Approach

The Virtual Centre concept is addressed by three different dimensions: Business, Operational and Technical. The Operational and the Technical dimension are provided in solution PJ.16-03, while the Business dimension is provided by the PJ.15-09 solution, where platforms are also updated.

The operational dimension handles all operational aspects of the Virtual Centre concept and is developed in the activity *"Operational dimension of Virtual Centre Concept"*.

The aim of this activity is to clearly define what the Virtual Centre Concept is and in particular, to define the operational impacts of the different scenarios by defining an Operational Service and Environment Definition (OSED) document, including the Interoperability and Safety / Performance requirements. These scenarios are modelled and included in the EATMA framework as needed. This document develops operational requirements to feed the technical dimension.

The **technical dimension,** developed in the activity *"Technical impacts of Virtual Centre Concept"*, is fed with operational requirements from the activity *"Operational dimension of Virtual Centre Concept"*.

This activity conducts two main tasks:

- The design task, to elaborate the functional and service architectures fulfilling the operational requirements, and then to define the open and standardisable services (based on SWIM standards) to be used between the CWP and ATM Data Service Providers (ADSP).
- The verification task develops adequate platforms and conducts the verification activities at each maturity step.

In the activity "*Operational Dimension of Virtual Centre Concept*", the **validation** from an operational perspective is conducted with controllers. The major objective is to validate the procedures defined in the OSED (Operational and Service Environment Description) – SPR (Safety and Performance Requirement)- Interop for the different agreed scenarios.

In the activity "*Technical impacts of Virtual Centre Concept*", the **verification** of technical perspective is conducted by technical teams (from Industrials or Air National Service Providers (ANSP)). The major objective is to verify the correctness of the proposed interfaces between CWPs and ADSPs. Another objective is to verify the correctness of technical requirements as network latency.

The figure below presents an overview of the planning. As the Technical dimension is linked to verification while the Operational dimension is linked to validation, separate V-maturity levels are expected.

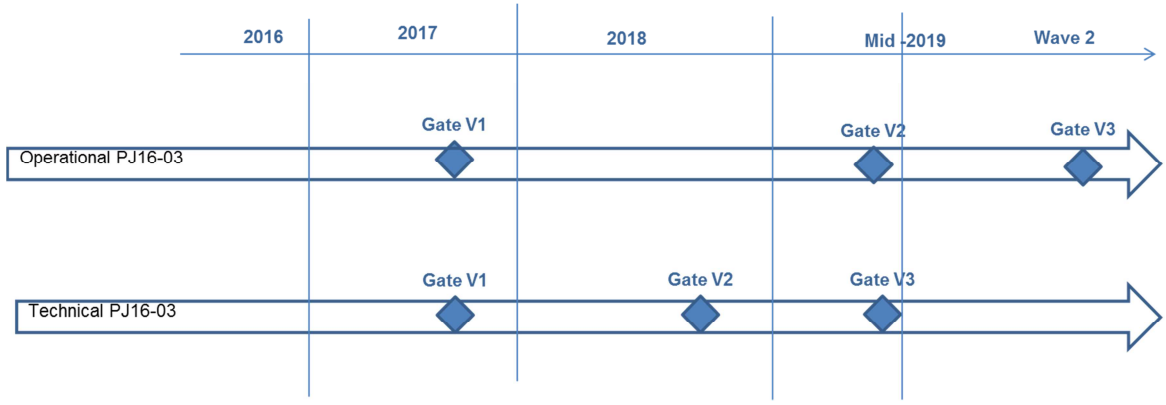

Figure 2: PJ.16-03 Overall schedule

As it is presented, the PJ.16-03 starts with a maturity level at the end of SESAR 1 as Not Applicable (N/A) so prior to V1. It is expected to reach a V3 maturity level for release R8 in mid-2019.

In details, as described above, there are 2 perspectives in the PJ.16-03 solution (Operational and technical):

- Technical dimension and Operational dimension is expected to reach V1 maturity level together in Q3-Q4 2017.
- Technical dimension is expected to reach V2 maturity level in Q2-Q3 2018.
- Operational dimension is expected to reach V2 maturity level in Q1-Q2 2019.
- Technical dimension is expected to reach V3 maturity level in Q1-Q2 2019.

No "formal" dependency (as input or output needed from/to another solution) is identified in this solution. "Informal" dependencies are referred in chapter 2.2.

Activity "Operational dimension of Virtual Centre Concept"

The outstanding R&D needs for this activity are:

Needs	*Rationale*	*Maturity level*
Definition of Virtual Centre Concept	It is necessary to refine the Virtual Centre Concept addressing the different needs and expectative of ATM stakeholders. This refinement will create an agreed definition to be used as basis to develop the concept	V1
Definition of Operational Use Cases	As for the definition, there is no definitive list of Operational Use Cases as they are analysed during the Brainstorming Session shown in Figure 3. An initial list of Use Cases, providing the basis of the Virtual Concept Model (VCM) Operating Concept, has to be identified. Then, based on agreed criteria, selections of these Use Cases were being elected for V2 maturity level. Some initial examples of Use Cases are provided in Table 2: Presentation of the platforms for PJ.16-03 solution. These Operational Use Cases have to cover ATFCM, En-Route, Approach, and Tower for Automation, Voice, and Training perspective.	V1
Definition of SPR requirements	Safety, Security (and cybersecurity) and Performances requirements have to be identified using SESAR methodology. These requirements are used to establish the performance for a controller point of view in line with: • the Use Cases of the VCM Operating Concept, • The ATM operations of the SESAR developed solutions	V1
Definition of possible operational showstoppers	It is important to identify as soon as possible the operational showstoppers (depending on the Use Cases and the agreed Virtual Centre Concept). These showstoppers are identified from security, cybersecurity, safety, regulation, military needs, etc.	V1
Definition of OI steps	In this solution, OI steps are not identified. This activity has to identify these OI Steps. This part is coordinated with PJ.19.	V1
Definition of Operational Services	Based on the agreed Use Cases list, this activity develops the corresponding OSED- SPR-Interop.	V1 V2
Validation of the Operational scenarios	Based on the OSED- SPR-Interop requirements, this activity validates the Operational scenario. The OSED- SPR-Interop requirements are updated depending on the results	V2
Report on showstoppers	This report defines the status of the showstoppers, the identification of Virtual Centre concept implementation risks and the mitigation strategy.	V2

Table 1: Outstanding R&D needs for Operational Dimension of Virtual Centre Concept activity

The process followed during the V1 maturity level is described in the Figure 3: V1 process for Operational dimension of Virtual Centre activity: Brainstorming sessions are organised to identify firstly an exhaustive list of Use cases and an exhaustive list of showstoppers, secondly, to elect some of these Use Cases based on agreed criteria. The next tasks are to detail these elected Use Cases and to develop the showstoppers definition.

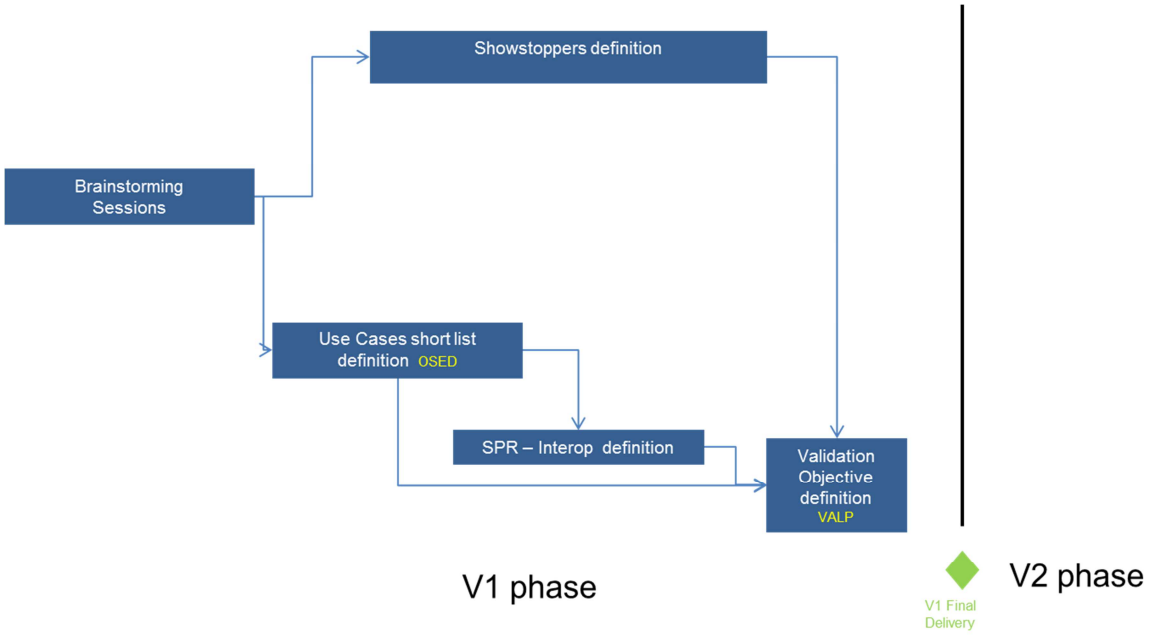

Figure 3: V1 process for Operational dimension of Virtual Centre activity

The process followed during V2 maturity level is described in the Figure 4: V2 process for Operational dimension of Virtual Centre Concept. In this example, only 2 operational services and 2 platforms are depicted: Platform A to support validation exercise (EXE) 1 and validation exercise (EXE) 2 and Platform B to support (EXE) 2.

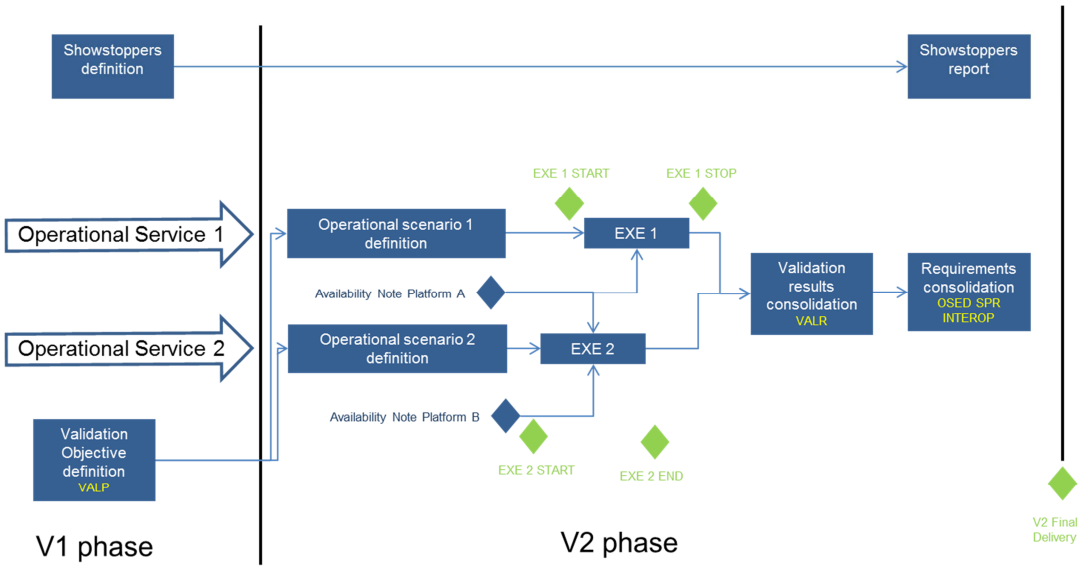

Figure 4: V2 process for Operational dimension of Virtual Centre Concept activity

The objective is to validate the developed operational scenarios using the platforms verified by the V2 maturity level of the activity “Technical Impacts of Virtual Centre Concept” (refer to the next paragraph where developments are identified).

As the platforms are close to Operational systems, validations are conducted in a realistic simulation environment or if possible, in shadow mode. Each validation is focused on an operational scenario and others members of this solution have access to the results through the validation reports.
At the end, the OSED / SPR / INTEROP documents are consolidated.

In parallel of this validation activity, the showstopper study is conducted to ensure implementation risks and corresponding mitigation strategy / action plan is identified.

Presentation of the platforms:

The table below presents the different platforms linked to already identified Operational Use Cases (some additional Uses Cases were identified during the V1 maturity phase and a process of selection is in place to select the most suitable Use Cases for the ATM community):

Possible Operational Use Cases	Domain	Partners (Platform)
Delegation of Airspace	ATFCM, En-Route Automation, Voice	HC (FSP), FRQ (FSP), skyguide, THALES AIR SYS, COOPANS partners, Finmeccanica, ENAV
Business Continuity	ATFCM, En-Route Automation, Voice	HC (FSP), FRQ (FSP), skyguide, THALES AIR SYS, COOPANS partners, Finmeccanica, ENAV
Training centralisation	ATFCM, En-Route, APP Automation	COOPANS partners, THALES AIR SYS
Delegation of Airspace	Tower Automation	ANS CR (B4), THALES AIR SYS
Infrastructure Rationalisation	Automation	DSNA, skyguide, Indra, FRQ (FSP)

Table 2: Presentation of the platforms for PJ.16-03 solution

Activity "Technical Impacts of Virtual Centre Concept"
The outstanding R&D needs for this activity are:

Needs	Rationale	Maturity level
Definition of functional and service architecture for the Virtual Centre concept	This activity is conducted using the common SESAR modelling tool MEGA, in order to include in the SESAR framework the modifications introduced by the Virtual Centre Concept at architecture and service level. Refer to the end of this chapter to find more details of the methodology used.	V1
Technology study	The study uses security, safety and performance requirements in order to define the adequate technologies able to support Virtual Centre Services, evaluating by priority SWIM technologies, and if necessary specifying new SWIM technologies or profile.	V1
Performance requirements	Based on the SPR defined in the operational view, this analysis is required to assess the ability of the virtual centre solution to support the same operational performance using a different development of underlying systems and services.	V1
Service modelling	This activity is conducted in respect of the state of the art SESAR 2020 Working Method on Service, and MEGA tool is intended to be used, reusing existing B.04.04 modelled services. The objective is to propose ready to standardise services able to fulfil the operational requirements defined in OSED and SPR. The objective of this service modelling activity is to cover an extended functional scope from SESAR 1 B.04.04, including voice and ATFCM, to provide common service interfaces until a "ready for standardisation" level, as well as to provide service description.	V3

Verification	Based on the platforms developed by partners, the objectives is to verify the correct implementation of the requirements.	V2, V3

Table 3: Outstanding R&D needs for Technical Impacts of Virtual Centre Concept activity

Modelling task
A stepwise approach is adopted to model and then implement the services which is a lesson learnt from B.04.04 SESAR 1 project. The scope of services and operations to model is divided into sets, whose modelling activities are planned for durations of 6 to 9 months.
This task delivers 2 deliverables: ADSP/CWP TS/IRS (Interface Requirement specification) and ADSP / CWP interfaces services and data models. These deliverables are updated at each maturity level after the verification task.

The beginning of Service modelling activities is independent of the beginning of the activity "Operational Dimension of Virtual Centre Concept" because B.04.04 services have to be improved for a deeper analysis. The operational / safety / cybersecurity / performance requirements are addressed in the next sets of Services (a set can contain previous services with new requirements and/ or lower level of design until the standard level). Based on the current schedule, 3 sets are expected with the objective to define all the services prior to the V2 verification exercises. With this approach, if needed, the services could be refined in parallel of some verifications tasks.

Platform Development
The development of the platforms is aligned with the delivery of the set of services. Each partner or group of partners develops its prototypes, in respect of the modelled services. Prior to the verification task, tests are conducted among partners to ensure the correct development.

Technical verifications:
The objective of these verifications is double:

- Verification of the interfaces based on the defined services
- Verification of the technical safety / security / performance requirements

SESAR verification methodology is respected, in particular with the provision of needed documentation, such as verification plan and report.

Verification of the interfaces based on the defined services: This verification is conducted at the V2 and the V3.

Objectives	Verify that the implemented services deliver the following principles: • Accessibility: ATSU/CWP can directly consume information using common service interfaces and network connectivity. • Equity: No individual ATSU/CWP dominates, or constraints, what may be consumed, by other ATSUs/CWPs • Flexibility: Capability for adequate, responsive, timely, dynamic and asynchronous changes of providers and services they consume.
Type of simulation	V2: Recorded Data and simulated environment (for example, using a common Dataset and One scenario where a flight go through a simplified Airspaces of multiple ANSP (NATS, DSNA, DFS, skyguide, Eurocontrol and ENAV)) V3: simulated mode or shadow mode
Service Provider	DSNA, Indra, Eurocontrol, NATS, ENAV
Service Customer	skyguide, NATS, DFS, FRQ (FSP) , Indra, THALES AIR SYS, Finmeccanica, ENAV

Table 4: Verification of the interfaces

Verification of the technical safety / security / performance requirements: This verification is conducted at the V2 and the V3

Objectives	Verify that the implemented services deliver the following principles: • Performance: Combined ATSU/CWP and infrastructure provisions must ensure required levels of performance, safety, and resilience, and provide effective incident and evolution management. • Quality, Integrity & Security: Each service provider will have full responsibility for the quality, integrity, security, and availability of the information they provide and will need to be certified as a qualified provider for those services. Information will only be exchanged between such qualified parties and the necessary security measures will be applied.
Type of simulation	V2: Input as Radar tracks are simulated and the link between ADSP and CWP is an available network (preferably SWIM) V3: simulated mode or shadow mode
Service Provider	THALES AIR SYS
Service Customer	ACG/COOPANS, CCL/COOPANS, IAA/COOPANS, LFV/COOPANS, Naviair/COOPANS

Table 5: Verification of the technical safety / security / performance requirements

Relevant national or international research and innovation activities:

Europe is a pioneer in the Virtual Centre concept and even if many presentations have been done in the past, no other national or international research and innovation activities have been identified for the moment.

The idea is to disseminate as much as possible the results of this solution (refer to chapter 2). It is expected to have an international coordination for this concept. This coordination could be done at the standardization bodies level (Eurocae / RTCA) but also in international organizations as ICAO or professional organizations (CANSO, ATCA, …).

No sex or gender analysis is required in this solution.

PJ.16-04 solution Work station, Controller Productivity

Concept:

The Controller Productivity Concept refers to the evaluation of a number of interaction technologies to determine how they can make interaction with data on the CWP more intuitive for controllers. In addition, this work package is looking for ways:

- to improve controller logon and role profile management,
- to investigate more efficient ways to develop controller requirements into operations and
- to investigate how CWP may make use of “thin client” technologies.

Projects PJ.01 to PJ.10 in SESAR 2020 intend to increase controller productivity by sophisticated support tools for the different controller tasks at dedicated controller working positions (CWPs). Project PJ.16-04 is additionally looking at innovative interaction and operation techniques used for human system interaction and efficient development of future CWPs.

Workstation Controller productivity shall be enhanced by a series of related activities under this solution. Existing advanced interaction technologies are applied to the ATM environment and analysed to determine the impact on controller workload and productivity. The new types of interaction to be investigated are Multi-Touch Input Devices, Automatic Speech Recognition and Attention Guidance. PJ.16-04 begins by determining the productivity measures and setting baselines of performance in coordination with the Solution Projects.

There are 6 activities under this Work Package, relating to different aspects of controller productivity described above. These are:

- 01 Multi Touch Inputs
- 02 Attention Guidance
- 03 Automatic Speech Recognition
- 04 User Profile Management Systems
- 05 Efficient Process
- 06 Qualification of CWP Virtualisation

Assumptions:

It is expected that this solution shall maintain a current “Assumptions Log” throughout the research phase and this log shall be updated as new assumptions are made and existing ones challenged.

Current Assumptions in the planning and HLD of PJ.16-04 are:

- Inputs from SESAR 1 will be available as required
- Dependencies with SESAR 2020 Projects shall be understood during V1 for V2 and V3 validations
- Platforms will be available in the time scales required
- Each Activity will be able to gather a clear user requirement in close coordination with the Solution Projects
- Technical Specification will be available in timescales required for each Activity

Methodology:

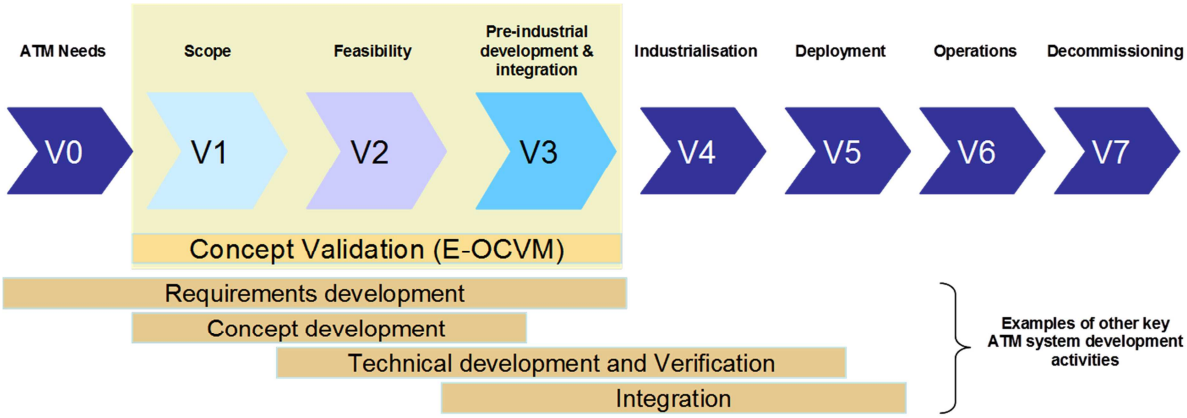

Figure 5: Maturity phases and scope of E-OCVM (c.f. SESAR 2020 MAWP, p.5)

Solution 16-04 partners have chosen to approach Controller Productivity as described by Figure 5: Maturity phases and scope of E-OCVM (c.f. SESAR 2020 MAWP, p.5) and Figure 6: Overall schedule.

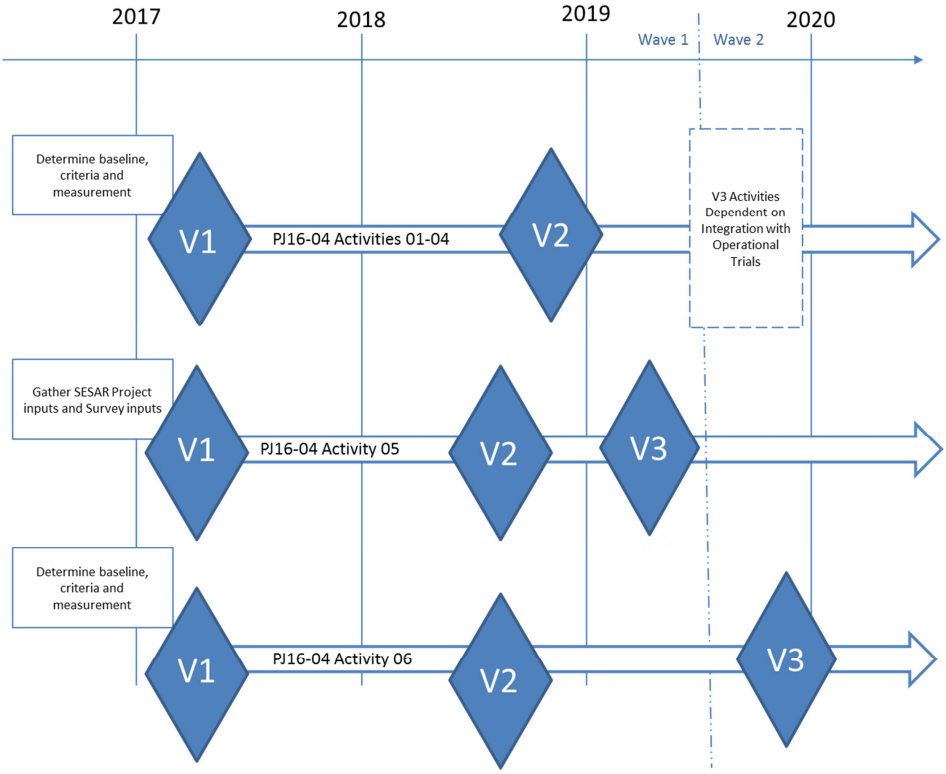

Figure 6: Overall schedule

In this simple approach, the Activities are largely independent of each other. They are grouped to show common approaches to validation, where these exist. **Activities 01 to 04** will perform V2 validations in Wave 1, utilising platforms developed by other SESAR 2020 Projects. The V3 validation will take place in Wave 2, most likely on improved versions of those same platforms. **Activity 05**, Efficient Process, makes use of "lessons learned" information from HMI Development in 10.10.02, amongst others, to select and test an efficient methodology to reduce timescales, costs and rework in development of the CWP functionality, HMI and adaptation. **Activity 06** also expects to achieve V2 in Wave 1 and V3 validation in Wave 2.

Determination of Metrics and Evaluation Methods
Before validating a single interaction technology integrated in Controller Working Positions (CWP) in Wave 1 solution projects, the participants in PJ.16-04, in coordination with the Solution Projects, will determine appropriate metrics for controller productivity and methods to collect evaluation 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, heart ratio measurement, EEG, 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. This preliminary work will be described as an outcome in a PJ.16-04 VALP document prior to V1.

Activity 05, Efficient Development Process will provide guidance on user-centred concepts of requirements capture, prototyping and design of CWP HMI, adaptation and functionality to reduce development time and rework experienced with the current generation of systems and processes. This will begin by assessing existing methodologies in use in SESAR and looking for opportunities to elicit requirements on SESAR Projects (inside and outside PJ.16) to perform validation activities to V3 in Wave 1.

The final part of PJ.16-04 is **Activity 06**, Qualification of CWP Virtualisation, which is independent of the other activities. This is looking to provide a stable prototype containing the virtualised aspects of the future CWP technology, investigating the application of thin clients to the CWP.

Validation Gate Process

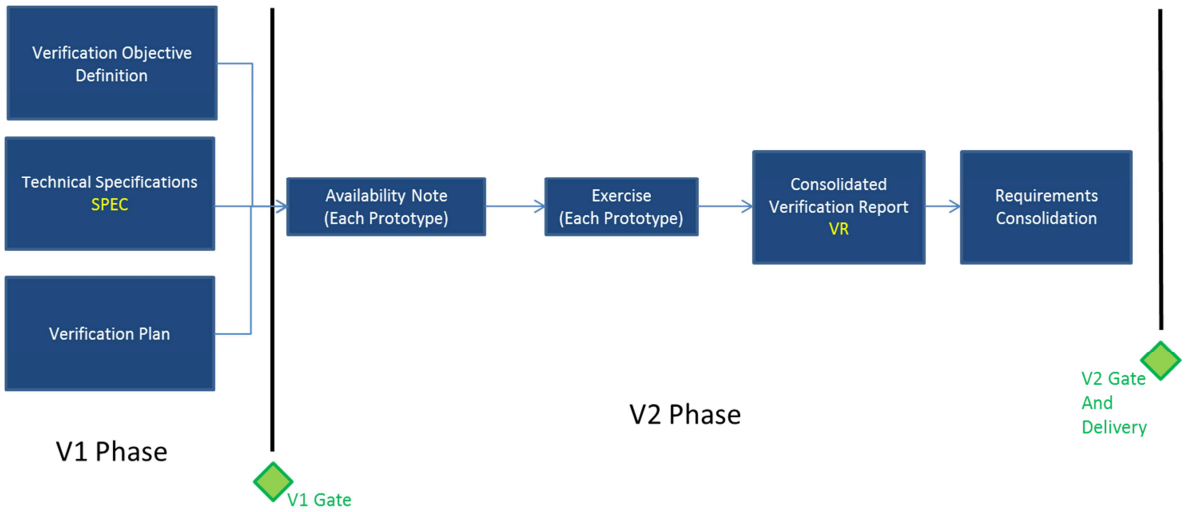

Figure 7: PJ.16-04 Validation Process to V2 – PJ.16-04 Activities

The figure above shows the Validation process and gates for V1 to V2 for all activities in PJ.16-04 work package. The figure below shows the V3 Validation process and gates, which are only applicable to Activity 05, Efficient Process:

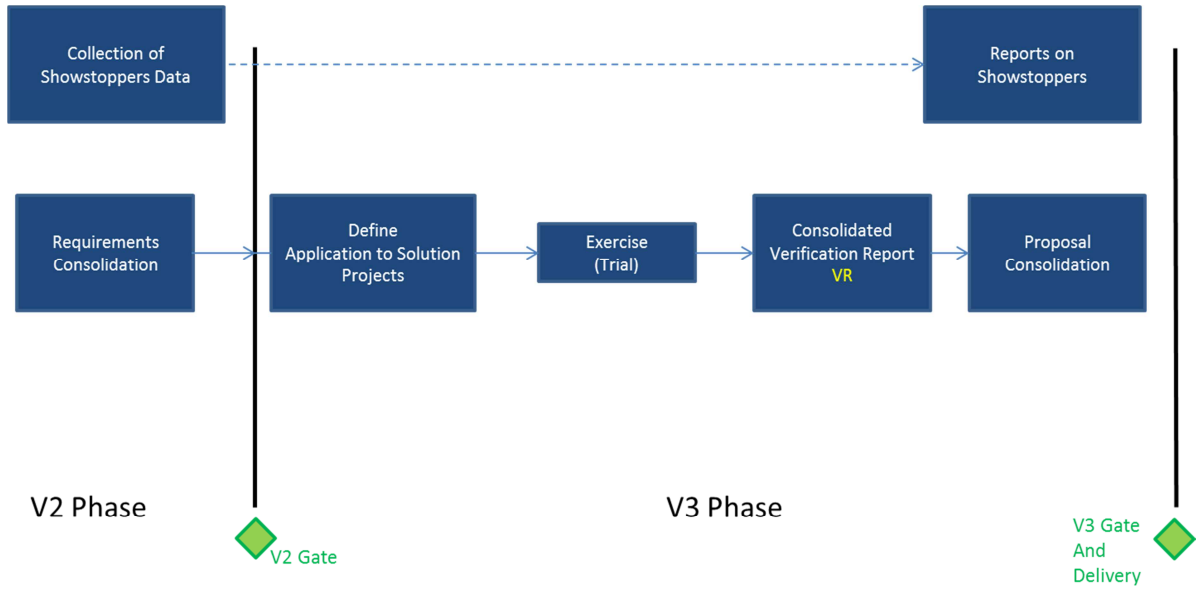

Figure 8: PJ.16-04 Validation Process to V3 – PJ.16-04 Activity 05

PJ.16-04 Relationships with Solution Projects

As PJ.16-04 is an enabling solution project itself, it is providing interaction technology prototypes to be embedded in the various validations of other solution projects. Further deliverables are parts of the corresponding Verification documents concerning the interaction technology and support for the human performance assessment in the Verification Result documents, to be used within other solutions.

The activities to do not have direct dependencies with Solution projects but do rely on them for use of platforms for evaluation of effectiveness in a complex ATM environment.

Solution	Name	ANSP	CWP	Use Cases	Validation
PJ.01-02	*Enhanced Arrivals and Departures*	skyguide	Skysoft	*Tower/TMA /ACC CWP*	Wave1, V1/2
PJ.01-03	*Enhanced Arrivals and Departures*	skyguide	Skysoft	*Tower/TMA /ACC CWP*	Wave1, V1/2
PJ.05-02	*Remotely Provided Air Traffic Service for Multiple Aerodromes*	HC (FSP) DLR (AT-One)	FRQ (FSP)	*Tower CWP for Remote Tower Applications*	Wave1, V1/2
PJ.05-03	*Remotely Provided Air Traffic Services from a Remote Tower Centre with a flexible allocation of aerodromes to Remote Tower Modules*	HC (FSP) DLR (AT-One)	FRQ (FSP)	*Tower CWP for Remote Tower Applications*	Wave1, V1/2
PJ.08	*Advanced Airspace Management*		SINTEF (NATMIG), ENAV	*TMA/ACC CWP*	Wave1, V1/2
PJ.09-02	*Integrated Local DCB Process*	ENAIRE	ENAIRE	*ACC CWP*	Wave1, V1/2
PJ.10-01B	*Flight Centered ATC*	DLR (AT-One)	DLR Research	*ACC CWP*	Wave1, V1/2
PJ.10-02A	*Separation Management, En-Route and TMA*	NATS		*TMA/ACC CWP*	Wave1, V1/2
PJ.10-02B	Advanced Separation Management	NATS, DLR (AT-One), COOPANS partners, DFS, ANS CR (B4)	Indra, THALES AIR SYS, DFS	*TMA/ACC CWP*	Wave1, V2
PJ.10-05	*Separation Management, En-Route and TMA*	NATS		*TMA/ACC CWP*	Wave1, V1/2
PJ.16-03	*Workstation, Service Interface Definition & Virtual Centre Concept*	skyguide	Skysoft	*TMA/ACC CWP*	Wave1, V1/2

Table 6: PJ.16-04 Relationships to ATM solution projects for SESAR 2020 Wave 1

- Table 6 presents the different ATM solutions supported by PJ.16-04 productivity solutions.
- The solution development is planned to be continued in Wave 2 where contributions to solution projects' V2 and V3 validation activities are foreseen and a respective maturity level of the PJ.16-04 solution shall be demonstrated.
- The validation scenarios are described by the solution project where the PJ.16-04 solutions will be embedded.
- These projects will provide details of validations performed utilising PJ.16-04 prototypes. These will form the basis of a consolidated Validation Report covering the whole work package.

Multi-Touch Devices

Concept: In SESAR 1 project P10.10.02 Multi-Touch Input Devices at the CWP was investigated with screenings of various technologies having been conducted. The conclusion from SESAR 1 was that *"if the overall HMI and HF requirements could define a common "gesture language", multi-touch technology can become an essential part of future SESAR technology and will influence the achievements of the overall SESAR 2020 goals."* (P10.10.02-D02 Available Technology Screening Document, p.71).

Within the same project, a follow-up validation involved operational experts (ATCOs) from various German ATC centres, enabling human performance data (usability, workload, situational awareness etc.) to be collected in the ATC simulation runs as well as interviews.

Figure 9: Different Multi-Touch Prototypes used during SESAR 1 P10.10.02 validations.

The results offer a valuable baseline for further developments, providing input to the SESAR 2020 V1 phase. (P10.10.02-D93 Innovation Analysis Report 2013, p. 136).

In summary, the initial validation results reflect a need to move this concept through V1 maturity level (i.e. "concept definition and exploring options/alternatives) to get to a prototype and V2 validation. Extensive empirical data was collected and analysed in SESAR 1, contributing to a SESAR maturity assessment showing final V1 maturity level achievement is highly feasible and, although there is an initial deviation from the DOW to perform V1, it is in line with the work defined in the MAWP.

The outstanding R&D needs for this activity are:

Needs/Activities	*Rationale*	*Target Maturity level*
Definition of Controller productivity concept and metrics	In coordination with the Solution Projects, definition of Controller Productivity and concept definition on a quantification through the use of Human Performance measurements	V1/V2
Consolidation of HMI needs	Consolidation of existing and additional HMI needs as expressed by operational users and the SESAR ATM Solution Projects PJ.01-10 as well as the specific use cases.	V1/V2
Specification of Touch / Multi-Touch gestures for ATM	Different gesture sets are available from previous work and other domains. Involve operational user to select an appropriate set of touch/ Multi-Touch gestures for ATM and to define a suitable "gesture language" and technically specify the HMI technical enabler	V1/V2
Verification on target	Verify prototype implementation according to	V2

Needs/Activities	*Rationale*	*Target Maturity level*
maturity level	solution specification	
Validation on target maturity level	Validate the concept by taking human performance measurements and applying the solution to the operational environment of SESAR ATM Solution Projects PJ.01-PJ.10	V2

Table 7: Outstanding R&D needs for Multi Touch Inputs activity

Methodology:

Maturity level V1 Activities

Operational HMI needs provided by SESAR 2020 solution projects shall be taken as guidance for the further development of the PJ.16-04 Multi Touch solution. 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.

Maturity level V2 Activities

In the present project, a proof-of-concept of the existing solutions will be verified and validated in active R&D work including prototypical implementations that are iteratively tested and include representative data with regard to technical feasibility (TRL 3). These examinations will include Human Performance measurements in a relevant environment (above TRL 3).

For the validation, human in the loop activities including human performance assessments are considered.

For SESAR 2020 Wave 1 target maturity level V2 is reached using operationally relevant scenarios from SESAR 2020 solution projects. Therefore, validation plans are setup in close coordination with connected SESAR ATM Solution Projects in order to be able to address their productivity needs and to assist them in reaching their OI steps. The goal is the adoption of the PJ.16-04 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.

Automatic speech recognition

Concept:

Automatic Speech Recognition (ASR) is a very promising interaction technology for future CWPs. 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.

ASR is already beyond maturity level V1 / TRL 2 with its benefits confirmed as a result of validations/ investigations in ATM research activities already performed by project members outside of SESAR, e.g. AcListant®, which is described in more detail in section 1.4 Ambition and ATVoice®.

Although the technology is beyond maturity level V1/TRL2, there is still a need to develop Operational Use cases involving ASR in ATC Procedures and to develop interoperability requirements between the ASR prototype and the platform for V2 validations. These developments will have to pass a V1 gate during this Activity.

In the ATM environment ASR offers a wide area of application:

- keeping the system up-to-date (supports stripless system operation)
- for intent recognition (use spoken information immediately in the decision support tools)
- for more efficient communication pilot-controller (recognise pilot-read-backs also, avoid misunderstandings even without data link by automatic verification and target location assistance)
- for automated detection of control events performed by controllers
- for ATCO training purposes e.g. to replace the pseudo pilots
- as safety net function by assessing clearances

SESAR 2020 PJ.16-04 pursues the area of usage in control rooms. 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. The PJ.16-04 prototypes shall focus on innovative CWP concepts. More and more ANSPs resign from using paper flight strips and it is obvious that keeping system information up-to-date by mouse at aircraft labels or stylus input at electronic flight strips puts additional workload on the controllers. Therefore, ASR support for keeping system information up-to-date concerning controller clearances is one of the issues to be addressed in SESAR 2020 Wave 1. Also, as with Multi Touch Inputs and Attention Guidance, Controller Productivity Measures need to be defined and agreed, as these have not been applied to this work in this context before. This requires a V1 Validation Gate to ensure fitness for purpose before continuing.

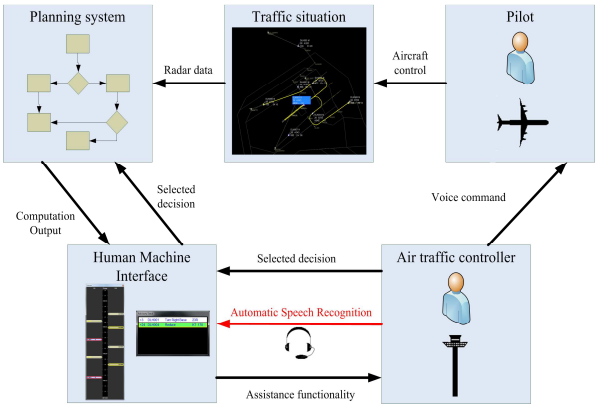

Figure 10: Assistant Based Speech Recognition in ATC

Furthermore, using ASR for automated detection of control events performed by the controllers enables the calculation of estimated workload. This information will then feed then Demand and Capacity Balancing, DCB tools to fine tune the controllers' environment to the real traffic demand and help the ATM system in providing the expected capacity.

As the intended prototypes were already validated outside SESAR their adaptation and interoperability with the target platform will ensure V2 maturity level at the end of Wave 1

The common outstanding R&D needs for this activity are described below.

Needs	*Rationale*	*Target Maturity level*
Definition of Operational Use Cases	Use cases require definition to appropriate level of maturity to support validation	V1/V2
Definition of Controller Productivity Measures	Definition of Controller Productivity and concept definition on a quantification through the use of Human Performance measurements	V1/V2
Definition of Interoperability requirements (INTEROP)	Definition of Interoperability requirements will be needed to interface the prototype to the platform	V1/V2
Technical Verification of Interoperability requirements	Interop will be technically verified for prototype interface to platform	V2
Definition of Operational Services	Any new, required Operational Services will be identified and defined for inclusion in the overall set of SESAR services	V2
Validation of the Operational Scenarios	Validate the concept by taking human performance measurements and applying the solution to the operational environment of SESAR ATM Solution Projects PJ.01-PJ.10	V2

Table 8: Outstanding R&D needs for ASR activity

Methodology:

Maturity level V1 Activities

Operational HMI needs provided by SESAR 2020 solution projects shall be taken as guidance for the further development of the PJ.16-04 ASR solution. 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 PJ.16-04 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, high lighting of targets etc.) in the best way to the controller.

Beside the operational needs V1 activities concentrate on the interoperability of the prototype and the target platform. The interoperability requirements are described in detail followed by their technical verification as prerequisite for human in the loop tests.

Maturity level V2 Activities

The resulting PJ.16-04 Solution ASR prototypes undergo project internal testing for usability and are subsequently integrated into predefined controller HMIs from SESAR 2020 solution projects. Validations are run as human in the loop trials with application relevant scenarios that were defined by the solution projects themselves. As PJ.16-04 is an enabling project it supports the human performance assessment through technically assisted Validations in the solution projects.

In the end, the validations planned for the solutions from the table below determine the maturity level that can be reached in Wave 1.

Solution	Name	ANSP	Industrial	Use Cases	Validation
PJ.05-02	Remotely Provided Air Traffic Service for Multiple Aerodromes	HC (FSP) DLR (AT-One)	FRQ (FSP)	Tower CWP for Remote Tower Applications	Wave1 V1/2
PJ.05-03	Remotely Provided Air Traffic Services from a Remote Tower Centre with a flexible allocation of aerodromes to Remote Tower Modules	HC (FSP) DLR (AT-One)	FRQ (FSP)	Tower CWP for Remote Tower Applications	Wave1 V1/2
PJ.09-02	Integrated Local DCB process	ENAIRE	ENAIRE	ACC CWP	Wave 1 V1/2
PJ.10-02B	Advanced Separation Management	NATS, COOPANS partners	THALES AIR SYS	TMA/ACC CWP	Wave1 V1/2
PJ.10-02B	Advanced Separation Management	DFS, DLR (AT-One)	DFS	TMA/ACC CWP	Wave1 V1/2

Table 9: Subset of PJ.16-04 Relationships for Validation of embedded ASR prototype

The solution development continues in Wave 2 where contributions to the corresponding V2 and V3 validation activities are intended and the respective maturity of the PJ.16-04 solution shall be demonstrated.

Attention guidance

Concept:
Attention Guidance (AG) is not new to the ATC environment, with guiding attention to HMI alerts and warnings is well-proven. The Human Factors Design Document[1] for controller HMIs delivered in SESAR 1 provides standards for layout of alerts and warnings. Mostly colour-coded signals or blinking parts of the HMI are used for this purpose. A further implementation could be the production of acoustic signals. The Attention Guidance concept to be investigated in PJ.16-04 will go far beyond these applications developed in SESAR 1.

Such innovative Attention Guidance technology is already available in the automotive area where in upper class limousines from various manufacturers this technology is included (e.g. "*ATTENTION ASSIST by Mercedes-Benz creates an individual driver profile, detects by reference to over 70 measured variables when the driver is becoming tired and duly prompts him to take a rest.*" or lane keeping assist:" *Lane Keeping Assist warns the driver by vibrations on the steering wheel when the vehicle is wandering unintentionally out of its lane, thus helping to prevent accidents*"[2]).

The application of Attention Guidance concepts in ATC in comparison is behind other industries due to delivery of safety objectives in a safety-related environment. This activity proposes a slight deviation from the DOW in this area, requiring the concepts to be applied to ATM and taken through V1 as part of this activity. The concepts can then be taken to V2 maturity in the prototyping phase.

The development of a prototype starts from scratch using eye tracking as an enabling interaction technology. A technology assessment already took place in SESAR 1 WP 10.10.02 (P10.10.02-D02 Available Technology Screening Document, p. 79 ff) but there is still work to do to reach V1 Maturity under PJ.16-04. PJ.16 will undertake to bring this technology past TRL3 to V2 Maturity as part of this activity.

As ATCOs' productivity is to be kept high permanently, independent from traffic situations, it is useful to guide their attention. Capturing ATCOs' eye movements can be used as an input mechanism to drive the human-system interaction and thus increase their productivity. Eye gaze systems can assess and guarantee the quality of their attention by assessing the real-time monitoring and attention state of the human operator. Furthermore eye gaze analysis could enable single operator working conditions (for instance remote or in a virtual centre) by building a safety envelope around the HMI. Permanent tracking eye movement can be abused for surveillance of controllers' work. So there should be legal regulations before deployment of eye tracking technology instructing that the recordings will not be used for those purposes. This issue is reflected in the ethics section also.

This Attention Guidance concept is based on analysing the current situation and the planned sequence of tasks in the next few minutes. The analysis delivers the identification of the next most important task. The area of interest is determined where the controllers should look at when fulfilling their task; this is the area of the required attention. Afterwards the area of current attention, the eye gaze focus, is gathered from eye gaze data. The concept in the end develops means to direct the attention of controllers as required.

In PJ.16-04, in coordination with the Solution Projects, a proof-of-concept of the planned solution is verified and validated in active R&D work including the prototypical implementation that is iteratively tested and includes representative data with regard to technical feasibility (TRL 3). These examinations include Human Performance measurements in a relevant environment (above TRL 3).

[1] Poiger, Michael and Hagemann, Konrad and Uebbing-Rumke, Maria and Del Veccio, Davide and Santanelli, Sara and Carneros, Isidora and Pinheiro, Jean-Philippe (2013)*Human Factors Design Document TMA/En-Route.*
[2] http://m.mercedes-benz.de/

The quality criteria to take into consideration are human factors issues, safety, productivity improvements against current interaction means, and workload reduction.

The outstanding R&D needs for this activity are:

Needs	*Rationale*	*Target Maturity level*
Definition of Attention Guidance Concept	Concept requires definition to appropriate level to support creation of prototype and further validations.	V1
Definition of Operational Use Cases	Use cases require definition to appropriate level of maturity to support validation	V1
Definition of Controller Productivity Measures	Definition of Controller Productivity and concept definition on a quantification through the use of Human Performance measurements	V1
Definition of Interoperability requirements (INTEROP)	Definition of Interoperability requirements will be needed to interface the prototype to the platform	V1
Technical Verification of Interoperability requirements	Interoperability will be technically verified for prototype interface to platform	V1
Definition of Operational Services	Any new, required Operational Services will be identified and defined for inclusion in the overall set of SESAR services	V1 V2
Validation of the Operational Scenarios	Validate the concept by taking human performance measurements and applying the solution to the operational environment of SESAR ATM Solution Projects PJ.01-PJ.10	V2

Table 10: Outstanding R&D needs for Attention Guidance activity

Methodology:

Maturity level V1 Activities

The Attention Guidance prototype needs to be developed in order to present the results of the Attention Guidance concept implementation in the best way to the controller. No off-the-shelf prototype is available.

Operational HMI needs provided by PJ.10-01B shall be taken as guidance for the development of the PJ.16-04 AG solution. 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 specific users' need, and iterative human in the loop simulations with operationally relevant scenarios. The goal is the integration of the PJ.16-04 solution into the validation platform in order to achieve PJ.10-01B OIs especially with respect to the controller productivity objectives.

Beside the operational needs, V1 activities concentrate on the interoperability of the prototype and the target platform. The interoperability requirements are described in detail followed by their technical verification as prerequisite for human in the loop tests.

Maturity level V2 Activities

The resulting PJ.16-04 Solution AG prototype is integrated into the predefined controller HMI from PJ.10-01B. Validations are run as human in the loop trials with application relevant scenarios that are defined by PJ.10-01B. As PJ.16-04 is an enabling project itself it supports the human performance assessment through Technical Validations.

Solution	Name	ANSP	CWP Platform	Use Cases	Validation
PJ.10-01B	Flight Centred ATC	DLR (AT-One)	DLR research	En-route CWP	Wave1 V1/2
PJ.10-02B	Advanced Separation Management	ANS CR (B4)	THALES AIR SYS	TMA/ACC CWP	Wave1 V1,V2

Table 11: Subset of PJ.16-04 Relationships for Validation of embedded AG prototype

The validations are run as human-in-the loop trials. Maturity level V2 is aimed to be reached with prototypes up to TRL level 3. The addressed CWP prototype will be ready for supporting V3 activities in Wave 2.

User Profile Management Systems

The objective of the particular Solution is to develop a 'User Profile Management Systems' (UPMS) technology. Starting at maturity level V1, including V0, an OSED from SESAR1 is expected to be used.

Identifying the UPMS in the ATM - CWP/HMI context-related safety tasks provides a crucial support to ATCOs for managing critical situations. 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 long-term experience of LPS SR (B4) and all involved Project partners with ID card identification systems.

  PJ.16-04 will further research and investigate the other available biometric (based on voice, fingerprint, face or iris recognition, etc.) user identification (Authentication) technologies and eventually identify the most appropriate, secure and reliable technology or multimodal biometric combination of technologies from the Operational, Safety and Technical point of view while presenting the benefits and disadvantages up to the OSED – SPR – Interop at V2 maturity level. Analysis of the Virtual Centre Architecture will be performed to identify ATCO's localization, localizing the ATCOs' positions according to their tasks, roles, and other attributes (Area name, virtual Flight Information Region (FIR), Physical sector, Volumic sector, Position on physical sector (EC, PC), etc.**).**

- In terms of the OSED – SPR – Interop at V2 maturity level of the 'UPMS configuration system,' questionnaires, expert brainstorms and workshops, as well as collection of ATCOs' inputs on their needs and requirements, common for all Project partners, will be taken advantage of for the purpose of identifying operational procedures and related settings or features of CWP, which is expected to be pre-configured before ATCOs' logon.

The outstanding R&D needs for this activity are:

Needs/Activities	*Rationale*	*Maturity level*
Definition of Controller productivity concept and metrics	Definition of Controller Productivity and concept definition on a quantification through the use of Human Performance measurements	V1/V2
Consolidation of user needs for authentication and relevant attributes of roles/tasks	Consolidation of existing and additional authentication and role profile needs as expressed by operational users and the SESAR ATM Solution Projects PJ.01-11 as well as the specific use cases.	V1/V2
Specification of User Profiling and authentication applications ATM	Authentication technologies are available from previous work and other domains. Involve operational user to select where UPMS could assist ANSPs and technically specify the HMI technical enabler.	V1/V2

Needs/Activities	*Rationale*	*Maturity level*
Verification on target maturity level	Verify prototype implementation according to solution specification	V2
Validation on target maturity level	Validate the concept by taking human performance measurements and applying the solution to the operational environment of SESAR ATM Solution Projects	V2

Table 12: Outstanding R&D needs for User Profile Management Systems activity

Maturity level V1 Activities

Starting at maturity level V1, including V0, an OSED is expected to be delivered.

Maturity level V2 Activities

Feasibility study in ATM context and a detailed design model with ATCO friendly environment in accordance with SESAR 2020 technologies, supporting Control Working Position productivity, are expected to be prepared and completed in TS-IRS at V2 for identified interfaces between UPMS and CWP functional Blocks. For an UPMS configuration system, a recommended common requirements would be an improvement as an integral part of the UPMS solution. This improvement could be evaluated in Verification and Validation Plan at V2, in coordination with the Solution Projects.

Progress of the Solution through V2 and V3 is independent of the preceding activities. In terms of the SESAR 1 there are no relevant data or deliverables related to this activity. Prototypical implementations shall be validated at V2 / TRL 5 level, Verification and Validation report will be delivered in SESAR 2020 Wave 1.

Efficient Development Process

Efficient Development Process will start slightly ahead of the other activities in this work package, to provide guidance on requirements elicitation and efficiency for the other activities where necessary. It is expected that V2 validations will be achieved by applying the process and evaluating its effectiveness on PJ.16 activities, with V3 validation coming from its application on one or more Solution Projects.

The first stage is to assess any Efficient Processes in use in SESAR 1 projects or planned for SESAR 2020. The maturity level is not yet known, although a questionnaire has been drafted to identify those processes in use and gain an initial view of suitability.

The outstanding R&D needs for this activity are:

Needs	*Rationale*	*Maturity level*
Definition of trial process	Mature industry processes and Survey reports will provide indications of application to ATM	V1
Definition of Operational Use Cases	Applicability to ATM development needs to be documented	V1
Definition of possible operational showstoppers	Where possible, issues should be found before application to SESAR projects	V1
Application to requirements derivation	Validation exercise carried out on appropriate scenarios	V1/V2
Report on showstoppers	Reports will be made available on results.	V2
Suggested Process	Proposed process documented based on validation recommendations	V3

Table 13: Outstanding R&D needs for Efficient Process activity

Maturity level V1 Activities
Before the V1 gate, candidate processes will be assessed from industry and SESAR. These will be applied to an ATM environment and refined to remove issues before validation.

Maturity level V2 Activities
To exit the V2 gate, the process needs to be applied successfully to requirements derivation for one or more SESAR projects and Validation reports concluded. Process recommendations will be documented based on the results of Validations.

Qualification of CWP virtualisation

The main objective within the qualification of CWP virtualisation is to investigate the application of thin clients and lightweight user applications for controller working positions.

As thin client a lightweight computer is understood connected to a server component to fulfil the computational role. This is different from the traditional desktop PC (fat client), which is a computer designed to take on these roles by itself.

The specific roles assumed by the server may vary, from centralised calculating of logic for the client, hosting shared virtualised application, a shared desktop stack or virtual desktop to data processing and file storage on the client or user behalf.

Based on the proof of concept of a service-oriented and decoupled software architecture within SESAR 1, B.04.04 and the definition and allocation of SMART functions, it additionally provides the possibility of light-weight user applications, supporting the thin client architecture. Although some prior work has been done, particularly in B.04.04, this activity needs to look at application of technology across ATM. The scope of this work means a deviation from the DOW to complete V`1 validation before moving on to V2.

The SMART functions manipulate data, reconcile data, provide missing information, and add value to data from the Functional Block, i.e. TP&M, FPLD FB etc. In the context of PJ.16, SMART functions are those functions defined within the scope of a FB, but should be allocated within the CWP/HMI boundary in order to add value to the CWP/HMI, enabling the controller to perform his activities. This means that the calculation of SMART functions is performed on server components providing the necessary data to the clients. This allows that no specific calculation logic is necessary on the client. The main goal of the client performed is the visualisation of data and the handling of inputs and outputs of the controller.

This will benefit in following aspects:

- Hardware resource optimization: Client hardware and I/O can be limited to a minimum.
- Reduced software maintenance: Software patching, security updates, application/OS updates, and OS migrations can be applied, tested and activated for all users in one instance to accelerate roll-out and improve administrative efficiency.
- Improved security: Software assets are centralized and easily fire-walled, monitored and protected. Sensitive data is uncompromised in cases of desktop loss or theft
- Improved mean time between repairs: The hardware of the clients can be easily exchange to minimize the down time of a controller working position.
- Improved environmental conditions. Due to the fact that no strong calculation activities have to be performed at each working position, it allows that the dimensions of the clients can be reduced and the noise of the hardware can be limited to a minimum.
- Improved controller working position technology based on user needs.

To provide a certified stable prototype thin client and light weight applications for the deployment phase, Key Performance Indicators especially for safety and performance are planned to be analysed in detail.

The following steps are conducted (in coordination with PJ16-03 solution):

Needs	*Rationale*	*Maturity level*
Definition of Virtual Centre Concept	Definition of virtual centre concept constraints defined within SESAR 1 B.04.04	V1
Definition of Operational Use Cases	Applicability to ATM needs to be documented	V1
Definition of possible operational showstoppers	Where possible, issues should be found before application to SESAR projects	V1
Definition of Operational Services	Definition of operational services necessary to be conducted	V1 and V2
Report on showstoppers	Reports will be made available on results.	V2

Table 14: Outstanding R&D needs for Qualification of CWP Virtualisation activity

Maturity level V1 Activities

The analysis of CWP Virtualisation is based on the Operational Use Cases and SPR requirements to identify the operational key performance indicators.
In coordination with the Solution Projects, and based on the operational KPIs, the technical KPIs will be traced and verified.

This is planned by using following methods:

- Expert groups
- Simulations

The first verification will take place on available verification platform to ensure the possibility of measurements of the Key Performance Indicators.

Maturity level V2 Activities

Based on the new demands and importance of controller working position according to the findings of SESAR 1 and SESAR 2020, the CWP virtualisation is expected to be prepared and completed within the maturity level V2. This verification is necessary as a baseline for the future virtual centre concepts with open and decoupled controller working positions. Due to this fact, the findings of the V1 activities (Key Performance Indicators) will be taken into account and improved with the finding of the first verification.

Following deliverables are planned to be produced:

- Technical Key Performance Indicators
- Verification Plan
- Verification Report.

This is planned by using following methods:

- Expert groups
- Simulations
- Feasibility tests

PJ.16-04 Common Elements

Relevant national or international research and innovation activities:
The European partners involved in PJ.16-04 are at the forefront of innovation in this field. Some material exists on Controller HMI interaction but no other relevant national or international research and innovation activities have been identified for the moment.

The idea is to disseminate the results of this solution as much as possible (refer to chapter 2). It is expected to have an international coordination for this concept, as with the 03 Solution. This coordination could be done at the standardization bodies level (Eurocae / RTCA) but also in international organizations as ICAO or professional organizations (CANSO, ATCA, …).

No sex or gender analysis is required in this solution.

Coordination with PJ.19

PJ.16, as a whole, closely coordinates with PJ.19 (see Figure 11). Within PJ.16, operational and functional define the needs (1) which are modelled by the PJ.16 MEGA Contributor (2&5) in the central SESAR 2020 MEGA repository which is used to generate the contents of the EATMA Portal (3&6). The project experts of PJ.16 review the contents of the EATMA Portal and provide comments (4). In order to ensure the alignment of PJ.16 with PJ.19, the MEGA Contributor of PJ.16 closely coordinates with the MEGA experts of PJ.19.

It is anticipated that this process will be executed throughout the course of PJ.16.

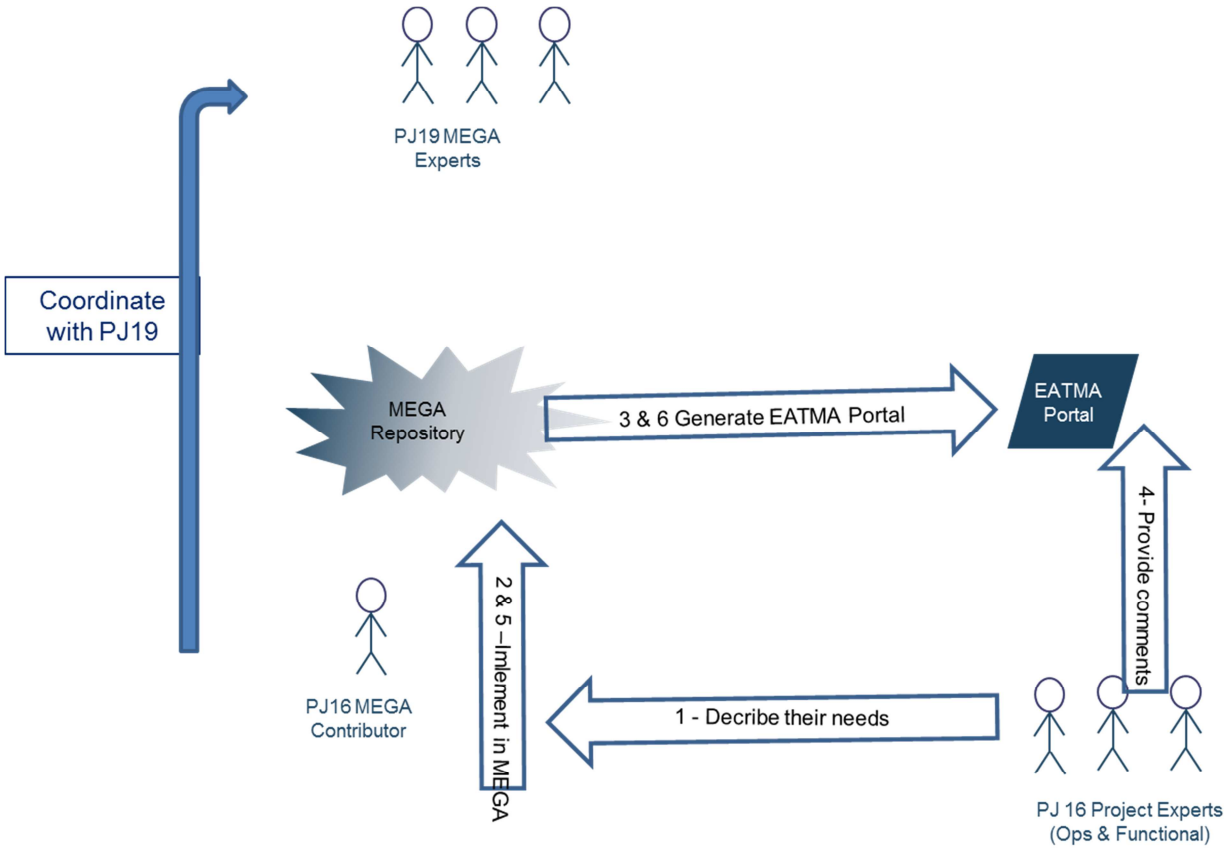

Figure 11: Use of MEGA repository and coordination with PJ.19

1.4 Ambition

PJ.16-03 solution Workstation, Service Interface Definition & Virtual Centre Concept

SESAR 1 Project B.04.04 has demonstrated the feasibility of common and open services for CWPs, in the Virtual Centre context. Nevertheless, the outputs from B.04.04 are services that are defined at logical level, and the scope of the project was not taking into account many aspects needed for the commissioning of such services (performance, safety, security, etc…). The result is that the feasibility to model such services is demonstrated, which was the goal of B.04.04 project, but the modelled services in SESAR 1 are not at this step of maturity and the global architecture of the Virtual centre Concept was neither in the scope of the project.

In consequences, the ambition of this solution is to develop the 2 aspects: Integration of the Virtual Centre concept in the operational environment agreed by the ATM community and details technically the interface services between CWP and ADSP.

Operational integration of the Virtual Centre concept
The potential of Virtual Centre concept is expected to be significant and major research and development are needed to reveal all possibilities, allowing complete control functionalities to be transferred between service providers independently of industrial ATM system

The development of the Virtual Centre will support following performance objectives:

- Increased Safety
- Increased ATCO efficiency
- Increased Capacity
- Improved Resilience
- Improved Interoperability in Airports, TMA and En-Route domains

Airspace delegation and effectiveness
Future concept enables airspace sectors to be flexibly assigned among the centre's units, depending on the resources available at any given time. It won't anymore be restricted to low traffic conditions but may be decided dynamically. It may for instance be driven by load sharing constraints or by cost optimisation. At low traffic conditions, ANSP in charge may extend the controlled airspace allowing more costly ANSPs to close down and therefore optimising the Network costs at given times.
The airspace delegation allows better staff allocation and allows multiple ANSPs to pool their resources in the longer term for a more efficient use.

Convergence of services and operations
With the possibility of delegating airspace sectors from one ANSP to the other, the control operations will converge. It would benefit in harmonized procedures, working methods and improved interoperability. For the airspace users' perspective, it means a seamless transition between airspaces irrespective of the ANSP in charge. The airspace users will benefit from reduced briefing and harmonised new functions deployment. Training for aircrew and ATCOs will be harmonized and economy of scale is expected.
Thanks to the decoupling Air Navigation Service Providers (ANSP) from ATM Data Service Providers (ADSP) using standardized interface, and the airspace delegation, a functional convergence will be observed.

Contingency
Currently ANSPs have limited contingency capabilities and the airspace they are in charge may suffer from long and important restrictions in case of emergency situation. By implementing airspace delegation, operational and technical convergence, contingency measures will be easier to put in

place, will shorten restriction time and offer less restriction. In a general manner, the control availability will be improved.

Services view
ANSPs would not anymore operate big monolithic systems or even integrate sub-systems with proprietary interfaces but would rather make use of certified "plug-in" services. Virtual Centre Concept pushes forward a decomposition of services, not only reduced to the link between CWPs and services but also between services. Some services will also be capable of subscribing to other services. Some services would be directly used by CWP (e.g. surveillance) while other services would need to combine information to be used by CWP (e.g. STCA would make use of surveillance and correlation).

Business perspective
With technical convergence and services decomposition, ANSPs may elect to purchase services from various providers. The technical certified "plug-in" capabilities are expected to increase competitive market and to offer economy of scale to ANSPs thus reducing costs for ANSPs and airspace users.
While cost reduction is one of the expected goals of the Virtual Centre, the social chapter is not forgotten as the Virtual Centre concept does not require physical consolidation nor impose mobility to control staff.

Detail the technical description of interface service
The ambition is also to address the global architecture of the technical impacts to the Virtual Centre Concept, and also to design the services supporting this concept at a detailed level (physical one) in order to ensure the interoperability of these services once implemented by different providers. The ambition is also to cover not only service interface description but to address also the service level agreement and the functional description of the operations, which are needed information in order to use such services.

A new actor in the ATM community:
These open, common and standardisable services will enable the appearance of a new stakeholder in the ATM business, the ATM Data Service Provider (ADSP), being able to centralize the provision of ATM Data and/or voice as a service, and thus optimizing the technical infrastructure and human operations needed to provide Data and voice to a group of ATSUs.

PJ.16-04 solution Workstation, Controller Productivity

Workstation Controller productivity pushes beyond SESAR 1 by utilising innovative interaction methods to do two things:

1) Give back time to the controller which would otherwise be taken away by new requirements to enter a greater deal of data into the future ATM system.
2) Make the process of system interaction easier and more intuitive than previous generation paper or electronic systems, further reducing workload or increasing productivity - with associated gains to be “spent” in capacity or safety terms as required by the Ops Projects.

Multi-Touch Input Devices

SESAR 1 research was done at maturity level V1, i.e. it comprised work on concept definition and exploring options/alternatives. Empirical data were collected in human performance assessments that allowed conclusions on the potential benefits of the technology. SESAR 2020 PJ.16-04 goes a significant step further by aiming at the fulfilment of a higher maturity level closer to operations, i.e. up to V2 in wave 1 and up to V3 (pre-industrial) in Wave 2.

HMI R&D needs of SESAR 2020 solution projects are taken as input for the further development of the PJ.16-04 solution. Evaluations and demonstrations are defined and run with involvement of operational users to investigate the possible benefits of the selected technologies to support V2 and/or

V3 activities in SESAR 2020 solution projects. Finally, the ATM Solution Projects have the opportunity to adopt and integrate the PJ.16-04 solution in their validation platforms in order to achieve their associated OIs especially with respect to their controller productivity objectives.

When looking at other safety relevant transport domains like automotive, advanced user interaction concepts such as Multi-Touch Input Devices are already well-integrated into many cockpits. Today, drivers take it for granted that innovative, easy to use technology is part of their human-machine interaction inside their car supporting them in safely reaching their final destination.

A European patent search for the keywords “Multi-Touch”, “CWP” and “ATC” on an international patent data base (http://worldwide.espacenet.com/advancedSearch?locale=en_EP, January, 21, 2016) revealed no hits. In the highly safety-critical Air Traffic Control (ATC) domain the development of an integrated solution for innovative Multi-Touch Input technology at the controllers’ operational workplace (CWP) is ambitious. However, some SESAR industry partners quite recently presented some CWP Multi-Touch concept studies (e.g. ATM Global Madrid. (2016, January 22). retrieved from URL: https://www.thalesgroup.com/en/worldwide/aerospace/case-study/shape-air-traffic-control-future). As stated above, initial prototypes from research institutes and industry partners alike have been assessed with operational users in SESAR 1 who encouraged CWP HMI developments based on Multi-Touch. The previously collected and analysed data provide insights into the potential benefit of the technology solution. As consequence, both ANSPs and system providers are very interested in integrating Multi-Touch Input Devices in solution projects supporting them in their tasks and integrating this controller productivity solution into their CWP equipment.

For SESAR 2020, it is the goal to further develop these concepts in a relevant operational environment including human in the loop simulations at a higher fidelity level such as V2 and beyond. Finally yet importantly, a deployment-ready state of development (V3) at the end of SESAR 2020 Wave 2 shall stimulate innovative ATC CWP productivity products for ANSP users and provide new business opportunities for Europe’s ATC system suppliers.

Automatic speech recognition

Higher automation levels are leading to more information that is available at CWPs and this greater amount of data has to be considered in the controllers’ decision making and guidance tasks. The improvement of decision support tools is subject to investigation and development in many SESAR 2020 solution projects. The advantage of decision support tools when processing all these data and extracting the relevant issues will be foiled if the interaction with the system via the HMI is time consuming and cumbersome.

So the aim of new interaction technologies is to assist the controller by making human system interaction more intuitive and efficient. HMI elements like big pop-up menus or long scroll bars should be avoided as well as displays overcrowded with icons carrying data outside the guidance information. The usability of the technology for controller input into the system should be as high as possible. Additional burden on the controller is a show-stopper for the deployment of new technologies.

New interaction technologies were already assessed in former SESAR 1 work package 10.10.02. The 2011 Available Technology Screening Document constitutes conclusively for the interaction technology ASR: “*Voice recognition could provide a good opportunity to ease some ATCOs tasks. However, some major issues have to be faced. 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 are a safety critical topic. Indeed, if the operator is overconfident on the system, he may accept the data without checking its validity.*

Thus, further studies are required to check how the likelihood of those false recognition can be reduced."[3]

As most input comes from the controller-pilot spoken dialog ASR is the appropriate technology to increase the productivity of controllers (or to reduce workload) by using the spoken commands as input to the system. Automatic speech recognition helps the controller to keep the system up-to-date with almost no additional effort to one of the main tasks, giving spoken clearances to aircraft pilots. In the best case and that should be the normal one (more than >90% recognition rate, an estimated value stemming from AcListant® validation trials) the system is updated by the spoken and correctly recognized clearance. Only in cases when the speech recognizer fails (should be less than 2 %) or does not recognize anything the controller has to use a further interaction technology like mouse or Multi-Touch.

As stated in section 1.3, DFS has used speech recognition and response for many years in their training environment. For the currently deployed use cases at DFS the technology is proven mature for operational "offline" (i.e. not live on board) applications at least. With SESAR 2020 PJ.16-04 ANSPs go a significant step further by starting to use automatic speech recognition in an operational environment to reach a higher maturity level also for operational online application, i.e. up to V2 in Wave 1 and up to V3 in Wave 2.

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. As interaction technologies used for the correction mouse and Multi-Touch were already assessed in human-in-the-loop trials[4]. In AcListant® the AMAN as supporting assistant system was in centre of the development and validation. In relation to this project DLR applied for a patent (European No.12746043.4) dealing with assistant based speech recognition. 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.

Particularly for multiple remote control, when the ATCO provides control for more than one airport simultaneously, the task load increases. The higher task load will increase the ATCO's workload which makes the air traffic control process more failure-prone. A mitigation means might be increased automation support to decrease the task load. One very promising concept is automatic speech recognition: if the automation is aware of the ATCO's voice communication with the pilot, the automation can highlight aircraft in the visual presentation, can fill in electronic flight strip information and is aware of planned sequences, routes and thus can establish a much better safety net in terms of conflict prediction and resolution as well as identification of communication vs. system input error by comparison of spoken controller clearance and made controller input.

Comparing the outlook statement from SESAR WP 10.10.02 with the results from AcListant® that started in 2011 we see the enormous progress the ASR technology in the ATM environment has made since then. As consequence both ANSPs and system providers are very interested in integrating assistant based ASR 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 ASR.

[3] Poiger, Michael und Hagemann, Konrad und Uebbing-Rumke, Maria und Gürlük, Hejar und Pigliacampo, Roberta und Pinheiro, Jean-Philippe und Quiles, Carlos und Terzioski, Predrag (2011)*DEL10.10.02.D032 Available Technology Screening Document.*

[4] Gürlük, Hejar, Helmke, Hartmut, Wies, Matthias, Ehr, Heiko, Kleinert, Matthias, Mühlhausen, Thorsten, Muth, Kathleen und Ohneiser, Oliver (2015) *Assistant Based Speech Recognition - Another Pair of Eyes for the Arrival Manager.* 34th DASC 2015, 14.-18. September 2015, Prague, Czech Republic

Attention Guidance

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 SESAR 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[5]. 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. In the present project, the feasibility of gaze detection deployment for attention control could be shown at TRL level 3.

The prototype to be developed aims at avoiding productivity 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 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.

New interaction techniques were already assessed in former SESAR 1 work package 10.10.02. The 2011 Available Technology Screening Document[6] constitutes conclusively for eye-tracking

[5] C.D. Wickens, The tradeoff of design for routine and unexpected performance: Implications of situation awareness in: D. J. Garland and M. R. Endsley (Eds.), Situation awareness: analysis and measurement, Erlbaum, Mahwah, NJ, 2000, pp. 211-226.

[6] Poiger, Michael und Hagemann, Konrad und Uebbing-Rumke, Maria und Gürlük, Hejar und Pigliacampo, Roberta und Pinheiro, Jean-Philippe und Quiles, Carlos und Terzioski, Predrag (2011)*DEL10.10.02.D032 Available Technology Screening Document.*

technology: “In conclusion, the technology seems promising but requires many research studies in order to increase its maturity. With the current status of our knowledge, it may not be envisaged into a CWP before several years.”

Solution project PJ.10-01B addresses sectorless air traffic management (ATM), in SESAR 2020 called Flight Centred ATC as a radically different, but operationally feasible approach to en-route air traffic control. Instead of partitioning the airspace into sectors, Flight Centred ATC regards the airspace as a single unit. Controllers are assigned to individual aircraft, for which they are responsible from their entry into the airspace until their exit. Each controller will have several aircraft to control. After first research experiments the feasibility of one air traffic controller safely guiding at least six aircraft under normal conditions is stated[7]. Hence, controllers working in that environment will have to monitor up to six aircraft in completely different disjunctive air space sectors. This wide area monitoring task will surely benefit to a great extent from innovative Attention Guidance assistance.

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.

Based on methods described in Chapter 1.3 and relevant data from R&D at V1 achieved by LPS SR (B4) and Project partners, by Operational, Technical and Safety Experts , common requirements of the UPMS are expected to be specified as an integral part of this solution.

For the prototype it is expected to reach V2 Maturity Level in Wave 1 or potentially V3 in Wave 2 and achievement of associated OIs respect to controller productivity objectives in accordance with ATM solution PJ.16-04 will be assessed in Validation Report at V2.

Efficient development Process

This activity is the first in PJ.16-04, kicking off in Autumn 2016. One or more candidate processes will be identified and developed to a V2 maturity level, sufficient to be trialled on other threads in PJ.16-04 and elsewhere, by the beginning of 2017. This will either allow candidate processes to be assessed against each other, or single process to be developed to maturity by trialling in parallel across multiple work packages. The Efficient Process is expected to build on work being done in ANSPs and suppliers by tailoring existing industry standard methodologies such as Agile or User Centred Design. It will advance the state of the art by giving all parties involved in SESAR access to a process which delivers:

- Reduced development time for ATC front-end applications
- Reduced development time for HMI designs

[7] Birkmeier, Bettina (2015) *Feasibility analysis of sectorless and partially automated air traffic management.* Dissertation, Technische Universität Carolo-Wilhelmina zu Braunschweig.

- Reduction in rework and retest activities
- Greater certainty of outcome
- Greater user engagement and buy-in to development process and outcomes

This activity will demonstrate evidence of viability of the selected process against these criteria as part of its V3 validation in Wave 1.

Qualification of CWP virtualisation

The solution is based on the work done within SESAR 1 B04.04. inspired by the concepts of interoperable open standard interfaces, ATM Data Service Providers (ADSPs),Virtual Centre Model (VCM) and increase modularity of ATM systems. SESAR B.04.04 provides a proof of concept, addressing ATM architecture from a service oriented approach (SOA) with a focus on the Controller Working Position.

This paves the way to optimise the controller environment using new technologies of CWP virtualisation to enable following aspects:

- Improve total cost of ownership by:
  - Hardware resource optimization
  - Reduced software maintenance
  - Improved mean time between repairs
- Improved security
- Improved environmental conditions

With SESAR 2020 PJ.16-03 ANSPs go a significant step further with the architectural concepts of new controller working position based on open and de-coupled interfaces. To optimise this approach it is necessary to provide the right technology of CWP virtualisation.

Therefore it is necessary to identify and test the performance and safety key performance indicators (e.g. response times) aiming to be ready with a stable prototypes of thin clients and light weight applications for the deployment phase.

2. Impact

2.1 Expected impacts

PJ.16-03 solution

The following performance objectives are expected with the assumption that at the right infrastructure is in place.

Performance Goals	*Level*	*Rational*
Capacity	H	Capacity is increased because with the Virtual Centre Concept, the capacity could be adapted dynamically.
Efficiency	H	Efficiency is increased because with the Virtual Centre Concept the right system is used at the right place
Safety	M	This concept allows innovative concept of business continuity.
Human Performance	M	Human Performance could be improved with this new concept.
Environmental Sustainability	L	By increasing capacity, environmental impacts are expected.
Access and Equity	M	By sharing development, multiples ANSPs could access to innovative functions more rapidly
Interoperability	H	By using standard interfaces, interoperability is drastically increased.
Cost Effectiveness	H	By using services, Cost effectiveness is increased.

Table 15: Performance Goals for PJ.16-03

Standardisation: Coordination with Eurocae is expected and material from this solution will be provided as input material for the relevant Eurocae Working Group.

The Virtual Centre concept could be implemented locally and in this case could be transparent for Airspaces users and neighbouring FIRs. If this concept is used in a network, G/G integration has to be carefully studied but it has to be transparent for Airspace users.

PJ.16-04 solution

The following performance objectives are expected.

Performance Goals	*Level*	*Rational*
Capacity	M	Increased time is available to controllers' due to increased productivity. Could chose 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 CWPs, 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
Environmental Sustainability	M	Better interaction with trajectories and more efficient selection of routes facilitates environmental gains promised by other SESAR

Performance Goals	*Level*	*Rational*
		projects.
Interoperability	M	Interoperability will be increased by tailoring interaction modalities to the controller tasks, best practices are supposed to get standard at corresponding CWPs.
Cost Effectiveness	H	The interaction methods under trial on PJ.16-04 are mature technologies and relatively cheap. The potential benefits in terms of capacity, performance and safety enhancements are conversely quite large.

Table 16: Performance Goals for PJ.16-04

2.2 Measures to maximise impact

a) Dissemination and exploitation of results

To increase the project success, it is foreseen to communicate largely on the contents of the work to be performed in the frame of PJ.16.

The main means for dissemination will be:

- participation in international conferences, presenting project results and achievements
- meetings, newsletters, organisation of workshops and tutorials or other common events
- publications to journals, website and interest group

It is expected that the consortium will submit an entire session to an international conference on the topic covered by this project, thus allowing the project to be presented as a whole.

Furthermore, it is planned to link the dissemination activities of PJ.16 results to already existing events. As soon as the project will have been released and initial results or progress can be reported, it is intended to propagate the achievements through events such as the SWIM Masterclass, EUROCONTROL ART workshops or ATM 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/ICRAT, the International Council of the Aeronautical Sciences Congress/ICAS, and International Conference on Human-Computer Interaction in Aerospace/HCI-Aero). Ideally, a common approach with existing conferences with SJU presence could also be planned, an active role in the WATC in 2017 or in the ATC-Global in 2017 would be a very good showcase.

Additional to the focus on the SESAR Innovation days or in associations gatherings such as the CANSO Conference in Vancouver in 2016, the IFATCA and IFATSEA annual meetings would be very good choices as well.

The target audience for the dissemination would be ATM leaders or ATM users. Changes in the scope of the environment need to be disclosed at all levels, from top management to end-users, to allow full buy-in in the new concepts. Dissemination will also address the implementation of project communication channels.

In addition, its expected research outcomes will be spread within the academia and to students of all levels (e.g., undergraduate, Master, doctoral) through the educational programs and training activities (e.g., courses, seminars, Master's theses, Ph.D. dissertations) of the research institute and of companies in the PJ.16 consortium supporting university education.

The PJ.16 Dissemination Manager will be in charge of defining the Exploitation Plan. The Exploitation Plan will be presented and updated ahead of the face to face meetings. The

Exploitation Plan will assess the benefits and quality of the new methods. It will control how the results flow into the other SESAR projects' activities (products, processes), will identify eventual spin-off processes or applications, licensing, technical and economic market considerations. Particular attention will be paid on the development of new design standards or policies including certification aspects.

Intellectual Property Rights protection and dissemination of knowledge are not incompatible, provided that they are based on clear principles and rules, shared by all the members of the PJ.16 consortium. These principles are predefined by the SESAR SJU and should be followed in any case.

In the MAWP, the following dependencies are identified:

Dependency type	*Solution*	*Rationale*
Input	PJ.10-01a	After coordination with PJ.10 leader, it was jointly decided these dependencies are not formal. As an enabling solution, PJ.16-03 solution could provide an architectural solution for implementing some PJ.10 solutions. In order to disseminate the results of PJ.16-03, these results could be presented during PJ.10 EPMB and additional actions, resulting from this dissemination, could be identified for Wave 2"
Input	PJ.10-01b	
Input	PJ.10-01c	
Input	PJ.10-02A	
Input	PJ.10-02B	
Input	PJ.14-02-04	After coordination with PJ.14-02-04 solution leader, it was jointly decided the input dependencies, identified in the DOW for PJ.16-03 solution, are not relevant.
Input	PJ.17-02	After coordination with PJ.17 Project leader, it appears the PJ.17-02 is no longer part of PJ.17 proposal. To ensure the right level of understanding of the PJ.17, the PJ.16-03 solution leader could participate to the PJ.17 EPMB, to be aware of the status of the development of solutions PJ.17-01, -03, -08."
Output	PJ.07.01	After coordination with this solution, it was jointly decided this dependency is no longer correct

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 and diverse airport and air transport community, through for instance workshops, conferences, and seminars. Another opportunity to disseminate project's results will be through presentations to the European Commission or at specific meetings organised by European bodies in Air Transport.

As internal communication channel the OneSky extranet is already established. Furthermore it is planned to build up a database on the OneSky extranet containing all relevant documents produced in PJ.16. At least all program documentation will be stored in order to have full electronic access to documentation.

The second step, after internally using OneSky extranet, will be the creation of a project's website for PJ.16 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 mean 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.

The coordinator and the so-called Project Coordination Committee (the leaders of tasks and subtasks) will pay much attention to deliver on due time contractual reports and cost statements to the Commission. A precise planning will be established to allow precise monitoring of reporting.

3. Implementation

3.1 Work plan — Work packages and deliverables

Overall structure of the work plan

The project is divided into 2 different solutions; each split into a certain number of activities and to a certain extent, coordinated independently by its Solution Leader (SL). The project structure is displayed in Figure 8.

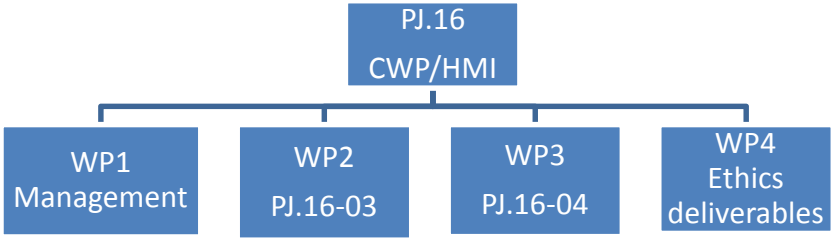

Figure 12: PJ.16 Work Break Down Structure

A further Ethics Deliverables Work package has been introduced to address the handling of ethics requirements.

As the 2 Work Packages of this project are independent, the schedule and the graphic presentation are presented by Work Package.

T0 is 1st of September 2016.

WP1: Project Management

For the Work Package Management, the schedule is directly the delivery date of the deliverables and no constraints have been identified between these deliverables.

WP2: PJ.16-03 solution Workstation, Service Interface Definition & Virtual Centre Concept

Overall Structure of Work Plan:

The work plan for PJ.16-04 has 6 main components, some of which rely on inputs from others or joint validations, some can be independently executed.

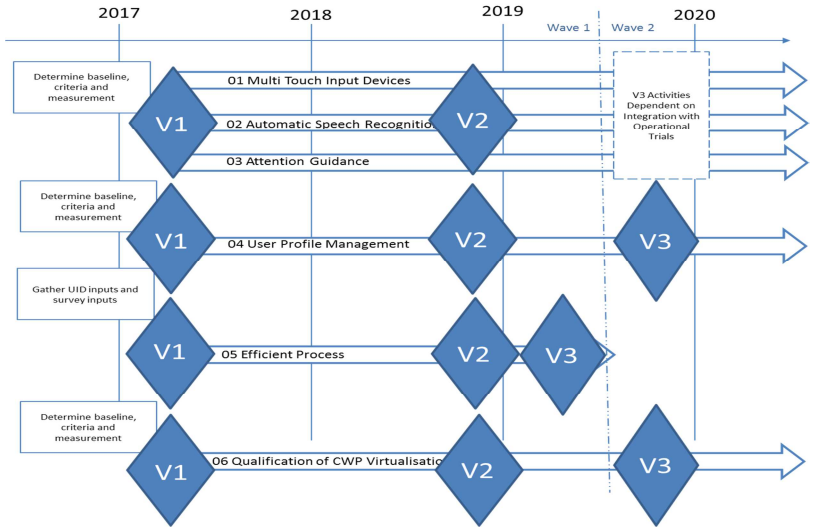

Figure 13: Chart of PJ.16-04 Activities

The above chart, Figure 12, shows the six independent Activities under WP03, PJ.16-04. WP03 will start with a task to determine data collection methods and metrics for the key controller productivity Activities and others as required. Activities 01 to 04 will run in step and will achieve V2 validation in Wave 1. In Wave 2 it is expected that they will all pass V3 Validation with the assistance of other SESAR 2020 Projects. It is possible that there may be common aspects to the V2 and V3 validations for Activities 01 to 03.

Activities 05 and 06 are independent of the others. Of these, only Activity 05 is expected to reach V3 validation in Wave 1.

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 Project Management Plan (PMP) will further refine management processes in line with the governance rules defined in the Grant Agreement and in the SJU Membership Agreement. The administrative and organisational management activities are hosted in WP1. 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 SMA will be negotiated and signed before the project starts. All of the administrative and organisational management activities are hosted in WP1. This approach allows 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 14.

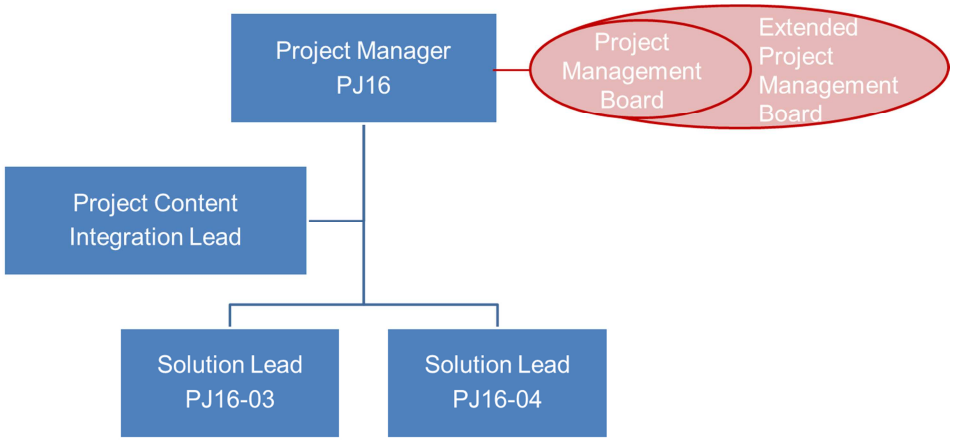

Figure 14: Project Structure for Project PJ.16

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 Team Lead (PCIL) ensures that the project is coordinated with Transversal Projects. At the implementation level, Solution Leaders (SLs) manage the execution of technical development and control implementation steps.

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 program 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 Technological Solutions and Enablers
- the timely execution of SESAR Solution validation activities,
- the preparation, execution and maintenance of a Programme Management Plan (PMP);
- 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;
- 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.

Project Management Board (PMB)

The Project Management Board ensures 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 SESAR Private Public Partnership Agreement will apply.

The Project Management Board should meet periodically (WebEx or Face to Face as required) to:

- review progress of the project;
- decide corrective actions;
- review project risks and associated mitigation actions;
- review any potential Change Request to the SGA when necessary.

The Project Management Board will be composed of:

- Project Manager (chairman);
- Project Content Integration Lead;
- Solution Leads;
- Representatives of key contributor to the project (the 5th highest budget contributors not representing above).

The PMB minutes are disseminated to all contributors.

Extended Project Management Board (EPMB)

An Extended Project Management Board meeting (including all contributors of the project) needs to be convened annually at a minimum.

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
  - V Data Pack
- Change Request to the SGA.

Decision making principles are the same as for the Project Management Board.

Solution Lead (SL)

The Solution Lead 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 Lead:

- 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;

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.

Project Content Integration Lead (PCIL)

The Project Content Integration Lead:

- Reports to the Project Manager
- Acts as a focal point for interaction with the Transversal Projects. 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.

In the PJ.16 project, there is NO Project Content Integration Team because the 2 solutions are too different for integration. The relevant expertise is provided by the solution experts and Ad-hoc meetings are organised by PCIL.

PJ.16-03 solution Workstation, Service Interface Definition & Virtual Centre Concept

The organisation structure for PJ.16-03 shall conform to the PJ.16 organisation proposed by the Project Manager of PJ.16, THALES AIR SYS.

The organisation structure allows Solution Management for each of the 2 activities that form part of PJ.16-03, under the direction and governance of the overall Solution Lead for PJ.16-03.

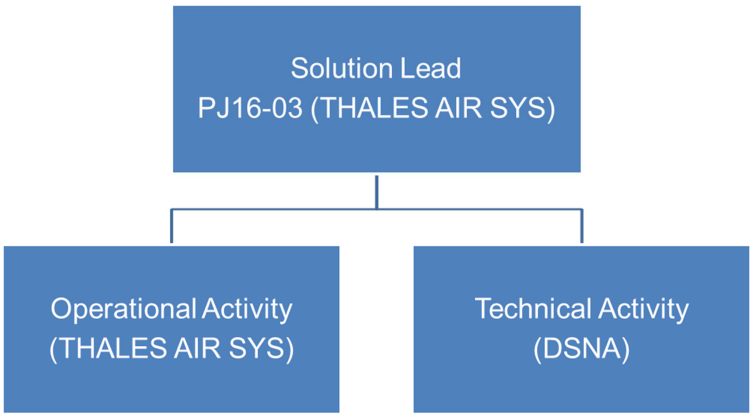

Figure 15: Project Structure for Solution PJ.16-03

The Solution lead provides the technical direction to the Activity to ensure the solution is clear about meeting/ delivering its technical objectives within the given constraints. He/She also provides the technical governance across the Solution, ensuring a consistent approach and delivery of the 'right' products across all the activities.

PJ.16-04 solution Workstation, Controller Productivity

The organisation structure for PJ.16-04 shall conform to the PJ.16 organisation proposed by the Project Manager of PJ.16, THALES AIR SYS.

The organisation structure allows Solution Management for each of the 6 activities that form part of PJ.16-04, under the direction and governance of the overall Solution Lead for PJ.16-04.

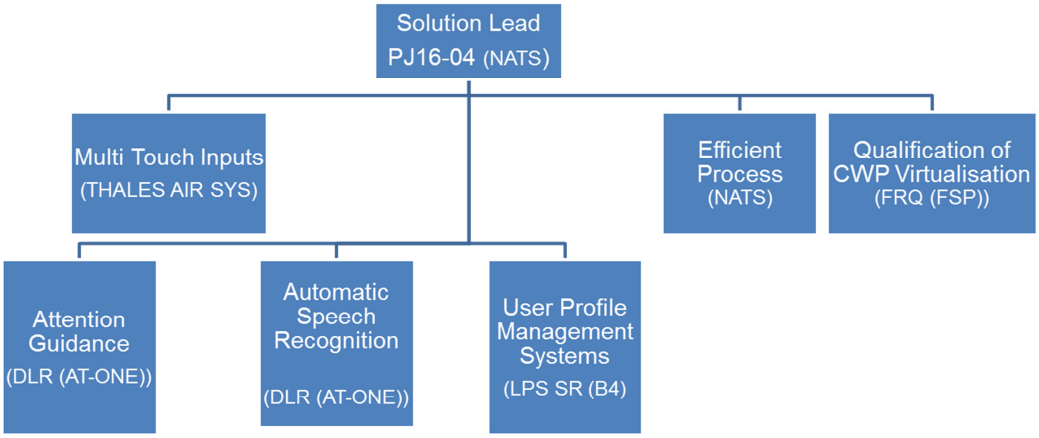

Figure 16: Project Structure for Solution PJ.16-04

The Solution lead provides the technical direction to the Activity to ensure the solution is clear about meeting/ delivering its technical objectives within the given constraints. He/She also provides the technical governance across the Solution, ensuring a consistent approach and delivery of the 'right' products across all the activities.

The WP for Solution PJ.16-04 defines the 6 activities that form part of the Overall Solution.

3.3 Consortium as a whole

The Consortium involves key stakeholders of the Ground ATM Systems, Service Provision, ATM Research and EUROCONTROL hence providing a wide range of expertise covering all aspects of CWP/HMI.

This consortium comprises 21 organisations representing 14 member states of the European Union, and 2 organisations from 2 nations beyond the EU (Norway and Switzerland). 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.

PJ.16 is represented by members from ground industry, ANSPs and, additionally, an ATM research organization. As the project comprises CWP/HMI and Virtual Centre concept and development (e.g. ground side development only), no need for airborne industry is expected. Together the members represent a broad cross section of the European ATM community.

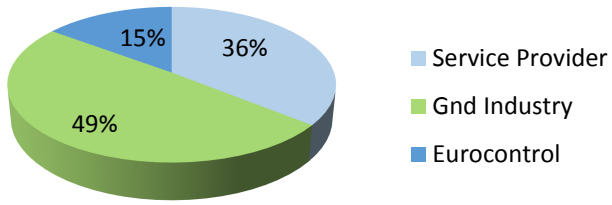

Figure 17: Budget share between stakeholder groups

The mix of participants is considered as valuable as the ground industry and ANSPs/Research organization complement each other in a beneficial way.

Required expertise to fulfil the Project objectives can be found among the members. The ATM operational expertise, supporting development of operational aspects will be provided mainly from the ANSPs. Human factor expertise, with experience of creating new interaction modes and HMI´s will be provided both from DLR (AT-One) (as research experts) and by the operational and HF experts provided via the ANSPs and ground industry participation. The ground industry partners will add vital technical knowledge related to system development, and be supported by the other members to find an operational acceptable solution for the new VC standard and the development of technical solutions.

The fact that members represent different systems/concepts/environments will cater for an extensive investigation of all development undertaken by PJ.16. Different members will have different approaches to the tasks and this in turn will stimulate discussions to find the best suitable solutions.

Thanks to this multifaceted involvement in this project it is expected that the results will be disseminated and exploited by the majority of the participants as the benefits derived are considered to be advantageous for both ground industry and service providers. PJ.16 will contribute to a new set of standard requirements and system design, incorporating VC capabilities that will be a prerequisite in future ATM systems. Furthermore, innovative interaction, operation, and

development technologies at the CWPs will be investigated up to embedding them in other solution projects' validation exercises in order to promote their application in modern operations rooms.

Members' expertise and task participation are described in Table 17: Members expertise and task participation.

Domain	Partner	technical expertise	Operational expertise	HF expertise	Participation in: Operational VC	Technical VC	touch input devices	Automatic Speech Recognition	Attention Guidance	Preferred Management Systems	Efficient Development Process	Qualification of CWP virtualisation
Ground Industry	FRQ (FSP)	X	X	X	X	X		X				X
	Indra	X		X	X	X	X	X	X	X	X	X
	SINTEF (NATMIG)	X		X	X	X	X	X			X	
	Finmeccanica	X		X	X	X		X		X		
	THALES AIR SYS	X		X	X	X	X	X	X			
Research	DLR (AT-One)		X	X				X	X	X	X	
Air Navigation Service Providers	ANS CR (B4)	X	X	X	X	X	X	X		X		
	LPR SR (B4)	X	X	X	X	X	X	X		X		
	ACG/COOPANS, CCL/COOPANS, IAA/COOPANS, LFV/COOPANS, Naviair/COOPANS		X	X	X	X		X	X		X	
	DFS	X	X	X	X	X	X	X	X			
	DSNA		X	X	X	X						
	ENAIRE	X	X	X	X	X	X	X	X	X	X	
	ENAV		X	X	X	X						
	NATS		X	X	X	X	X	X	X	X	X	X
	HC (FSP)		X		X							
	skyguide		X	X	X	X		X				
	Eurocontrol		X	X	X	X						X

Table 17: Members expertise and task participation

THALES AIR SYS justification for participation

During the proposal preparation phase it was found necessary because of H2020 implementation constraints applicable to linked third parties to change the initial Thales membership application structure and it was consequently agreed with SJU to split the Thales application into two separate members: Thales Air systems (THALES AIR SYS) primarily addressing ground activities, and Thales Avionics primarily addressing Airborne activities. In this project Thales Air Systems is the sole Thales member contributing to the project.

For the Virtual Centre Concept, Thales Air Systems is a major contributor of SESAR 1 B04.04, in particular by industrialising the service interface definition from the logical level to the physical one. Thales is also contributing of one of the major demonstrations, fulfilling most of the B04.04 demonstration objectives. More globally, Thales is a leading industrial in this concept by presenting ideas and proof of concept during seminars of the ATM community.

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). Developped 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 will help in de-risking the design through V2 exercises. Thales will also bring his Topsky ATC product to perform V3 exercises.

The V2 exercises will take place in the SkyCentre in Rungis which provides ATC platforms and debrifing capabilities and where a dedicated Human Factors team and a dedicated innovation development team are present.

To help during the 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

B4 Consortium is a consortium of four small- and medium-sized Air Navigation Service Providers from the Czech Republic, Lithuania, Poland and Slovakia, which was established in 2014 as a platform for mutual cooperation among its participants. These include the Air Navigation Services of the Czech Republic (ANS CR), Oro navigacija (ORO NAVIGACIJA), the Polish Air Navigation Services Agency (PANSA) and Letové prevádzkové služby Slovenskej republiky (LPS SR), which bring together a unique blend of diverse company profiles, decades of expertise in provision of complex package of high-quality ANS, as well as active involvement in state-of-the-art operational and R&D partnerships. Only ANS CR and LPS SR will participate actively in this project.

ANS CR (B4) will contribute to the Solution PJ.16-03, where it brings a strong added value in its experience from evaluation of possible system support for dynamic sectorization required by CONOPS in FAB CE, as well as from its contributions to operational and technical expertise especially in its TWR related part

Additionally, in Solution PJ.16-04, LPS SR (B4) will support the whole consortium in the research and specification activities with know-how from a long-term operation of an ID card identification system, expert capacity of its in-house software development team as well as with 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. In terms of the development and validation efforts, ANS CR (B4) will provide its Development and Test Centre (DTC) platform, while in overall, its initial concepts for reduction of the role of keyboard in the new ATM system and ideas of using new interface technologies, such as touch input device or voice recognition, will serve as a sound basis for development of the Solution as such.

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 partners would like to investigate the potential of new CWP/HMI technologies, e.g. Automatic Speech Recognition, and explore possible impact on ATCO performance and system efficiency. COOPANS Topsky system already has CWPs 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. 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.

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. Furthermore validations with Thales Air Systems and DLR (AT-One) are planned to assess the operational benefits of Automatic Speech Recognition. COOPANS partners will bring in operational and system experts with experience from trajectory management and a highly automated ATM system.

DFS justification for participation

DFS Deutsche Flugsicherung GmbH (DFS) is responsible for air traffic control in Germany and is headquartered in the town of Langen. It is a company organised under private law and 100% owned by the Federal Republic of Germany.

Besides the main business of providing air navigation services DFS has an outstanding expertise in the development (incl. HMI-development) and validation of concepts in the German national research programme on aviation (Luftfahrtforschungsprogramm) and also in the SESAR Programme.

In PJ.16-03 DFS will contribute to the modelling of service interfaces, the development of prototypes and their verification/validation. Within the SESAR 1 programme, DFS is participating in project B.04.04 in which service-oriented interfaces between CWP and mainly FDP are designed and demonstrated. DFS actively contributes to the service modelling, the implementation of a prototype and its technical demonstration. DFS is leading a joint demonstration with NATS, ENAIRE and Indra.

In PJ.16-04 DFS will evaluate the potential of new CWP/HMI technologies and explore possible impacts on ATCO workload, situation awareness and safety. DFS already introduced Voice Recognition and Response (VRR) in their ATC training environment since 2011. The controller given clearances are recognized, the aircraft is controlled by the VRR-pilot (machine/simulator) and the text-to-speech engine provides the readback of the VRR-pilot. This gives a lot of flexibility using the simulation environments also during non-office hours as well during weekends. Based on this experience, the use of Automatic Speech Recognition within Operational Environment is a next step for DFS.

DSNA justification for participation

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 and is a major active contributor to the current development phase.
Within the on-going SESAR 1 programme, DSNA is leading project B.4.4 that aims at defining a common service interface for the Controller Working Position (CWP) based on clear and open industry standard interface. Much of DSNA experience, which is also being developed through its service oriented strategy on ATM architecture, Coflight As A Service project being one example, will continue to be shared within this project through our contribution to operational and architecture definition, models and demonstrations.

ENAIRE justification for participation

The Public Corporate Entity ENAIRE, which is attached to the Ministry of Public Works, manages air transit control, aeronautical information and the communication, navigation and surveillance networks required so that airlines and their aircraft can fly safely, smoothly and in an orderly manner through Spanish airspace. Through Aena S.A. ENAIRE manages an international network comprising 46 airports and 2 heliports, serving over 187 million passengers per year.

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 and DFS).

ENAIRE already applied its knowledge SESAR 1 in the contingency tower (06.08.04), En-Route (05.09) and Tower (06.09.02) CWP projects, and in projects analysing the use of Automatic Speech Recognition (VOICE).

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 CWP/HMI technologies and explore 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 contributor of SESAR 2020 PJ.16 has to be seen as follow-up of its involvement in SESAR 1 projects into the both en-route and TMA domain for technical and operational aspects. In particular, the leadership of SESAR 1 P05.09 and participation as contributor of P10.10.02, P10.10.03, WPB4.4 and WPB4.3 has to be considered as an added value for the participation of SESAR 2020 PJ.16a activities.

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. The NATS architecture will thus be based on a design of services that mirror real-world operational activities. This project defines the CWP architecture to include the services that are internal to the CWP and the services to be provided by external systems. The project is thus fully aligned with NATS' current investment programme and therefore the company can bring significant experience in understanding the service context of the work-station and the design of the individual services. In SESAR 1, NATS is a significant contributor to Project B.4.4, leading the development of the service design.

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

- Strong and recognised Architecture expertise: SESAR WP-B (Lexicon, EATMA, System lead, Service Coordination Group (SCG) 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;
- In-depth knowledge of non SESAR activities such as the EUROCONTROL Centralised Services and ICAO ATM activities (EUROCONTROL chairing the ICAO ATMRPP);
- Strong and recognised expertise in ATM CWP design and development (be it for R&D purposes such as ODID, Phare Demonstration and associated implementations in the EUROCONTROL Real Time and Rapid prototyping simulations platforms; or for operational environment such as ODS interface for MUAC operational system); 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 order to ensure full contribution to EATMA (including service method update if need be) and System Engineering Activities and fully alignment with PJ.15 (Common Services). EUROCONTROL will provide technical prototyping and simulation platforms (i.e. ESCAPE, eDEP) and SWIM test-bed supporting reference PJ.16 CWP service and PJ.16 HMI implementation usable (locally and/or remotely) by any SESAR Partner for integration, verification or validation purposes.

DLR (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'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 VINTHEC 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 an 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, 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 was acting as consultant and supported the project with its expertise.

Furthermore, DLR (AT-One) has developed a variety of decision and negotiation support tools with their corresponding HMIs.

Frequentis SESAR Partners (FSP) justification for participation

Frequentis AG and HUNGAROCONTROL MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG work together within Frequentis SESAR Partners (FSP) and will contribute together in PJ.16. Frequentis SESAR Partners is in an excellent position to contribute, by bringing in the expertise in voice communication solutions (being the world market leader in ATC voice communication), previous work done in B.04.04 and knowledge, know-how, operational experience from HC (FSP)in planning, development, implementation process and operation of remote ATS (Air Traffic Service) provision in third country (KFOR sector – Kosovo).

The operational experience within Frequentis SESAR Partners consortium 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 Frequentis SESAR Partners can create and use the environment and ensures 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 B.04.04 Modelling and Demonstration Phases and 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.

The CWP gain prominence as Indra focuses on their final users. Relevant collaborations in SESAR regarding the CWP are the definition of technical requirements and guidelines for an Advanced CWP (to support validations of solutions) and the analysis of innovative technologies or HMIs that could be used to improve the usability and performance of the CWP interactions (like Multi-Touch, eye tracking, NFC …).

Finmeccanica justification for participation

Starting from 1 January 2016 Selex ES and Alenia Aermacchi were merged in Finmeccanica. Due to the unavailability of the Finmeccanica name in some template. Selex was used instead of Finmeccanica as suggested by SESAR JU during the information day held on 19 January 2016.

FINMECCANICA is a global player in the high-tech sectors and a major operator worldwide in the Aerospace, Defence and Security sectors. FINMECCANICA designs and creates products, systems, services and integrated solutions both for the defense sector and for public and private customers of the civil sector, both in Italy and abroad.

Other countries and international organisations:

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.

SINTEF (NATMIG) justification for participation

SINTEF (http://www.sintef.no/) is the largest independent research organization in Scandinavia, and is a non-profit research foundation. SINTEF ICT has gained competence in state of the art ATM research for several decades, and the increased focus through the SESAR 1 involvement (32 projects) 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 PJ.16 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). 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.

The controller acceptance of new CWP processes will be crucial so it is important to develop prototypes and run evaluations with controller to learn and tailor the proposed solutions in PJ.16. SINTEF has knowledge and tools to model, develop rapid prototypes and run user early validation activities with controllers to inform the work.

SINTEF will participate in PJ.16-03 and PJ.16-04. In 03 we will contribute with our knowledge in user interface modelling and link that to our contributions in PJ.08 and PJ.19. In 04 we will contribute with our knowledge in state-of-the art user interface design and rapid prototyping. We will work closely with PJ.08 and participate in PJ.08 validation activities 08.01.06 and 08.01.03.

3.4 Resources to be committed

The tables below is fulfilled only for partners who sum of the costs for' travel', 'equipment', and 'goods and services' exceeds 15% of their personnel costs (according to the budget table in section 3 of the proposal administrative forms).

2 /ANS CR (B4)	*Cost (€)*	*Justification*
Travel	**40.000**	Travel cost covers validation participation, project meetings, coordination meetings at solution level, validation coordination meetings, international workshop/conference participation.
Equipment		
Other goods and services	**2.000**	Auditing costs
Total	**42.000**	

4/ACG/COOPANS	*Cost (€)*	*Justification*
Travel	**14.514,13**	Validation activities on non-ACG site
Equipment	**20.000,00**	Automatic Speech Recognition validation equipment
Other goods and services	**492,44**	Audit costs
Total	**35.006,57**	

7/LFV/COOPANS	*Cost (€)*	*Justification*
Travel	**12.974,47**	Standard travel cost
Equipment	**11.800,00**	Update & maintenance of IBP
Other goods and services	**417,53**	Audit costs
Total	**25.192,00**	

17/FRQ (FSP)	*Cost (€)*	*Justification*
Travel	**76.050**	Travels for PJ16-03, PJ16-04: • Preparation for Verification and Validation Exercises • Verification and Validation Exercises • Project Meetings • Workshops
Equipment	**14.550**	IT Equipment
Other goods and services	**29.240**	Virtual Machine Rental, needed for Prototype development
Total	**119.840**	

As per Section 3.5 of the amended Annual Work Programme, due to annual budget constraints of the SJU, 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 50M€ SJU budget available.*

On the basis of the First SJU Contribution for this Action established at a maximum grant amount of 2,608,680.16 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*
- *D1.3 Q4 2016*
- *D1.4 Q1 2017*
- *D4.1 H – Requirement No. 1*
- *D4.2 POPD – Requirement No. 2*
- *D4.3 NEC Requirement No. 3*
- *D4.4 M – Requirement No. 4*

Any further SJU contribution resulting from further budget availability, will be implemented through a Grant Amendment as per Section 3.5 of SJU amended AWP 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.

4. Members of the consortium

4.1 *Participants (applicants)*

4.1.1 Companies profile

4.1.1.1 Participant N°1 (Coordinator)– THALES AIR S YS

Organisation	**1 THALES Air Systems SAS**	**Industry**
Description	**Thales Air Systems (or Thales ATM), from takeoff to touchdown and everything in between.** World leader in ATM, Thales 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. Thales has the largest installed base of solutions and technologies with over 360 TopSky - ATM Solutions, 7,000 navaids, 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. **At the forefront of all major modernisation initiatives around the world** Growing aircraft numbers make Air Traffic Management more complex. Thales' ATM solutions help to make the skies safer, greener and more efficient. 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.	
Previous experience	**Previous main projects:** **SESAR 1**: THALES has been involved in all SESAR 1 WorkPackages. THALES has been Co-Leader for : ➢ WP10 (En-Route & Approach ATC Systems) ➢ WP 14 (SWIM technical architecture) **4-FLIGHT: Thales is delivering the future innovative Air Traffic Management system for France, 4-Flight. DSNA 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** **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 Selex. 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, with TopSky - ATC (potentially) 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**

LORADS III: LORADS III integrates state of the art multi-sensor tracking technology, capable of fusing data from radars, ADS-B, Wide Area Multilateration
(WAM) and ground sensors with multi-hypothesis filtering, to give controllers a holistic and highly accurate picture of the current operating environment. The system also provides an ADS-C surveillance capability for remote and oceanic areas. The centrepiece of the system is Thales's award-winning Java Human Machine Interface (JHMI) Engine – an advanced display designed in collaboration with air traffic controllers. The high performance configurable software reduces controllers' workload through new ways of viewing, organising and interacting with flight information. Another key feature is Thales's next generation Flight Data Processing, which manages gate to gate flight trajectories in 4D, based on aircraft performance.

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

➔ **NextGen**

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. Thales is a key contributor to NextGen • Member of RTCA NextGen Advisory Committee • Key technology provider for ADS-B program • Enabling data comm with Thales automation platform • Providing analysis work with the areas of safety and security ➔ **ICAO ASBUs** **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.**
Contribution	For the Virtual Centre Concept, Thales Air Systems is a major contributor of SESAR 1 B04.04, in particular by industrialising the service interface definition from the logical level to the physical one. Thales is also contributing of one of the major demonstrations, fulfilling most of the B04.04 demonstration objectives. More globally, Thales is a leading industrial in this concept by presenting ideas and proof of concept during seminars of the ATM community. For HMI innovative interaction, Thales is particularly involved in the future of ATM and innovation through the different Innovation Lab (France, Australia, Singapore, US). Developped 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 will help in de-risking the design through V2 exercises. Thales will also bring his Topsky ATC product to perform V3 exercises. The V2 exercises will take place in the SkyCentre in Rungis which provides ATC platforms and debrifing capabilities and where a dedicated Human Factors team and a dedicated innovation development team are present. To help during the exercises, Thales 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.

4.1.1.2 Participant N°2– ANS CR (B4)

Organisation	**2**	**RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK**	**Service Provider**
Description	Air Navigation Services of the Czech Republic (ANS CR), the state enterprise provides public Air Traffic Services in the airspace of the Czech Republic, at Prague Airport and 3 regional Airports of Brno, Ostrava and Karlovy Vary. En route services are provided as integrated with the MIL. It provides specialized aviation training in its own Training Centre of ANS CR/Czech Air Navigation Institute (CANI) and offers also the training for		

	pilots in its subsidiary company the Czech Aviation Training Centre (CATC) on aircraft simulators, both units being part of the Aviation Academy Group. The part of ANS CR organization is the Flight Inspection Service Unit providing the flight checking within Czech Airspace as well as outside on a commercial basis. ANS CR is a member of the FAB Central Europe (FAB CE). . ANS CR is constituent entity of B4 Consortium.
Previous experience	**EMMA project**: • Project number: TREN/04/FP6AE/SI2.374991/503192. • Project sponsored by EC (Sixth Framework Programme), 24 partners, 9 countries, 3 international airports, 2004-2006. • ANS CR supported the operational concept, user requirements, data provision, validation test preparation and also provided test platform. **EMMA2 project:** • Project number: TREN/04/FP6AE/SI2.374991/503192 • Project sponsored by EC (Sixth Framework Programme), 21 partners, 9 countries, 4 international airports, 2006-2009. • ANS CR supported the operational concept, user requirements, data provision, validation test preparation and also provided test platform. **Malorca project:** • Project Proposal number: 698824 • Project sponsored by Horizon 2020 (EU Research and Innovation programme), 5 partners, 4 countries, 2016-2017 • Malorca - Machine Learning of Speech Recognition Models for Controller Assistance • ANS CR is responsible for Operational Concept Document, data provision to build improved Assistant Based Speech Recognizer prototype and evaluation of the proposed. • ANS CR already participated on the validation trials for AcListant® system in Braunschweig in 2014 and 2015. The main goal was to prove that the ASR components improve the assistant planning system. **INSuRE project:** • Project Number: RPAS.02, SESAR 1 Demonstration Activities. • October 2013 – December 2015. • ANS CR led the operational activities at the selected aerodrome and the dedicated safety analysis.
Entity Profile matching the task	ANS CR (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. Experience relevant to Project PJ.16 includes ATM Operational services (TWR), development, prototyping and operation of specific technical tools

	(proprietary interface for regional airports, interface for Airport Operators), System architecture design, Project and Quality management, prototype and operational validation, ATM Safety assessment (provided by linked third party Integra A/S). Additional to the abovementioned expertise and experience ANS CR (B4) can support Project PJ.16 by its knowledge in the areas of ATM Operational Concept (TWR), ATC, Airspace users and Airport Operators requirements, development of pan-European Air Traffic management solutions and SESAR Programme objectives knowledge specific to the project.
Contribution	ANS CR (B4) will contribute to solution PJ.16-03 by providing operational and technical expertise especially in its TWR related part. ANS CR (B4) will be responsible for supporting activities of solution PJ.16-03 at the maturity level V1 and V2. In solution PJ.16-04 ANS CR (B4) will provide contribution to the ATCO's needs definition and will be responsible for the support of validation activities. ANS CR (B4) Linked Third Party (Integra A/S) will be responsible for addressing the safety aspects of the project activities: • Development of safety requirements • Analysis of human factor aspects No specific OIs are assigned to this solution in MAWP.

4.1.1.3 Participant N°3– LPS SR (B4)

Organisation	**3**	**Letové prevádzkové služby Slovenskej republiky, štátny podnik**	**Service Provider**
Description	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. With a total staff of 495 (including 114 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 km2 and provides ATC services at five designated Slovak international airports as well as within small parts of the Hungarian airspace. In 2015, LPS SR provided services to 467,863 IFR flights, marking an annual 7.2% increase, which was preceded by a 9.8% increase in 2014 caused by substantial re-routings due to total closure of parts of the neighbouring Ukraine´s airspace, while ensuring the highest standards of safety (acceptable level of safety for incidents of the severity A and B in 2014: 0.35 ALS/TLS) and minimal average delays (average en-route ATFM delay per flight in 2014: 0.14 min/flight) without significant additional costs or increases in number of ATCOs. LPS SR (B4) is constituent entity of B4 Consortium, composed of four ANSPs from Central and Eastern part of Europe and their Linked Third Parties.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.
Previous experience	Current and previous projects: ***Upgrade of the E2000 system (system upgrade, 2015 – 2019):*** upgrade of E2000 system to enable compliance with the SES operational requirements in the region as part of FAB establishment. ***Local and Global ATM-CWP related projects (E2000 system, 2000 – 2015):*** - ***ISC (Intersuite Coordination):*** locally developed project to manage coordination between internal sectors inside FIR - ***Internally specified and developed HMI supporting tools:*** Separation Tool (supporting safety tool to detect minimal separation in the future), Precaution Tool (supporting safety tool to predict and prevent STCA conflicts), Probe Filter (the immediate display of the only related traffic) - Global projects developed internally or supported by our in-house development department: ***FPL2012, Mode S, FRA (Free Route)*** ***Functional integration of ASM/ATFCM processes (international cooperation, 2010 – present):*** optimisation of the flow of air traffic and the management of airspace within FAB CE. ***Air-ground Radio-Communication System (infrastructure upgrade, 2014 – 2017):*** upgrade of radio stations to allow VoIP interfaces. ***HETA Harmonisation (international cooperation, 2016):*** harmonization of transition altitude at 10 000 ft. (TA10K project) within FIR Bratislava, Wien and Budapest. ***GAMMA – Global ATM Security Management (FP7, 2013 – 2016):*** addressing security issues in the new global ATM scenarios created by the SES. ***Mode S Station Mošník (infrastructure construction, 2008 – 2015):*** construction of a new SSR/Mode S radar to improve coverage in the Eastern part of airspace of the Slovak Republic. ***ACCEPTA – Accelerating EGNOS adoption in Aviation (FP7, 2012 – 2014):*** implementation and publication of RNP approach procedures at Bratislava/M. R. Stefanik airport and Košice airport for all instrument RWY ends. ***AIM systems development and operation (systems development, 2001 – 2014):*** design, implementation, testing and operations of systems used for processing of static and dynamic data and the creation of AIM. ***Design and transformation of AIPs (international cooperation, 2006 – 2008):*** transformation of three AIPs (United Arab Emirates, Greece, Mongolia) from an 8-part to a 3-part structure as subcontractor for Avitech

	Ltd. ***European AIP Study (international study, 2003 – 2004):*** study contract awarded by European Commission to STASYS with support of LPS SR.
Entity Profile matching the task	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. 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. Additional to the abovementioned expertise and experience, LPS SR can support Project PJ.16 by its knowledge in the areas of ATM Operational Concept, ATC and SESAR Programme objectives knowledge specific to the project.
Contribution	LPS SR will be responsible for supporting activities of solution PJ.16-03 at the maturity level V1. Maturity levels V2 and V3 are currently not foreseen to be reached during the project execution period. In solution PJ.16-04 LPS SR will provide significant contribution to the User Profile Management Systems solution, supported by the in-house SW development unit, Operational staff, Development and Test Platform and APP/ACC Simulator, those activities are foreseen to be reached at Maturity level V2 potentially V3. No specific OIs are assigned to this solution in MAWP.

4.1.1.4 Participant N°4– ACG/COOPANS

Organisation	**4**	**Austro Control Österreichische Gesellschaft für Zivilluftfahrt MBH**	**Service Provider**
Description	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 Governance structure: A Supervisory Board and a Management Board is responsible for the corporate governance. An audit committee is also established. 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 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). 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 & Innovation by the establishment of the COOPANS Consortium. 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.
Previous experience	Austro Control has participated in SESAR via NORACON consortium in the following WPs: WP00 SESAR2020 preparation: 00.15 WP3 Validation infrastructure adaptation and integration: 03.03.02, 03.03.03 WP5 TMA Operations: 05.03.00, 05.06.02, 05.06.04, 05.06.07, 05.07.02, 05.09 WP6 Airport Operations: 06.05.05, 06.06.01, 06.07.01, 06.08.08, 06.09.03 WP7 Network Operations: 07.05.04 WP8 Information Management: 08.01.01, 08.01.06, 08.03.03, 08.03.06, 08.03.10 WP10 En-Route & Approach ATM Systems: 10.02.01, 10.02.03, 10.03.01, 10.03.08, 10.07.01, 10.10.03 WP12 Airport Systems : 12.02.01, 12.06.03 WP13 Network Information Management Systems: 13.02.02 WP14 SWIM Technical Architecture: 14.02.03, 14.04 WP16 R&D Transversal Areas: 16.01.01, 16.06.01, 16.06.01.b WP B Target Concept and Architecture Maintenance: B.04.05 WP C: Master Plan Maintenance C.02, C.03 SESAR Exploratory Research Ongoing CODACAS study (in collaboration with DSNA)
Entity Profile matching the task	Expertise can be offered in many areas: • ATM expert – Operations • ATFCM Expert – Operations • Development and supervision of operational concepts • Safety concepts & Safety Assessments • Development and implementation of ATM systems & Tools (common development and implementation of TopSky) • Trajectory management (core functionality in TopSky) • Validation and Integration
Contribution	ACG will mainly provide operational experts and can draw on safety expertise if required. ACG will put emphasis on Automatic Speech Recognition from a human performance and system efficiency perspective. Validations in this respect are planned in collaboration with AT-One and Thales Air Systems. ACG intends to buy add-ons to the speech recognition engine “KALDI”, tailored to the intended validation environment. These will be integrated into the validation platform by AT-One and Thales Air Systems for validation exercises in an operational context, most likely together with PJ.10.

4.1.1.5 Participant N°5– CCL/COOPANS

Organisation	**5** Croatia Control, Croatian Air Navigation Services ltd ANSP
Description	Croatia Control is a state-owned limited liability company. Location: The company headquarters is located in Velika Gorica and the subsidiaries (regional ATC centres) are located in Pula, Rijeka, Lošinj, Split/Brač, Zadar, Dubrovnik and Osijek. Divisions: Air Traffic Management, Technical Division, Aeronautical Meteorology, Military Operations and Human Resources Management, Legal and Financial Affairs. Governance structure: Company Assembly, Supervisory Board and Management- Director General. The Company Assembly consists of the Minister of the Maritime Affairs, Transport and Infrastructure – Chairman, Minister of Finance and the Minister of Defence. The Supervisory Board monitors the activities of the organization. The Director General manages and represents the organization. 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: • Air Traffic Services (ATS) • Communication, Navigation and Surveillance Services (CNS) • Aeronautical Information Services (AIS) • Aeronautical Meteorological Services (MET) Croatia Control is a member of COOPANS Alliance consisting of 5 Air Navigation Service Providers: Austro Control (ACG), Croatia Control (CCL), Irish Aviation Authority (IAA), Naviair and LFV. The cooperation between COOPANS partners goes beyond SESAR – partners have 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 ATM systems harmonisation. This cooperation is now expanded to Research & Innovation by the establishment of the COOPANS Consortium. Croatia Control has many years of experience, both in the delivery of Air Traffic Services and the design of concepts as in the development, validation and implementation of Air Traffic Management tools. Croatia Control is ISO 9001, ISO 14001 and BS OHSAS 18001 certified.
Previous experience	Croatia Control as a part of COOPANS participates in ongoing CODACAS study in collaboration with DSNA.
Entity Profile matching the task	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. Many of the Croatia Control's experts had been working in EUROCT-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. Croatia Control has experience in many areas related to this project, as for example: • Development and supervision of operational concepts • Safety concepts & Safety Assessments • CWP design • Development and implementation of ATM systems and tools

	• Trajectory management (core functionality in EUROCAT-E and TopSky) • Development and implementation of safety and monitoring tools (core functionality in EUROCAT-E and TopSky – 4D MTCD) • Flight procedures, special approach procedures (including RNAV) • Free route (implemented cross border direct routes and FRA within Zagreb, Sarajevo and Belgrade FIRs, known as SEAFRA) • Validation and Integration • Human Performance Assessment • ATM expert – Operations • ATC User Requirements
Contribution	As a medium sized ANSP, Croatia Control together with the COOPANS partners will provide operational and technical, human factor and safety experts. The current ATM system is highly advanced, and COOPANS partners have experience from some initial Virtual Centre capabilities (with remote CWPs). COOPANS partners will host validations (in collaboration with Thales) to investigate Virtual Centre capabilities to facilitate business continuity and training environment scenarios.

4.1.1.6 Participant N°6– IAA/COOPANS

Organisation	**6**	**UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY**	**Service Provider**
Description	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 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. Governance structure: Irish Aviation Authority has a Board of Directors having responsibility for the corporate governance. 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 & Innovation by the establishment of the COOPANS Consortium. 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. The enterprise is certified ISO 9001.		
Previous experience	Irish Aviation Authority (IAA) has participated in SESAR via NORACON consortium in the following WPs: 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 & Approach ATM Systems (10.2.1, 10.3.8, 10.10.3), WP 16 R&D Transversal Areas (16.4.3, 16.6.1), WP C Master Plan Maintenance (C3)		
Entity Profile matching the task	IAA has successfully concluded a trial of the SESAR concept of dynamic sectorisation – the tactical switching of air traffic services between providers, proving a key concept for the next generation of air traffic management.		

	The UK-Ireland FAB launched the first ever Dynamic Sectorisation Operational Trial (DSOT) in 2014. The first phase of the trial, which completed in late 2014, saw the Irish Air Navigation Service Provider, the IAA, deliver air traffic control services in a portion of UK airspace on a trial basis. The second phase of the trial, which has recently concluded, involved the tactical switching of a piece of Irish airspace between the Irish and UK air traffic management systems, with UK air traffic controllers at NATS live shadowing a portion of Irish airspace and both Irish and UK controllers working closely to assess the impact of real time dynamic sectorisation of airspace. Expertise is present in the company in many areas: • Safety concepts & Safety Assessments • CWP design • Development and implementation of ATM systems & Tools (common development and implementation of TopSky) • Validation and Integration • Human Performance Assessment
Contribution	IAA will provide ATCO & engineering expertise. Together with the other COOPANS partners IAA will also provide operational and technical, human factor and safety experts. The current ATM system is highly advanced, and COOPANS partners have experience from some initial Virtual Centre capabilities (with remote CWPs). COOPANS partners will host validations (in collaboration with Thales) to investigate Virtual Centre capabilities to facilitate business continuity and training environment scenarios.

4.1.1.7 Participant N°7– LFV/COOPANS

Organisation	**7** **Luftfartsverket**	**Service Provider**
Description	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. LFV has three main divisions: - Operational Systems & Development - ATM Operations - Sales, International Affairs & Business Development All supported by corporate services. Governance Structure: 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), Naviair and Luftfartsverket (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 & Innovation by the establishment of the COOPANS Consortium. 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. 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. The enterprise is certified ISO 9001.
Previous experience	LFV has participated, contributing to and also been leading projects in SESAR 1 via NORACON Consortium in the following WPs: WP00 SESAR2020 preparation: 00.14, 00.15 WP3 Validation infrastructure adaptation and integration: 03.01.01, 03.02.01, 03.02.02, 03.03.02, 03.03.03 WP4 En-route Operations : 04.08.04, 04.10 WP5: TMA Operations 05.03.00, 05.06.01 (Lead), 05.06.02, 05.06.04, 05.06.07, 05.07.02, 05.09 WP6 Airport Operations: 06.06.02, 06.07.01, 06.08.01, 06.08.02, 06.08.04, 06.08.08, 06.09.03(Lead) WP7 Network Operations: 07.05.02, 07.05.03, 07.05.04 WP8 Information Management: 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 WP9 Aircraft Systems : 09.48 WP10 En-Route & Approach ATM Systems: 10.02.01, 10.02.03, 10.03.01, 10.03.08, 10.04.04, 10.07.01, 10.09.04, 10.10.03 WP12 Airport Systems : 12.02.01, 12.04.06, 12.04.07, 12.04.08, 12.04.10 WP14 SWIM Technical Architecture: 14.01.03, 14.04 WP15 Non-Avionic CNS System: 15.01.06, 15.01.07, 15.02.04, 15.04.05.a, 15.04.05.b WP16 R&D Transversal Areas: 16.01.02, 16.04.01, 16.04.03, 16.04.04, 16.05.04, 16.06.01.b WP B Target Concept and Architecture Maintenance: B.04.01, B.04.02, B.04.03, B.04.05 WPC Master Plan Maintenance: C.02, C.03 Of special relevance for this project is WP5.9 Usability Requirements and Human Factors Aspects for the Controller Working Position LFV also has knowledge from participate in the work of WP16.01.02, WP16.04.1 and WP16.06.01b Participation in Exploratory Research, research activities within ATM together with Linköping University. Ongoing CODACAS study (in collaboration with DSNA).
Entity Profile matching the task	Expertise is present in the company in many areas: • Remote airport ATC • Development and supervision of operational concepts • Safety concepts & Safety Assessments

	• Airport safety support tools • Collaborative Decision Making • Air traffic forecast/Capacity planning incl. runway capacity enhancement • CWP design • Development and implementation of ATM systems & Tools (common development and implementation of TopSky) • Trajectory management (core functionality in TopSky) • Development and implementation of safety and monitoring tools (core functionality in TopSky – 4D MTCD) • Flight procedures, special approach procedures (incl. RNAV) • Performance Based Navigation • Integration, validation and analysis of test result • Extended lab environment including NARSIM and Thales IBP • Participation in European deployment activities (IDSG) • Human performance assessment
Contribution	LFV will provide operational and technical, human factor and safety experts. LFV has a documented experience from development of interaction between human and system. The current ATM system is highly advanced, and LFV within the COOPANS context has experience from some initial Virtual Centre capabilities (with remote TWRs). LFV will together with COOPANS partners will host validations (in collaboration with Thales) to investigate Virtual Centre capabilities to facilitate business continuity and training environment scenarios

4.1.1.8 Participant N°8– Naviair/COOPANS

Organisation	**8 Naviair**	**ANSP**
Description	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 & Nuuk (FIS/FIC). Naviair has three main divisions - Operations, Technical Maintenance and ATM Projects & 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 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 & Innovation by the establishment of the COOPANS Consortium. Naviair 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.	
Previous	Naviair has participated in SESAR via NORACON consortium in the	

experience	following WPs: WP00 SESAR2020 preparation 00.14, 00.15 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 WP6 Airport Operations: 6.8.4 WP7 Network Operations: 7.5.4 WP 8 Information Management: 08.1.3, 8.1.5, 8.1.9, 8.3.4, 8.3.10 WP 10 En-Route & Approach ATM Systems: 10.2.1, 10.2.3, 10.3.1, 10.3.8, 10.9.4, 10.10.3 WP 14 SWIM Technical Architecture: 14.1.3, 14.4 WP 16 R&D Transversal Areas: 16.2.3, 16.6.2 WP B Target Concept and Architecture Maintenance: B4.2, B4.3, B4.5 WP C Master Plan Maintenance: C2 & C3 Of special relevance for this project is WP5.9 Usability Requirements and Human Factors Aspects for the Controller Working Position Naviair also has knowledge from following the work in WP16.01.02, WP16.04.1 and WP16.06.01b via the NORACON partners Participation in SESAR Exploratory Research Ongoing CODACAS study (in collaboration with DSNA)
Entity Profile matching the task	Expertise is present in the company in many areas: • Development and supervision of operational concepts • Safety concepts & Safety Assessments • CWP design • Development and implementation of ATM systems & Tools (common development and implementation of TopSky) • Validation and Integration • Participation in European deployment activities (IDSG) • Human Performance Assessment
Contribution	As ANSPs, Naviair together with the other COOPANS partners will provide operational and technical, human factor and safety experts. The current ATM system is highly advanced, and COOPANS partners have experience from some initial Virtual Centre capabilities (with remote CWPs). COOPANS partners will host validations (in collaboration with Thales) to investigate Virtual Centre capabilities to facilitate business continuity and training environment scenarios.

4.1.1.9 Participant N°9– DFS

Organisation	**9**	**DFS DEUTSCHE FLUGSICHERUNG GMBH**	**Service Provider**
Description	DFS Deutsche Flugsicherung GmbH (DFS) is responsible for air traffic control in Germany and is headquartered in the town of Langen. It is a company organised under private law and 100% owned by the Federal Republic of Germany. 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, a		

	unit within the Maastricht Upper Area Control Centre of EUROCONTROL as well as 16 control towers at Germany's designated international airports. With its approximately 5,900 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.
Previous experience	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. The demonstrations involved three ANSPs and Indra as an industry partner providing the ATS system which implemented the new services defined in B.4.4. DFS implemented an own CWP prototype which was connected to the Indra system. Demonstration was distributed over sites of the different partners which were connected through a wide area network. DFS contributed to SESAR 1 projects P10.10.02 "CWP Human Factors Design" and P5.9 "Usability Requirements and Human Factors Aspects for the Controller Working Position". Within P10.10.02 various innovative HMI technologies including speech recognition and multi-touch input devices have been explored in technical and human performance assessments. Both projects delivered HMI Design Guideline material for the program. Moreover, DFS HF specialists had the project lead or participated in several transversal SESAR projects in WP16, e.g. 16.04.02, 16.05.01, 16.05.03 and supported numerous validation exercises, which were conducted at DFS. In planning and conducting international and national projects DFS is involved since many years. Especially in the research and development domain DFS were very active in coordinating projects and validating concepts and new tools. For both areas, Tower (e.g. Tower HMI, Augmented Reality for TWR-CWP) and En-Route (e.g. Multi-Sector Planer, Sectorless flight, Controller Assistance tools, RPAS integration into ATM) projects were conducted. Also new technical developments were investigated in different projects like new navigation ore surveillance (e.g. continuously ADS-B data analysis, analysis of Mode S Conspicuity Codes) techniques. DFS has also experience in development, validation and evaluation of new ATM concepts (e.g. sector less flight), ATM procedures and new controller tools. These capabilities were demonstrated in a lot of international and national projects and even in the SESAR 1 context. Even large validation exercise were conducting from the first step of planning the validation up to the development and use of metrics and tools, to the execution of the validation and evaluation of the results including validation reports. Together with the available simulation infrastructure DFS can investigated all aspects of ATM. DFS comprises its ATM Simulator Centre that is responsible for the development and maintenance of all DFS ATM Simulators. The ATM Simulator Centre has a very good expertise in adapting the DFS V&VI to the Verification & Validation Needs of its customers. Experts of the ATM Simulator Centre have contributed to SESAR 1 WP03 "Validation Infrastructure Adaptation and Integration" and have contributed to all projects of this workpackage. DFS has a long reputation in ATM simulations in national and international projects for air traffic control organizations, airports, airlines and military organizations.

	DFS is also involved in the German national research programme on aviation (Luftfahrtforschungsprogramm) in the various projects on enhancing the productivity including automatic speech recognition and multi-touch input devices. Publications: Buxbaum, Jörg, Helmke, Hartmut, Rühl, Oliver, Slotty, Michael (2015) *Spracherkennung im Flugsicherungsumfeld.* Innovation im Fokus, 1/2015, ISSN 2198-896X, Langen, Germany
Entity Profile matching the task	The DFS has both the systems and expertise for simulations as well as an ultramodern real-time simulator center with En-route and Tower simulators. The modular and scalable simulator architecture allows validations beginning with desktop simulations using simplified displays up to simulations including more than 60 fully equipped controller working positions. This includes basic functions as well as very advanced systems and even sectorless operations. Interconnections of different simulators (En-Route and Tower) using Eurocae standard are possible as well as integration of prototypes and future operational ATM systems and/or flight simulators. In order to adapt the infrastructure to the particular requirements, the various simulation systems are constantly evolving. The DFS provides comprehensive solutions ranging from planning a simulation campaign from design to implementation, statistical analysis and preparation of recommendations. The simulations support both the development, validation and the assessment of future systems, ATM concepts, airspace structures and operating procedures. The simulation team integrates the experience of civil and military air traffic controllers, flight data specialists, aeronautical engineers, software experts and human factors specialists. DFS already use Automatic Speech Recognition (ASR) in the simulation environment. Since 4 years ASR is used in the controller training as Simulation Pilot alternative. In this case not only speech is recognized, also the pilot's response is generated based on the clearance the controller is given. For almost all types of training (proficiency, cross training, pre on the job training) speech recognition is in operation. Also voice recognition is used in the DFS Tower FDPS to support the controllers. Based on this experience the further research will be conducted in SESAR 2020 to bring this technology in an operational environment.
Contribution	DFS, as an ANSPs, provides operational and technical expertise including HMI design, system development, operating of simulators and IBPs, human factors and security.In solution PJ.16-03 DFS intends to contribute to: • Concept definition • Service definition • Prototype implementation • Technical demonstrations The developed concepts and services will be implemented and verified in technical demonstrations which will involve several industry partners and service providers.

In solution PJ.16-04 DFS intends to contribute to:

- Concept definition
- Prototype implementation
- Verification / Validation

DFS plans to work on automatic speech recognition for increasing the productivity of the air traffic controllers and lowering their stress level in high load conditions. DFS will contribute to conceptual work, develop prototypes, and perform validations. Moreover, DFS intends to provide expertise for multi-touch input devices and attention guidance activities.

4.1.1.10 Participant N°10– DSNA

Organisation	**10** **Direction des Services de la Navigation Aérienne**	**Service Provider**
Description	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 and is a major active contributor to the current development phase.	
Previous experience	DSNA has developed significant experiences within the current SESAR programme in participating to several projects that can be considered of high value to SESAR 2020: • Lead and strong involvement in project B.04.04 that will have a strong link with 16-03 solution. • Strong involvement in projects B.04.05 “Common services”, • Participation to project 08.03.10 regarding service defintion DSNA also has operational experience in specifications, development and deployment of CWPs.	
Entity Profile matching the task	DSNA team of Technical and Operational Senior experts in CWP specifications and deployments and in charge of Service oriented Approach activities and already involved in SESAR1 (mainly in B.04.04 management - CWP interface-)	
Contribution	In continuation with its current activities, DSNA intends to pursue its strong involvement on the concept of remote HMI and virtual centre to bring this concept to a level of maturity beyond the results of current SESAR project B4.4. Workstation, Service Interface Definition. Further prototype validation are planned to achieve a sufficient level of maturity for standardisation input and to enable future Very Large Scale Demonstration and further deployment.	

4.1.1.11 Participant N°11– ENAIRE

Organisation	**11**	**Entidad Pública empresarial ENAIRE**	**Service Provider**
Description	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. Airspace under ENAIRE control includes the Peninsula Ibérica (except Portugal), Balearic and Canary Island, and part of North Atlantic, West Mediterranean and West Sahara. ENAIRE is a major European company in ATM, R&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. 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&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. 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: • 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; • Platforms are able to assume validations and simulations in a wide range of maturity levels, covering from the more immature phases of the R&D till complex simulations using both industrial products and also prototypes; • ATCOs from different ACC's, who are familiar with traffics, contingencies and events of multiple characteristics; and also from towers of different categories; • Engineers/ATCOs with vast expertise on the definition of future CNS and ATM; 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	Previous projects of interes for PJ.16 are: ENAIRE's contribution in SESAR 1, specifically in the projects related to Controller Working Posistion, (CWP) in En-route and TMA, and on the Airport (projects P05.09 and P06.09.02). This proejct searched the explotation and integration of the new SESAR 1 concepts in an CWP that facilitated and supported controllers work. As service provider ENAIRE is constantly enhancing their controller working positions 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) ENAIRE has been developing an internal project, VOICE, centered in the explotation of information contained in controller's voice communicattion since 2008. This project used Automatic Speech Recognition to identify the events that contribute to controller's workload.
Entity Profile matching the task	Among others, relevant profiles/experience referred to the Project topic could be included (no names) • Operational expert • ATC system expert • System engineering exper • Human factors expert • Safety and performance expert • Performance expert
Contribution	ENAIRE will participate in both solution of WP16. In the WorkStation, Service Interface Definition and Virtual Centre Concept ENAIRE will participate as operational and system expert in: 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. In the Work Station Controller Productivity solution, ENAIRE will contribute as operational and system expert in the development of guidance and assessment when using new interaction modes in the next activities: • Multi-touch input device • Automatic Speech Recognition • Attention guidance • User profile management systems • Efficient development process

4.1.1.12 Participant N°12– ENAV

Organisation	**12 ENAV SPA**	**ANSP**
Description	ENAV is one of the major European Air Navigation Service Providers in terms of volume of controlled airspace, number of flights managed, investments in technology innovation and R&D. ENAV is a Joint-Stock Company, 100% owned by the Italian Ministry of Economy and Financial Planning, in charge of the provision of air navigation services within the airspace and the airports placed under its own responsibility by the Italian Government. In particular, the Company has the responsibility for the provision of the following institutional services: • Air Traffic Control; • Aeronautical communications and radio-navigation; • Aeronautical Information Service and Management, • Aeronautical cartography and obstacle charts; • Airspace and flight procedure design; • Airport air-side operations design; • Aeronautical meteorology; • Maintenance and logistics management of CNS/ATM systems; • Flight inspection; • Recruitment, Training and Licensing of ANS Personnel; • R&D and studies on any matter related to ATS. Staffed by more than 4.100 people, its H.Q. are located in Rome; Its ATS infrastructure includes 4 ACC, 19 APP units, 27 TWR units and 20 AFIS units plus a broad variety of CNS/ATM systems and assets spread all over the country to guarantee continuous operations, extensive service cover and adequate systems redundancy. About 2.0 million flights per year are safely managed in a complex operating scenario with significant operational and economic performance results internationally acknowledged. ENAV has an outstanding expertise in Air Traffic Management operations and services, in the development and validation of concepts, system prototypes and procedures for the continuous improvement of its operational performance, in providing its staff with a continuous competency up-dating and operational training, in assisting the supply industry to design and engineer new systems to safely support the ATM operational personnel in their highly demanding tasks. About its involvement in international activities/panels, ENAV is member of SJU since 2007, member of the SDA Consortium in charge of the SESAR Deployment management, member of A6 Group (strategic alliance amongst some of the largest and most influential European ANSP), member of CANSO (Civil Air Navigation Services Organization), member of European

	CANSO CEO Committee (EC3) as well as member of ESSP (European Satellite Services Provider). In addition to the above participation, ENAV experts are actively involved in the most important committees, working groups, expert panels dealing with CNS/ATM matters with special regard to ADS, ASAS, A-SMGCS, VHF digital communication systems, Satellite Navigation Systems (e.g. EGNOS and Galileo), advanced automated Flight Data Processing Systems and Surveillance Data Processing Systems (e.g. 4-Flight/Coflight). In line with its mission, ENAV, through its participation in the BLUE MED FAB, is playing a leading role in the Mediterranean Area by promoting synergies with other Service Providers and of neighbouring regions in support of the Single European Sky Implementation. ENAV Group includes the three 100% controlled companies: Techno Sky S.r.l., SICTA and ENAV Asia-Pacific. More recently, ENAV invested 61M$ by purchasing 12,5% of Aireon, a U.S. Company, founded by Iridium group and owned 51% by NAVCANADA. The company intends to deploy the first global surveillance satellite system by 2018, exploiting ADS-B OUT technology and the mandates which will impose, to most commercial aviation around the world, to equip their aircraft with ADS-B OUT transponders.
Previous experience	ENAV is involved in R&D, strategic planning, technical co-operation and service provision programs with international organizations (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. 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. Previous R&D projects: • SESAR 1 (WPB, WPC, WP3, WP4, WP5, WP6, WP7, WP8, WP10, WP12, WP13, WP14, WP15, WP16) • SESAR 1 Very Large Scale Demonstrations: o ATC Full Datalink (AFD) o WE-FREE o MEDALE o RACOON o FREE SOLUTIONS • BEYOND (H2020, 2015-2017) • DARWIN (H2020, 2015-2018) • SAWSOC (FP7, 2013-2016) • GAMMA (FP7, 2013-2017) • FUTURE SKY SAFETY (H2020, 2015-2019)

	• OPTIMAL (FP6, 2004-2008) • AD4 (FP6, 2005-2007)
Contribution	ENAV will provides operational and technical expertise including system development, integration, verification and validation, platforms and infrastructures for Virtual Centres including ATC Systems and CWPs (local and remote), human factors, safety and security. ENAV will support the service design of the virtual centre in PJ.16-03, providing also valuable input from its own experiences on the ENAV SESAR 1 programme and validating actively the Virtual Centre concept by undertaking a validation of SESAR concepts using its validation infrastructure and ATC Systems to feed data from a number of different data sources (and data centres) to distributed workstations using defined services.

4.1.1.13 Participant N°13– NATS

Organisation	13	NATS (EN ROUTE) PUBLIC LIMITED COMPANY	Service Provider
Description	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. 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). 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: • En-route and Terminal Air Traffic Control (ATC) for all UK airspace under a 30 year operating licence to UK Government. In 2015, NATS handled over 2.2 million flights, carrying more than 200 million passengers safely through some of the busiest and most complex airspace in the world. • The design and management of airspace, engineering project and maintenance activities for ANS communications, navigation and surveillance systems, and IT and network management. • 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. • 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. • Consultancy services to UK and overseas customers in air traffic management, airspace design, instrument flight procedures, control tower system integration and transition, safety management, engineering, project management. • 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. • Training of engineering staff.		
Previous experience	Previous projects: NATS has been involved in key SESAR 1 Projects (e.g. B04.03), leading SESAR, WP B04.05 – 'Options in High Level Architecture' SESAR, WP B04.04 – 'Workstation, Service Interface Definition', leading the Scoping and Service Modelling Activities within this WP, which is project managed by DSNA. NATS provides experience in many areas relevant to the SESAR 2020 PJ16 project, as listed below:		

	• Development of operational concepts • Collaborative Decision Making • Air traffic forecast/Capacity planning incl. runway capacity enhancement, i.e. Time Based Separation, Cross Border Arrival Management (XMAN) etc • CWP and Strategic HMI design as part of the NATS Strategic HMI project delivering the HMI in our business transformation programme in NATS. • Development and implementation of ATM systems & Tools, i.e. tactical tools • System Wide Information Management • Human Performance Assessment • Resilience Engineering applications within ATM • ATC CONOPs and evolution of CONOPS in line with SESAR 'Any Controller, Any Workstation, Anywhere.' 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. The NATS architecture will thus be based on a design of services that mirror real-world operational activities. This project defines the CWP architecture to include the services that are internal to the CWP and the services to be provided by external systems. The project is thus fully aligned with NATS' current investment programme and therefore the company can bring significant experience in understanding the service context of the work-station and the design of the individual services. In SESAR 1, NATS is a significant contributor to Project B.4.4, leading the development of the service design. Avinor ANS as a Linked Third Party to NATS will contribute to the definition of Business Services so that the ANSP's CWP can be separated from other stakeholders' information flows through the application of SOA orientated standardised interfaces. Avinor ANS has relevant experience from their existing research in Project ALMAR (Advanced Large-scale Management of the Air traffic control Research), which is a collaboration with industry partners and R&D institutions to study the human ability to consume large quantities of information while maintaining situational awareness. This research already takes advantage of new interaction technologies like eye tracking and speech recognition.
Entity Profile matching the task	NATS will lead Solution PJ16-04 and contribute to Solution PJ16-03. **R&D Solution Team** NATS has described our contribution to research and validation as part of each Solution description. **ATM Focal Points and expertise** NATS will provide expertise in Operations, Technical Architecture, Services and Human Factors.
Contribution	NATS, in support of its strategic aims for full flexibility in deploying its controller staff and a service oriented architecture based upon open services, will validate the virtual centre concept by undertaking a validation of SESAR concepts using its validation infrastructure. The validation will aim to show the ability to provide air traffic services by consuming data

from a number of different data sources (data centres) belonging to different providers to feed its workstations.
NATS as the Solution Lead for PJ16-04 will oversee the delivery of the six technologies being assessed & validated as part of PJ16-04. NATS will focus its technical contribution, including HF expertise, on the following technologies: Multi-touch Devices, Automatic Speech Recognition and Attention Guidance. NATS shall provide input from its own experiences, gained through developing a strategic HMI, along with Human Factors expertise to direct the appropriate solutions within PJ16-04, i.e. Multi-touch devices, Automatic Speech Recognition and Attention Guidance. The aim is be for NATS to share expertise and cost with Solution projects that can validate the proposed technologies coming out of PJ16-04.
In PJ16-04, NATS is dependent on Avinor ANS as a Linked Third Party to provide their knowledge from their ongoing R&D project ALMAR, as well as supporting operational validation to analyse potential ATCO productivity improvements.

4.1.1.14 Participant N°14– SKYGUIDE

Organisation	**14**	**SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIENNE CIVILS ET MILITAIRES**	**Service Provider**
Description	Skyguide is the civil and military ANSP of Switzerland. Skyguide performs its services under a legal mandate issued by the Swiss Confederation and the Federal Office of Civil Aviation (FOCA), Switzerland's national aviation authority. This mandate requires skyguide to ensure the safe, fluid and cost-effective management of air traffic in Swiss airspace and in the adjacent airspace of neighbouring countries that has been delegated to its control. Skyguide's legally-prescribed duties and tasks entail providing civil and military air navigation services, aeronautical information and telecommunications services and the technical services required to install, operate and maintain the associated air navigation systems and facilities. 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. Skyguide manages En Route operations from Geneva and Zurich Area Control Centres (ACC) and provides Terminal and Aerodrome control for Geneva and Zurich international airports and for regional and military airports located in Alpnach, Bern, Buochs, Dübendorf, Emmen, Grenchen, Locarno, Lugano, Meiringen, Payerne, St. Gallen-Altenrhein and Sion. 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, 204000 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. For further information visit us at: www.skyguide.ch		
Previous experience	**Previous projects:** **SESAR 1 :** Skyguide is associate partner of DSNA and DFS and contributes in following Work Packages : • **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 • **WP-4.2 (DSNA)** : Consolidation of operational concept definition and validation including operating mode and air-ground task sharing Skyguide has the lead on the Detailed Operational Description (En-route DOD) and is contributing to SESAR 2020 Transition CONOPS development. **WP-4.3 (DSNA)** : Integrated and pre-operational validation & cross-validation IOP validation exercises Free Route validation exercises performed on skyguide SCCD platform		

	• **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-10.2.5 (DSNA)** : Flight Object IOP System Requirement & Validation Participation to IOP Requirements • **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 • **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 In addition skyguide is participating to several large scale demonstrations : • **WeFree (Air France)** : Week-end Free Route trials (Swiss, Italy and France airspace) • **Fairstream (DSNA)** : Enhanced Arrival Management trials • **Pegase (Airbus)** : "Providing Effective Ground & Air data Sharing via Extended projected profile" • **iStream (DSNA)** : "Integrated SESAR Trials for Enhanced Arrival Management" • **Free Solutions (ENAV)** : "Free Route Environmental and Efficient Solutions" • **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
Entity Profile matching the task	Air Navigation Service Provider including profiles : **Operational Expertise** : • En-route and TMA Air Traffic Controllers acting in one of the most complex ATC environment • Ops experts : experts already contributing to SESAR 1 **Technical Development expertise** : • Major software developments of the operational system • Dedicated software development team for R&D. • System Engineering: Platform development, integration and validation **Simulator expertise** : • Simulator team use to prepare and run R&D simulation
Contribution	Within the core area, 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 ATC working methods. Skyguide has a competitive advantage in the field of virtualisation. Skyguide has 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. Skyguide technical infrastructure will be adapted in the same timeframe as the SESAR 2020 programme will be conducted. Skyguide contribution in the programme is seen 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, Skyguide can also show early advantages and report initial successes from experience back into the PJ and make both developments to be synchronised.
Skyguide will contribute to the following solutions:

PJ.16-03 Solution Workstation, Service Interface Definition & Virtual Centre Concept

Within PJ.16-03 Skyguide intends to:

- Contibute to the Virtual Centre Concept and Services definition
- Conduct V2/V3 validations covering delegation of airspace and Business continuity

PJ.16-04 Solution Workstation, Controller Productivity

Within PJ.16-04 Skyguide intends to:

- Conduct V1/V2 validations covering Automatic Speech Recognition (ASR)

4.1.1.15 Participant N°15– EUROCONTROL

Organisation	**15**	**EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION**	**Intergovernmental Organisation**
Description	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 qualified professionals spread over four European countries. Their expertise is deployed to address ATM challenges in a number of key roles: • 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. • The Maastricht Upper Area Control Centre provides an air traffic control service for the Netherlands, Belgium, Luxembourg and northern Germany. • The Central Route Charges Office handles billing, collection and redistribution of aviation charges. • The Organisation is developing the Centralised Services initiative, which will open up some services to market competition on a pan-European level, generating significant savings and making for greater operational efficiency. • It supports the European Commission, EASA and National Supervisory Authorities in their regulatory activities. • It provides a unique platform for civil-military aviation coordination in Europe. • Finally, 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.	
Previous experience	EUROCONTROL was involved in nearly all SESAR 1 Work Packages either as leader of Work Package and Projects or contributors. More specifically concerning Virtual Center, EUROCONTROL has been involved in all activities within SESAR WP B04.03, B04.04 and B04.05. EUROCONTROL provides experience in ATM system architecture modelling, operational concept development as well as validation platforms to support the verification and validation of concepts.		
Entity Profile matching the task	EUROCONTROL employee profiles includes: - operational expertise with En-route/TMA air traffic controllers having developed solid experience in Research & Development projects - technical expertise with software engineers with strong experience in ATM system architecture design, standardized activities and ATM simulators software development - simulation expertise in preparing and conducting real time simulation either on airspace validation or R&D		
Contribution	EUROCONTROL will mainly contribute to PJ.16-03 service design with both		

	operational and technical expertise. EUROCONTROL will participate to the verification activities by contributing to the development of the verification plan, verification platforms and tools as well as to the verification report. EUROCONTROL will contribute to PJ.16-04 with a particular focus on CWP virtualization providing validation platforms to support the set-up of validation exercises.

4.1.1.16 Participant N°16– DLR (AT-ONE)

Organisation	**16 Deutsches Zentrum für Luft-und Raumfahrt EV Research**
Description	Deutsches Zentrum für Luft-und Raumfahrt e. V. (German Aerospace Center) is coordinating the AT-One Consortium, DLR (AT-One). The AT-One consortium is formed by the German Aerospace Center (DLR) and the Netherlands Aerospace Centre (NLR). AT-One combines the strength of DLR and NLR by joining their capabilities with respect to innovative and independent Air Traffic Management research and implementation support. DLR (AT-One) 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 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 the nation’s largest project management agency. DLR has approximately 8000 employees at 16 locations. Several DLR (AT-One) research institutes are participating in SESAR which are shortly introduced in the following: DLR (AT-One) 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. DLR (AT-One) 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 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. The DLR (AT-One) 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. DLR (AT-One) 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. DLR (AT-One) Air Transport Systems is conducting research in the field of understanding the system complexity in air transportation. The portfolio comprises of concepts, preliminary designs and the optimization of sub systems, as well as the simulation and assessment of entire air transportation systems with respect to economic and ecological sustainability. DLR Air Transportation Systems has several years of experience with the design and the assessment of new concepts and technologies for future air transportation.
Previous experience	Publications: Gürlük, Hejar, Helmke, Hartmut, Wies, Matthias, Ehr, Heiko, Kleinert, Matthias, Mühlhausen, Thorsten, Muth, Kathleen und Ohneiser, Oliver (2015) *Assistant Based Speech Recognition - Another Pair of Eyes for the Arrival Manager.* 34th DASC 2015, 14.-18. September 2015, Prague, Czech Republic Oualil, Youssef und Schulder, Marc und Helmke, Hartmut und Schmidt, Anna und Klakow, Dietrich (2015) *Real-Time Integration of Dynamic Context Information for Improving Automatic Speech Recognition.* Interspeech 2015, 06.-10. September 2015, Dresden, Germany Carneros, Isidora und Cuenca, Fernando und Gürlük, Hejar und Hagemann, Konrad und Labreuil, Aline und Pinheiro, Jean-Philippe und Udovic, Andreas und Uebbing-Rumke, Maria (2015) DEL10.10.02.D96 *Innovation Analysis Report 2014.* Uebbing-Rumke, M., Gürlük, H., Jauer, M., Hagemann, K. & Udovic, A. (2014). *Usability Evaluation of Multi-Touch-Displays for TMA Controller Working Positions*, SESAR Innovation Days, Madrid. Gürlük, Hejar und Uebbing-Rumke, Maria und Jauer, Malte-Levin (2014) *Design and Evaluation of a Multi-Touch Interaction Language for Approach Controllers.* International Conference on Human-Machine Interaction in Aerospace, 29.Jul. - 01. Aug. 2014, Santa Clara, California, U.S.A. Ohneiser, Oliver und Helmke, Hartmut und Ehr, Heiko und Gürlük, Hejar und Hössl, Michael und Mühlhausen, Thorsten und Oualil, Youssef und Schulder, Marc und Schmidt, Anna und Khan, Arif und Klakow, Dietrich (2014) *Air Traffic Controller Support by Speech Recognition.* In: Advances in Human Aspects of Transportation: Part II, Seiten 492-503. CRC Press. AHFE 2014, 19.-23. Jul. 2014, Krakau, Poland Uebbing-Rumke, Maria und Gürlük, Hejar und Schulze-Kissing, Dirk (2012) *Adaptive Automation Support for Time-Based Operations in ATC.* 3rd International Air Transport & Operations Symposium ATOS, 18.06.-20.06.2012, Delft, Netherlands Previous projects:

	SESAR 1 WP3, WP4, WP5, WP6, WP10, WP-E: BETA (FP5, 1999-2002): ground movement, Tower CWP EMMA (FP6, 2003–2008): ground movement, Tower CWP OPTIMAL (FP6, 2004-2008): optimised arrival procedures, TMA CWP LUFO (German R&I program, 2005-2008): cooperative ATM, TMA CWP Helmholtz Validation Fund: (2012-2015) AcListant®, Assistant based speech recognition at controller working positions in control rooms, TMA CWP
Entity Profile matching the task	DLR (AT-One) members contributed over the last decades to many ATM projects in European and national frameworks. They elaborated innovative air traffic guidance concepts and validated them in their company facilities that allow real time human-in-the-loop trials including CWPs for tower and ACC/TMA. The company profile fits to solution PJ.16-04 (Workstation, Controller Productivity) activities. DLR (AT-One) researchers stand for expertise in the field of: • Human factors enabling them to elaborate human-centered concepts of controller working positions related to innovative guidance strategies that are coming along with SESAR 2020 implementations, • Human Machine Interface (HMI) design. They know how to transfer the operator's needs to interaction concepts while minimising the workload. Ergonomic and usability aspects determine the design philosophy. The evaluation results of workload parameters are used to improve the CWP productivity as a whole.
Contribution	DLR (AT-One) is providing its longtime expertise in the field of CWP design. Recent activities focussed on the interaction technologies ASR and Multi-Touch. In SESAR 2020 solution projects DLR (AT-One) contributes with ASR and attention guidance prototypes and supports the human factors and productivity investigations in the corresponding validation environments.

4.1.1.17 Participant N°17– FRQ (FSP)

Organisation	**17**	**Frequentis AG**	**Industry**
Description	**Frequentis AG,** member of SESAR1, 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. 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 we have demonstrated remarkable achievements towards the next generation ATM system architecture. 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 HUNGAROCONTROL MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG and Atos Belgium and was founded in 2014 for the main purpose of joining SESAR2020 activities. Frequentis SESAR Partners is member of the SESAR Joint		

	Undertaking. 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.
Previous experience	Frequentis AG brings in experience from SESAR 1, participating in B04.04. Added to that the experience in the provision of voice communication infrastructure to FAB Europe Central and the Danube FAB, where the first operational steps regarding cooperative ATM for En-route are taken.
Entity Profile matching the task	Frequentis AG is in an excellent position to contribute to this solution, by bringing in the expertise in voice communication solutions (being the world market leader in ATC voice communication), previous work done in B.04.04 and knowledge, know-how on virtual centre developments.
Contribution	Frequentis AG will support PJ16-03 with the provision for a voice services platform, ready to be integrated in the independent CWP platform. In PJ 16-04 Frequentis AG will provide the demo HMI for speech recognition integration and thin client verification. This CWP prototype will follow the B04.04 of ADSP enabled and service-independent HMI architecture.

4.1.1.18 Participant N°18– HC (FSP)

Organisation	**18**	**HUNGAROCONTROL MAGYAR LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG**	**Service Provider**

Description	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. 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. Frequentis SESAR Partners is member of the SESAR Joint Undertaking. 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.
Previous experience	HC (FSP) brings in experience from SESAR 1 Demonstrations, participating in Remote Virtual Tower project.
Entity Profile matching the task	HC (FSP)is in an excellent position to contribute to this solution, by bringing in the expertise through planning, development, implementation process and operation of remote ATS (Air Traffic Service) provision in third country (KFOR sector – Kosovo).

Contribution	The Budapest ACC is planned to be used in validation exercises of the planned use cases for the virtual centre.

4.1.1.19 Participant N°19– SINTEF (NATMIG)

Organisation	**19 STIFTELSEN SINTEF**	**Industry**
Description	SINTEF 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 Stiftelsen SINTEF (non-profit research foundation - Norway). NATMIG support a clear connection between the exploratory research, applied/industrial research, validation and demonstrations, and underlines the need for a link between the different maturity levels. By encompassing both SME, larger Industry and the research sector with a close connection with the academia NATMIG will be a strong contributor in this area. NATMIG took part in 32 projects and in WP E in SESAR 1, and has brought results from that work into other work packages already, and intend to continue this approach in SESAR 2020. SINTEF carries out contract research in a wide range of scientific and technical areas. Our business model spans from basic research with main focus on applied research to commercialisation of results into new business ideas. SINTEF employs more than 2250 employees from 70 different countries. The main office is in Trondheim, Norway, and SINTEF has offices in several locations both in Norway and abroad. SINTEF (http://www.sintef.no/) is the largest independent research organization in Scandinavia, and is a non-profit research foundation. 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%). Our business area SINTEF ICT is continuously specialising in leading edge information and communications technology (ICT), and forms the technology basis for our ATM activities. SINTEF ICT provides research based expertise and technology in the areas of: micro- and sensor systems, electronics, communication, optical systems, computational software, information systems as well as security and safety. Although SINTEF ICT has gained competence in state of the art ATM research for several decades, the increased focus through the SESAR 1 involvement (32 projects) has substantially improved our technology and aligned it further to the needs of the aviation industry and airspace users. The Activity in SESAR 1 has also increased SINTEFs aeronautical research portfolio outside SESAR. SINTEF 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 & Gas, Space, Health & Medicine, Constructions, Energy, Marine, Railway, Roads, Harbors, and Resilience etc. SINTEF 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). 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.
Previous experience	Publications: Eide Aslak Wegner, Ødegård Stian Støer, Karahasanovic Amela (2014). A Post- Simulation Assessment Tool for Training of Air Traffic Controllers. HCI International 2014, jun 22 - jun 27: Relevance: a novel human performance evaluation tool was developed to support human performance evaluation 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: Developed an on-line, cost effective way to engage users to design together with the designer user interfaces Stiso Michael, Eide Aslak Wegner, Halvorsrud Ragnhild, Nilsson Erik Gösta, Skjetne Jan Håvard (2013). Building a flexible common operational picture to support situation awareness in crisis management. 10th International ISCRAM Conference 2013. Proceedings, Baden-Baden, Germany, 12-15 May 2013. (s. 220- 229). Karlsruhe: KIT. Relevance: Design of a multi-touch application supporting complex work situations. Newaz Fahd, Eide Aslak Wegner, Pultier Antoine (2015). Supporting first responder

	in-field communication and navigation using head-mounted displays. 12th International Conference on Information Systems for Crisis Response and Management (ISCRAM2015), mai 24 - mai 27. Relevance: Design of a state-og-the art application supporting complex work situations. Previous projects: Project **ZEFMAP** is successful SESAR WP-E project led by SINTEF (NATMIG) in collaboration with Frequentis AG 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%. 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. **BRIDGE**, "Bridging resources and agencies in large-scale emergency management", FP7-SEC-2010, The goal of BRIDGE was to increase public safety by developing technical and organisational solutions that improve crisis and emergency management in the EU Member States. The BRIDGE consortium developed a platform to provide technical support for multi-agency collaboration in large-scale emergency relief efforts. SINTEF (NATMIG) was responsible for designing and developing the front-end of the platform – essentially, a digital, multi-touch interactive common operational picture that collects, filters, shares, and allowed quick access to situational information during an emergency response. The platform works across a variety of devices, including table displays, laptops, and tablets.
Entity Profile matching the task	The controller acceptance of new CWP processes will be crucial so it is important to develop prototypes and run evaluations with controller to learn and tailor the proposed solutions. SINTEF (NATMIG) has knowledge and tools to model, develop rapid prototypes and run user early validation activities with controllers to inform the work
Contribution	SINTEF (NATMIG) will participate in PJ.16-03 and PJ.16-04. In 03 we will contribute with our knowledge in user interface modelling and link that to our proposed contributions in PJ.08 and PJ.19. In 04 we will contribute with our

	knowledge in state-of-the art user interface design and rapid prototyping. We will in both work closely with PJ08 and participate in PJ08 validation activities 08.01.06 and 08.01.03.

4.1.1.20 Participant N°20– INDRA

Organisation	20 INDRA SISTEMAS SA	Industry
Description	Indra is a global technology, innovation and talent company. It is on the cutting edge of high value-added solutions and services for the Transport and Traffic, Energy and Industry, Public Administration and Healthcare, Financial Services, Security and Defence and Telecom and Media sectors. The company operates in more than 149 countries and has more than 39,000 employees worldwide, focusing on developing innovative solutions that meet the needs of the most demanding clients. Indra ranks second in Europe by R&D spent, investing close to €195m during the last year. 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. 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&D, we are one of the leading companies in the SESAR program, the key technology behind the Single European Sky initiative. 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. 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. 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.	

	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 (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. Since 2009, Indra is full member of the SESAR Joint Undertaking, participating 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).
Previous experience	Previous projects: SESAR 1 (WPB, WP04, WP05, WP06, WP08, WP10, WP14 and WP15). EUROCAE (ED-133)
Entity Profile matching the task	The preparation of Indra's employees helps to the development of solution PJ.16-03 (Work Station, Service Interface Definition & Virtual Centre Concept) as Indra provides several profiles: • Operational experts who analyse the needs of the ANSPs. They quickly understand and share the details of the old, present and future ATM concepts. • Technical experts providing ways to support the needs of the ANSPs. Required to capture the relevant operational concepts for the system point of view. They determine the technology and the mechanisms that best fits for these concepts, so they have great notions of all the operational concepts they support. • Service Oriented Architecture and information experts required to harmonise the whole picture drawn in the operational and technical sides. As such, they need to be in touch with Operational and Technical experts or even have specific knowledge by their own. The harmonisation is done to maximise ANSP capabilities and adaptability so their work is based under proven paradigms and patterns that make this possible. • Network experts to analyse the technology infrastructure required whenever a communication is needed. They are up-to-date in the last network protocols, tools and technologies. The previous profiles are also useful for solution PJ.16-04 (Workstation, Controller Productivity). In addition, Indra is also providing specific profiles such as: • Human factors experts to capture the user needs when interacting with a system from different points of view such as availability, response times, safety or security. They always take into account the physical environment and physical conditions of the users. • Human Machine Interface (HMI) experts to provide and adapt interaction means supporting the needs captured by the human factors experts. They are able to do so thanks to their vast knowledge on interaction technologies and the application of design patterns to ensure ergonomics

	and usability.
Contribution	Indra provides contributors with the mentioned profiles to support the whole PJ.16-03 solution (Work Station, Service Interface Definition & Virtual Centre Concept) directly involving operational and Service Oriented Architecture and information experts to properly face the *"Operational dimension of Virtual Centre Concept"*. Technical, Service Oriented Architecture and information and network experts are provided to face the *"Technical solutions of Virtual Centre Concept"*, where TI study, involving SWIM, and development of prtotypes to be used in validations are expected. Indra focuses on specific innovative interaction means regarding development of prototypes under solution PJ.16-04 (Workstation, Controller Productivity). Thus, the provision of specific HMI experts will be limited to those: Multi-Touch input devices and Automatic Speech Recognition. Anyways, the knowledge of our participants will be shared and improved to support activities of all the rest of PJ.16-04 avtivities.

4.1.1.21 Participant N°21– FINMECCANICA

Organisation	**21**	**LEONARDO – FINMECCANICA SPA**	**Industry**

Description

Finmeccanica is a global player in the high-tech sectors and a major operator worldwide in the Aerospace, Defence and Security sectors. Finmeccanica is based in ltaly, has about 47,000 employees (latest updates 11/30/2015), of whom about 37% abroad, and in 2014 recorded 14.6 billion euro in revenues and received orders in the amount of 15.6 billion.

Finmeccanica 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.

The wide range of defence and security solutions that Finmeccanica 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, Finmeccanica 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.

Finmeccanica 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. The new Finmeccanica is the culmination of a radical renewal and transformation process: from a financial holding company to a great integrated industry focused on four activity sectors:

- Helicopters
- Aeronautics
- Aerostructures
- Electronics Defence and Security Systems
- Space

Finmeccanica operates through seven divisions that have inherited the activities of its 100% owned companies (AgustaWestland, Alenia Aermacchi, Selex ES, OTO Melara and WASS):

- Helicopters
- Aircraft
- Aerostructures
- Airborne & Space Systems
- Land & Naval Defence Electronics
- Defence Systems
- Security & Information Systems

Finmeccanica also retains Parent Company and Corporate Centre functions for participated companies and joint ventures not included in the divisional scope. 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.
Previous experience	**SESAR 1**: Finmeccanica has been actively involved in the following SESAR 1 WorkPackages: WP3, WP4, WP5, WP6, WP7, WP8, WP9, WP10, WP12, WP13, WP14, WP15, WP16 and WPB.
Contribution	Finmeccanica - Security & lnformation Systems division will provide operational and technical expertise to support the development and validation of the Virtual Centre Concept in PJ.16-03, by properly capturing the operational needs in order to put in place the technical solution that best fits them. Finmeccanica - Security & lnformation Systems division will also contribute to the HMI and HF study on the innovative technologies to be investigated in PJ.16-04, in particular User Profile Management System and Automatic Speech Recognition.

4.1.1.22 Participant N°22– ON (B4)

Organisation	**22 Valstybes imone Oro navigacija**	**Service Provider**
Description	Valstybes imone "Oro navigacija", Air Navigation Service provider in Lithuania, was founded in 1995 as independent, 100% State owned enterprise. It operates under the supervision of the Ministry of Transport and Communications. Valstybes imone "Oro navigacija" provides air navigation services in Lithuanian airspace and in airspace over the part of Baltic Sea offering its users air traffic management services, communication, navigation and surveillance services as well as an aeronautical information services. It operates one combined En-route/TMA control centre at Vilnius, 3 TMA control centres at Lithuania's international airports, each year providing safe and efficient air traffic control services to almost 230 thousands movements. It continues to maintain 0 min/flight delays level and to meet users expectations while flexibly and in cost effective way accommodating increase of the traffic up to 10%. Oro navigacija" is constituent entity of B4 Consortium, composed of four ANSPs from Central and Eastern part of Europe and their Linked Third Parties (further - L3Ps). B4 Consortium is a member of A6+ on SESAR 2020 Programme content. Valstybes imone "Oro navigacija" together with Polish ANSP PANSA forms Baltic FAB, and it is also a member of GATE ONE (joining 11 ANSPs), a regional platform of Central and Eastern European ANSPs.	
Previous experience	Not applicable	
Entity Profile matching the task	Not applicable, Valstybes imone "Oro navigacija" initially will not participate directly in this action.	
Contribution	Support to participating members of B4 Consortium if required.	

4.1.1.23 Participant N°23– PANSA (B4)

Organisation	**23 POLSKA AGENCJA ZEGLUGI POWIETRZNEJ** **Service Provider**
Description	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 to almost 700 thousands movements. 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. PANSA is a Member of the Baltic FAB and Gate One, a regional platform of Central and Eastern European ANSPs.
Previous experience	Not applicable
Entity Profile matching the task	Not applicable, PANSA initially will not participate directly in this action.
Contribution	Support to participating members of B4 Consortium if required.

4.1.1.24 Participant N°24– NLR (AT-ONE)

Organisation	**24**	**Stichting Nationaal Luchten Ruimtevaartlaboratorium**	**Research**
Description	Stichting Nationaal Lucht en Ruimtevaartlaboratorium (Netherlands Aerospace Centre) is participating in the AT-One Consortium, NLR (AT-One). The AT-One consortium is formed by the German Aerospace Center (DLR) and the Netherlands Aerospace Centre (NLR). AT-One combines the strength of DLR and NLR by joining their capabilities with respect to innovative and independent Air Traffic Management research and implementation support. NLR (AT-One) is the Netherlands Aerospace Centre for identifying, developing and applying advanced technological knowledge in the area of aerospace. NLR (AT-ONE) activities are relevant to society. They are market-oriented and carried out on a non-profit basis. NLR (AT-One) strengthens the innovativeness, competitiveness and effectiveness of government and business. The mission of NLR (AT-One) 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 & Evaluation. NLR thereby bridges the gap between research and practical applications, while working for both government and industry. Founded in 1919, and employing some 650 people. NLR (AT-One) is participating with two divisions in SESAR which are shortly introduced in the following: The division Aerospace Operations of NLR (AT-One) 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&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. The division Aerospace Systems of NLR (AT-One) 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 (AT-One) has deep expertise in GNSS.		
Previous experience	Not applicable		
Entity Profile	Not applicable		

matching the task	
Contribution	Not applicable

4.1.1.25 Participant N°25– ATOS (FSP)

Organisation	**25 Atos Belgium** **Industry**
Description	**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 & Systems Integration services, Managed Services, Cloud operations, Big Data & Security solutions, as well as transactional services. Throughout Europe, more than 300 Atos ATM experts provide solutions and architecture support to Air Navigation Service Providers, Airports, Airlines and Eurocontrol Network Manager. Atos Belgium is member of the Frequentis SESAR Partners consortium together with the companies HUNGAROCONTROL 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. 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.
Previous experience	Not applicable
Entity Profile matching the task	Not applicable, Atos Belgium initially will not participate directly in this action.
Contribution	Support to participating members of Frequentis SESAR Partners if required.

4.1.1.26 Participant N°26– AIRTEL (NATMIG)

Organisation	**26 AIRTEL ATN LIMITED**	**Industry**
Description	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 Stiftelsen SINTEF (non-profit research foundation - Norway). Airtel is an SME which has an extensive line of ATN & 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. Airtel 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. Airtel 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.	
Previous experience	Not applicable.	
Entity Profile matching the task	Not applicable, Airtel (NATMIG) initially will not participate directly in this action.	
Contribution	Support to participating NATMIG members if required	

4.1.1.27 Participant N°27– SAAB (NATMIG)

Organisation	**27 SAAB AKTIEBOLAG**	**Industry**
Description	Saab is part 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 Stiftelsen SINTEF (non-profit research foundation - Norway), where the latter one will be the coordinator. While Saab 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. Saab'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 & Avoid system or related ATM components. Saab is a global supplier in the ATM domain and Saab has a long history of developing and delivering ATM solutions. Saab has pioneered future concepts such as the Remote Tower, which in operational use in Sweden and is undergoing trails in several other countries. In total, Saab 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 ATM systems guide 2 million aircraft movements each month via our airport surface safety systems. Saab's main areas of interest are: • RPAS • Remote Tower
Previous experience	Not applicable.
Entity Profile matching the task	Not applicable, Saab (NATMIG) initially will not participate directly in this action.
Contribution	Support to participating NATMIG members if required

4.1.2 Main profiles/CV (they may be the same person for more than one role)

Richard Beaulieu will be the Project Manager and SGA Coordinator

Richard Beaulieu graduated as Engineer in the Ecole Supérieur des Télécommunications de Paris (1993).
He started his carrier as consultant in Altran, collaborating in projects for the specification, validation and later on for safety studies in several ANSP (DSNA, ASECNA, ICAO for AFI) during 14 years.
After joined Thales Air Systems in 2008, he went to Thales Australia, ATM branch. He developped locally the safety team.
Back in France, he worked in the safety team and then in the Engineering team for a major ATM project in France. During this period, he also worked on various SESAR 1 projects.
He joined the marketing team for 2 years to provide its operational and technical expertise and also, its knowledge of the market.
After joining the SESAR Team, he worked for B04.03 (Automation expertise for global architecture), B04.04 (Virtual Centre) and B04.05 (Marketing approach for Common Services)

Richard Beaulieu skills are:

- ATM domain expertise: more than 20 years
- ATM system architecture more than 20 years

- Safety for ATM for than 15 years
- Project Management for small and medium projects: many projects
- Virtual Centre: SESAR1 contributor and Grant response leader.

4.2 *Third parties involved in the project (including use of third party resources)*

4.2.1 Linked to Participant 1 (Coordinator) – THALES AIR SYS

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 Systems has a general policy to outsource a limited proportion of some of its non-critical activities. In accordance with this policy, Thales Air Systems 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 Systems 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[8]	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

[8] 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).

4.2.2 Linked to Participant 2 – ANS CR (B4)

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
Does the participant envisage that part of its work is performed by linked third parties	Y

Integra A/S

Integra A/S is an independent, privately owned Danish consultancy company established in 1988. Today the company provides a wide range of services within the ATM environment throughout the world including Legal support, Management and project services, technical support and safety services. In the context of SESAR 2020, Integra A/S will provide expertise in safety related activities and human factor. Operational experts will contribute to the definition of interaction needs.

Among other services, Integra developed a manual safety management for air traffic services for ICAO and was responsible for the development of safety assessments for the Network Manager in relation with the validation activities performed within SESAR 1.

Integra A/S has a long track of records related to aviation safety including the development and implementation of Safety Management Systems, development of safety assessments and safety cases, development of safety requirements for new operational concepts or related to the implementation of new CNS/ATM systems, examination and evaluation of SMS and safety documentation, safety culture survey and improvement programmes, safety audits and reviews, safety training or support to the implementation of an ATM Safety regulatory framework.

The Integra A/S has provided ANS CR in the past and on contractual basis consulting services and support in different areas of ATM (organization and corporate governance, ATM consulting, safety, etc.). Currently the mutual cooperation is covered by Framework Cooperation Agreement (Ref. No.: 014/2016/PS/088) formalizing and extending existing mutual cooperation in the areas of:

- ATM
- Air Navigation Service and
- Other areas of aviation

and in particular with respect to SESAR2020 the provision of support to selected SESAR2020 projects, PJ.16 being one of them.

Integra A/S will contribute to Solution PJ.16-03: Work Station, Service Interface Definition & Virtual Centre Concept and PJ.16-04: Workstation, Controller productivity.

For Solution PJ.16-03, the safety experts will contribute to the development of safety requirements and safety assessments before V2 and V3 validations. They will contribute to the development of the SPR V2 and V3.

The operational experts will contribute to the refinement of interaction needs by the analysis of the outputs from the Solution projects and to the development of the ADSP/CWP Interface Requirements Specification.

For Solution PJ.16-04, Integra' safety and human factor experts will focus on human performance contributing to the development of safety requirements in V2 and V3.

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

4.2.3 Linked to Participant 3 – LPS SR (B4)

No third parties involved

4.2.4 Linked to Participant 4 – ACG/COOPANS

No third parties involved

4.2.5 Linked to Participant 5 – CCL/COOPANS

No third parties involved

4.2.6 Linked to Participant 6 – IAA/COOPANS

No third parties involved

4.2.7 Linked to Participant 7 – LFV/COOPANS

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
Not applicable	
Does the participant envisage that part of its work is performed by linked third parties[9]	N
When drafting the proposal it was expected to involve Linköping University as Linked Third Party. It has later been clarified, that involvement will be limited in size and that the legal demands for being a linked third party might be difficult to fulfill as this would require contractual agreements. The scope of the projects/activities/deliverables performed by LFV is not changed and the envisaged involvement will be performed by LFV staff.	
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
Not applicable	

4.2.8 Linked to Participant 8 – Naviair/COOPANS

No third parties involved

4.2.9 Linked to Participant 9 – DFS

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
DFS plans to subcontract tasks related to adaptation of its Verification & Validation Infrastructure in order to support V&V activities on its Verification & Validation Platforms.	
Does the participant envisage that part of its work is performed by linked third parties[10]	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

[10] 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).

4.2.10 Linked to Participant 10 – DSNA

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
DSNA has in house expert engineers. They have the ability to develop new concepts and define specifications for new ATM services. But, in order to fulfill its prospective studies, DSNA needs additional expertise. In PJ.16-03, subcontracted activities will encompass the support to: the modelling of new services in the MEGA tool and the platform maintenance and configuration in preparation of validation exercises, collect of the data steaming from the validations, and the analysis of the results through specific tooling. 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 Publics”	
Does the participant envisage that part of its work is performed by linked third parties[11]	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

[11] 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).

4.2.11 Linked to Participant 11– ENAIRE

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
Does the participant envisage that part of its work is performed by linked third parties[12]	Y
CRIDA is a reference ATM R&D&I centre created by ENAIRE, Ineco and the Universidad Politécnica de Madrid. Its main focus is the performance improvement of the ATM system, developing , validating and implementing ATM solutions. CRIDA A.I.E. is the branch from ENAIRE in charge of the R&D activities and it plays a relevant role in all the ENAIRE's activities developed in the SESAR programme. Its main focus is the performance improvement of the ATM system, developing, validating and implementing ATM solutions. CRIDA will participate in the solution PJ.16-4 (Wok Station, Controller Productivity solution) of PJ.16. CRIDA will contribute to the Human-Machine Interface evolution through the investigation of the use of Automatic Speech Recognition in the Controller working Position. A prototype will be developed and incorporated in a validation exercise that will take place in PJ.09. All together duly justify the huge involvement of CRIDA A.I.E. in this project (more than 50% of ENAIRE's contribution) and more precisely in WP3 (solution PJ.16-4) on behalf of ENAIRE.	
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 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 60.000 € (direct costs) for the work developed on ENAIRE's premises (since there is no specific place in Annex 2 to indicate these costs).	

[12] 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).

4.2.12 Linked to Participant 12 – ENAV

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
Does the participant envisage that part of its work is performed by linked third parties[13]	Y

ENAV contribution in the project is complemented by the following LTPs: SICTA, NAIS & BULATSA

SICTA

SICTA - Advanced Systems for Air Traffic Control - is the Research Branch of ENAV Group. SICTA is an internal subsidiary company, namely the SICTA Consortium, which is 100% controlled by ENAV Group as of July 2012.

SICTA's staff is made up of highly skilled professionals like Air Traffic Management experts, Systems experts, Systems and software engineers, operational concept and simulation experts (both fast and real time), validation and demonstration experts.

Established in 1993 SICTA boasts a solid tradition of research and applied studies in ATM/CNS. It conducts research, development, validation and demonstration activities related to the Innovation in the Air Traffic Management domain participating in National and European research projects, playing an important role in the European field as the Italian R&D lab for ATM/CNS.

The multi-year experience gained on ATC/ATM topics both in operational as well in innovative contexts makes of SICTA a dynamic company ready to act as a joining link between today operations and future solutions. The daily proximity with ENAV operational staff allows SICTA's resources to full understand key issues in the ATC/ATM domain and to strongly contribute into the investigation of solutions addressing them.

SICTA participation is quite significant from an ENAV perspective considering it brings an important piece of transversal technical, operational and management expertise.

On the basis of the considerations and skills depicted above and taking into account that SICTA, as part of the ENAV Group, is to all effects same as an ENAV department, the ENAV and SICTA in kind contribution is to be considered as a single block.

NEXTANT APPLICATIONS & INNOVATIVE SOLUTION SRL

Established at the end of 2006, NEXTANT APPLICATIONS & INNOVATIVE SOLUTION SRL (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

[13] 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).

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.

BULATSA
Bulgarian Air Traffic Services Authority (BULATSA) is a legal entity based in Sofia and performing state functions for the provision of air navigation services in the controlled civil airspace of the Republic of Bulgaria, in line with the international agreements in the field of civil aviation signed and ratified by the Republic of Bulgaria.
BULATSA consists of a central headquarter and air traffic control centres - Area Control Centre (ACC) in Sofia and APP/TWR Centres in Varna, Burgas, Plovdiv and Gorna Oryahovitsa. The scope of BULATSA's activities encompasses all aircraft departing from and arriving at civil airports and overflying the controlled civil airspace of the Republic of Bulgaria.
BULATSA successfully fulfils the functions delegated by the Bulgarian state, namely the provision of air traffic services, and follows its development strategy. A pro-active stand to the Single European Sky initiative is in place. The new SATCAS ATM System has recently commenced operations, equipped with state-of-the-art hi-tech functionalities anticipating the future needs of air traffic service provision.
Bulgaria constantly promotes and boosts the co-operation in the region through their active participation in several regional initiatives and agreements. BULATSA is an active partner in ATM Co-operation in South Eastern Europe and is a key partner along with ROMATSA in the DANUBE FAB.
The above LTP(s) are Companies which are either bound to ENAV through shared ownership (i.e. our affiliate SICTA) or are linked to ENAV through the sharing of a strategic plan for cooperation in several ATM related domains, as established in the framework of an Agreement for Cooperation (AfC) addressing various areas of development, such as Research & Development, Commercial Activities and Organisational Development (the AfC is attached to Appendix B – Technical Part of the ENAV application to the SJU Call for Final Membership – Ref. SJU/LC/0122-CFP). Such plans may well include joint and coordinated efforts to be injected in SESAR to foster the development of specific key features of the SESAR 2020 Programme.

SICTA will support ENAV in both Operational and Technical thread, in particular SICTA will provide expertise for the definition of Virtual Centre operational concept contributing at the definition of maturity level during the OSED drafting which include safety, security, human factors and regulation aspects and in the conduction of verification and validation activities.
NAIS will support ENAV in the analysis of Interoperability aspects and the specification of Safety / Performance requirements, the identification of showstoppers linked to (cyber-)security and the specification and design of ADSP / CWP interfaces services and data models. Moreover NAIS will support ENAV in the execution of Technical Verification and Validation activities.
BULATSA will support ENAV in the analysis of performance, operational requirements and validation activities related to the controller work station and its associated HMI.

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

4.2.13 Linked to Participant 13 – NATS

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
Does the participant envisage that part of its work is performed by linked third parties[14]	Y
NATS will work with Avinor ANS, who will bring to SESAR 2020 their experience gained from activities in the current SESAR Programme, specifically in WP 8. NATS and Avinor ANS have a signed Charter of Cooperation and a number of contracts exist for mutual support in various areas related to ATM Avinor ANS will contribute to the NATS effort in support of some of the PJ16-04 technologies, including Multi-touch, Attention Guidance and Automatic Speech Recognition. Avinor ANS will contribute to the definition of Business Services so that the ANSP's CWP can be separated from other stakeholders' information flows through the application of SOA orientated standardised interfaces.	
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

[14] 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).

4.2.14 Linked to Participant 14 – SKYGUIDE

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
Does the participant envisage that part of its work is performed by linked third parties[15]	Y
SkysoftATM SkysoftATM 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 PJ.16, skyguide needs to entrust to Skysoft-ATM for the elaboration and the provision of the simulation platform and the development the necessary functionalities Specifically, in the frame of PJ16.04 Workstation, Controller Productivity, SkysoftATM contributes to Automatic Speech recognition aspects of the solution. Skyguide operates the system that SkysoftATM provides and therefore the need to have the LTP providing more effort on this solution is justified.	
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

[15] 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).

4.2.15 Linked to Participant 15 – EUROCONTROL

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
EUROCONTROL will sub-contract non-core activities to support the verification and validation activities of PJ16-03 and PJ16-04. These activities consist in the necessary adaptation of EUROCONTROL validation platform (ESCAPE, AudioLAN, eDEP) that will support the verification of the architectural model, the services definition as well as the industrial prototypes. These adaptations would be either to comply with CWP and/or ADSP standards or to provide verification tools. The purchase and installation at EUROCONTROL premises of a verification test-bed (SWIM compliant) is also planned to support the transversal verification activities. 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 PJ16.	
Does the participant envisage that part of its work is performed by linked third parties[16]	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

4.2.16 Linked to Participant 16 – DLR (AT-ONE)

No third parties involved

[16] 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).

4.2.17 Linked to Participant 17 – FRQ (FSP)

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N
When drafting the proposal it was envisaged to involve Universität des Saarlandes UdS as subcontractor. It has later been clarified, that involvement will be too limited in size. The scope of the projects/activities/deliverables performed by Frequentis is not changed and the envisaged involvement will be performed by Frequentis staff.	
Does the participant envisage that part of its work is performed by linked third parties[17]	Y
The affiliate / Linked 3rd party to Frequentis AG, the PDTS GmbH is contributing to this action. 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. 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 SESAR 1 projects, especially where their high level of competence in relation to VoIP communications for e.g. Remote Tower applications was required. For SESAR 2020 the PDTS contribution will focus also on its core competence around complex IT and VoIP solutions in the Virtual Centre environment.	
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

4.2.18 Linked to Participant 18 – HC (FSP)

No third parties involved

4.2.19 Linked to Participant 19 – SINTEF (NATMIG)

No third parties involved

4.2.20 Linked to Participant 20 – INDRA

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	N

Does the participant envisage that part of its work is performed by linked third parties[18]	Y
For the present proposal, ROMATSA is a linked third party of Indra, as declared in the Indra Proposal for Membership Accession -REF. SJU/LC/0122-CFP, dated 28-January-2016. ROMATSA (Romanian Air Traffic Services Administration) is the provider of air navigation services in FIR Bucuresti, including air traffic services, aeronautical meteorological services, aeronautical information services, as well as the communication, navigation and surveillance services. It holds a Certificate of Air Navigation Services Provider, valid from 18th of February 2014 until 15 th December 2018. It is designated by the Ministry of Transportation to provide air traffic services and meteorological services in FIR Bucuresti in accordance with the article 8 and 9 from Regulation (EC) 550/2004. Considering Art. 8, para 5 of Regulation (EC) No 550/2004, as amended by Regulation 1070/2009, and in accordance with Article 19 para 19.3 of the Agreement on the establishment of DANUBE Functional Airspace Block between the Republic of Bulgaria and Romania, ROMATSA is jointly designated to provide air Traffic services on an exclusive basis in the airspace under the responsibility of the Republic of Bulgaria and of Romania within the DANUBE Functional Airspace Block. At present ROMATSA is in the process of implementing a new ATM System based on a modern architecture and technologies which will fully comply with the SESAR standards and European Commission requirements for the years 2015+. The final goal of the project is therefore to deliver an ATM system able to support the full SESAR operational concept. ROMATSA is active in the DANUBE FAB developments, being involved in the implementation of the applicable requirements stemming for Regulation (EC) 550/2004. They are implementing the night-time Free Route Operations within the Bucharest FIR from 14 November 2013. This implementation is in-line with the implementation of the Free Route Concept at European level and represents a first step towards implementation of FRA in Bucharest FIR. ROMATSA has an experience in international cooperation. In this context we are acting as user of the EAD system and from 1 January 2014 we also provide the data for this service, being the provider of the aeronautical information service in Romania. The goal of the participation of ROMATSA in this proposal is to enrich the natural role of Indra as a ground industry manufacturer with the operational expertise, complementing technical work with an operational view for better support SESAR 2020 solutions. ROMATSA will participate in the project providing IT and ATCO experts, for the areas of requirements definition, verification and evaluation of results.	
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

[18] 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).

4.2.21 Linked to Participant 21 – FINMECCANICA

Objective	
Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	Y
According to the company outsourcing policy of an average of 20% for external non-core activities, Finmeccanica plans to delegate a set of sub-contractors to perform part of activities for the non-core components of the ATM system. In particular, the activities sub-contracted regard the Technical Specification phase, Low Level design and SW implementation as well as CSCI integration since Finmeccanica could not have internally available resources for this job profile. For this project Finmeccanica plans to subcontract part of the activities of Technical Specification and Prototype Development for the Solution PJ16-03.	
Does the participant envisage that part of its work is performed by linked third parties[19]	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

4.2.22 Linked to Participant 22 – ON (B4)

No third parties involved

4.2.23 Linked to Participant 23 – PANSA (B4)

No third parties involved

4.2.24 Linked to Participant 24 – NLR (AT-ONE)

No third parties involved

4.2.25 Linked to Participant 25 – ATOS (FSP)

No third parties involved

4.2.26 Linked to Participant 19 – AIRTEL (NATMIG)

No third parties involved

[19] 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).

4.2.27 Linked to Participant 19 – SAAB (NATMIG)

No third parties involved

4.3 *Global budget approach taken by the SJU candidate members*

The SJU Members comprising EUROCONTROL and the 19 Members selected as a result of the Membership Accession Process have actively participated to the SESAR2020 dialogue phase, launched by SESAR JU, considering the 28 Projects (18 IR, 3 Transversal and 7 VLD) as part of a unique Work Programme.

During the dialogue phase the SJU Members, have supported SESAR JU both in DoW preparation and in the estimation of the effort per project.

Then SESAR JU published, in the SESAR2020 Multi-annual Work Programme, an indicative co-financing estimation per Project, per Stakeholder Group (Service Providers, Airborne Manufacturing Industry, Ground Manufacturing Industry) and per Wave (Waves 1 and 2).

In view of the response to be given in a short period, the SJU Members decided to start the preparation activities before the official launch of the call for proposal, using the available documents published by SESARJU (i.e. SESAR2020 Multi-annual Work Programme) in order to have more available time for the proposal preparation.

A deep and comprehensive analysis of the required work was done, bringing to a revision of the estimated effort necessary to perform the activities. In such analysis also the interests to invest from both Service Providers and Manufacturing Industries were taken into account.

The result was a limited different co-financing distribution among the 28 Projects.

The SJU Members have collectively decided to maintain these limited differences because the revised values were more close to the described activities while keeping the overall maximum co-financing for W1 and per Stakeholder group.

The rationale for maximum co-financing deviation is explained at project level.

The following table contains the allocation of co-financing required to support Wave 1 (extracted from the SESAR2020 Multi-annual Work Programme) and the co-financing distribution agreed by the SJU Members for the 28 Projects for Wave 1:

Topic	NAME OF PROJECT	Max Co-financing Value Wave 1	Co-financing agreed by Candidate Members
1	PJ.19 Content Integration	**€8.320.000**	**€7.395.141**
2	PJ.20 Master plan maintenance	**€3.510.000**	**€3.327.673**
3	PJ.22 Validation and Demonstration Engineering	**€4.940.000**	**€2.051.363**
	TOTAL TRANSVERSAL WAVE 1	**€16.770.000**	**€12.774.177**
4	PJ.02 Increased Runway and Airport Throughput	**€13.845.000**	**€15.592.847**
5	PJ.03a Integrated Surface Management	**€12.220.000**	**€12.925.438**
6	PJ.03b Airport Safety Nets	**€8.125.000**	**€8.228.635**
7	PJ.04 Total Airport Management	**€10.465.000**	**€8.909.071**
8	PJ.05 Remote Tower for Multiple Airports	**€6.630.000**	**€9.013.622**
9	PJ.07 Optimised Airspace Users Operations	**€3.640.000**	**€2.247.337**
10	PJ.08 Advanced Airspace Management	**€2.730.000**	**€2.738.354**
11	PJ.09 Advanced DCB	**€7.020.000**	**€7.153.377**
12	PJ.01 Enhanced arrivals and departures	**€17.680.000**	**€17.521.365**
13	PJ.06 Trajectory Based Free Routing	**€6.045.000**	**€6.029.406**
14	PJ.10 Separation Management En-Route and TMA	**€25.935.000**	**€26.388.527**
15	PJ.11 Enhanced Air and Ground Safety Nets	**€5.265.000**	**€5.478.828**
16	PJ.13 Air Vehicle Systems	**€10.140.000**	**€9.251.386**
17	PJ.14 CNS	**€22.880.000**	**€23.213.553**
18	PJ.15 Common Services	**€6.435.000**	**€5.784.518**
19	PJ.16 CWP - HMI	**€11.635.000**	**€12.861.755**
20	PJ.17 SWIM Infrastructures	**€9.490.000**	**€9.754.600**
21	PJ.18 4D Trajectory Management	**€21.125.000**	**€22.193.942**
	TOTAL SESAR 2020 PROJECTS WAVE 1	**€201.305.000**	**€205.286.559**
	TOTAL TRANSVERSAL & PROJECTS WAVE 1	**€218.075.000**	**€218.060.736**
22	PJ.28 Integrated Airport Operations (incl. TBS)	**€4.300.000**	**€4.001.243**
23	PJ.24 Network Collaborative Management	**€3.600.000**	**€4.759.841**
24	PJ.23 Flexible Airspace Management and Free Route	**€4.400.000**	**€1.443.374**
25	PJ.25 Arrival Management extended to en-route Airspace	**€4.000.000**	**€3.914.104**
26	PJ.26 Enhanced Terminal Airspace using RNP-Based Operations	**€2.400.000**	**€539.333**
27	PJ.27 Flight Information Exchange	**€6.100.000**	**€6.079.367**
28	PJ.31 Initial Trajectory Information Sharing	**€17.200.000**	**€18.955.119**
	TOTAL VLD WAVE 1	**€42.000.000**	**€39.692.380**
	TOTAL SESAR 2020 PPP (TRANSVERSAL, IR & VLDs) WAVE 1	**€260.075.000**	**€257.753.116**

5. Ethics and Security

5.1 *Ethics*

All participants of the PJ.16 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
- Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data

During the project WP1 will ensure compliance with ethics. This means that WP1 will verify that all documents from the PJ.16 project are following European ethical rules and the ethical rules of the concerned country. Furthermore WP1 will provide support for all WPs regarding ethical issues.
During project Kick-off Meeting, WP1 will conduct an information session in order to draw attention to, and inform partners of all relevant ethical issues. Furthermore, WP1 will provide publicly available literature to provide all participants with the opportunity to learn more about appropriate ethical standards and practices in research.

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 PJ.16 project.

5.1.1 Humans

In the project, validation/demonstration activities will be conducted to achieve the required maturity for all Operational Improvements addressed by the project, and in particular to gain knowledge about human-machine interaction.
These activities will involve Air Traffic Controllers, Pilots or other operational staff of the entities participating to the project. Participants will be selected through the management of operational divisions of the involved partners, depending on the requirements for the specific validation exercise (e.g. air traffic controller licence for specific sectors or type of airspace), availability, and willingness to contribute to the SESAR programme. Within these activities, observations, instantaneous self-assessments and interviews may be conducted in all PJ.XX solutions.
Participants of these validation activities will be clearly informed of the research goals, the methodology of data protection in a presentation of the project and in interviews at the beginning of the study. According to the declaration of Helsinki, subjects are free to leave any validation activities 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.

Section: Humans		YES	NO	Information to be provided	Documents to be provided
Does your research involve human participants?		X		Confirmation about obtained Informed consent of the participants.	Examples of "informed consent form"
If YES:	Are they volunteers for social or human sciences research?		X		
	Are they persons unable to give informed consent (including children/minors)?		X		

Section: Humans	YES	NO	Information to be provided	Documents to be provided
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.	
Does your research also involve physical interventions on the study participants?		X		

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.

5.1.2 Protection of Personal Data

In advance and during the action execution, 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. These personal data will be collected and processed fully in accordance with the Directive 95/46/EC of the European Parliament on the protection of individuals with regard to the processing of personal data and on the free movement of such data.

Personal data collected and further processed concern mainly all the technical and/or operational experts contributing to the action, either during its whole duration or playing a punctual or temporal role, for the purpose of the needed mutual contact among involved parties, exercises preparation and execution, meeting and logistic arrangements and communication activities. For the latter, personal data collection from the people to which communication is aimed at, is also envisaged.

In the context of this action, collected personal data would comprise information identifying the person designated by its organization. Typically, personal data would relate to the following:

- Name;
- Identification Number (ID);
- Company position / action role;
- Business contact details (e-mail address, business telephone number, mobile telephone number, fax number, postal address, company and department);
- Level of qualification, professional experience.

Under no circumstances these personal data will refer to racial or ethnic origin, political opinions, economical situation, religious or philosophical beliefs, trade-union membership, physical and mental health, sex life, or any other sensitive data.

Section: Protection of Personal Data		YES	NO	Information to be provided	Documents to be provided
Does your research involve personal data collection and/or processing?		X			
If YES:	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, MACs, cookies, etc.)?		X		
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)?			X		

5.1.3 Misuse

The PJ.16 project is part of the SESAR 2020 program and as such will be supervised by the SESAR Joint Undertaking (SJU) and its members of the Administration Board. Several independent advisors are included in that body: e.g. Staff Representative, Airspace User, Military, and Scientific Community Representative. The SJU has or will expand on the development of a strategy on how to deal with possible risks regarding misuse and related consequences during the project execution inside of SESAR 2020.
In the case that ethical issues arise unexpectedly during the project, the project coordinator will contact the SESAR JU immediately and provide detailed information on the issue and how the project team intend to handle it.

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 SESAR JU immediately and provide detailed information on the issue and how the project team intend to handle it.

5.2 *Security*[20]

Section: Security	YES	NO	Information to be provided	Documents to be provided
Are activities planned or results expected raising security issues?		X		
Are 'EU-classified information' as background or results foreseen?		X		

References

[1] European Commission: **H2020 CALL: SESAR2020 IR-VLD WAVE1**, http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/calls/h2020-sesar-2015-2.html#c,topics=callIdentifier/t/H2020-SESAR-2015-2/1/1/1&callStatus/t/Forthcoming/1/1/0&callStatus/t/Open/1/1/0&callStatus/t/Closed/1/1/0&+identifier/desc, Brussels, 22 October 2015.

[2] SESAR Joint Undertaking: **SESAR 2020 Multi Annual Work Program**, Edition 1.0, Brussels, 01 July 2015.

[3] SESAR Joint Undertaking: **Annual Work Programme* 2015**, Amendment n°1 Edition 00.01.01, Brussels, 20 October 2015.

[20] Article 37.1 of the Model Grant Agreement: *Before disclosing results of activities raising security issues to a third party (including affiliated entities), a beneficiary must inform the coordinator — which must request written approval from the Commission/Agency.* Article 37.2: *Activities related to 'classified deliverables' must comply with the 'security requirements' until they are declassified. Action tasks related to classified deliverables may not be subcontracted without prior explicit written approval from the Commission/Agency. The beneficiaries must inform the coordinator — which must immediately inform the Commission/Agency — of any changes in the security context and — if necessary — request for Annex 1 to be amended (see Article 55).*

[4] SESAR Joint Undertaking: **Introduction to the SESAR 2020 Programme Execution**, Edition 01.00.01, Brussels, 12th October 2015.

[5] xxxx

Abbreviations

This list extends the list given in [2] and [3].

ATM	Air Traffic Management
EC	European Commission
EPMB	Extended Project Management Board
EU	European Union
H2020	HORIZON 2020 (research and innovation program of the EU, 2014-2020)
IP	Internet Protocol
IR	Industrial Research project
MAWP	Multi Annual Work Programme [2]
PCIL	Project Content Integration Lead
PCIT	Project Content Integration Team
PEG	Programme Execution Guidance [4]
PJ00	Project No. 00 described in [2] corresponds to the Topic of the call
PJ00-01	Solution No 01 in PJ00
PM	Project Manager (is 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
SJU	SESAR Joint Undertaking
SL	Solution Lead
TA	Transversal Action
VLD	Very Large Demonstration
WAN	Wide Area Network
WP	Work Package

ESTIMATED BUDGET FOR THE ACTION (page 1 of 3)

	Estimated eligible[1] costs (per budget category)									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[2]	Total costs	Reimbursement rate %	Maximum EU contribution[3]	Maximum grant amount[4]	Information for indirect costs	Information for auditors	Other information:
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons [A.6 Personnel for providing access to research infrastructure]		A.4 SME owners without salary A.5 Beneficiaries that are natural persons without salary				D.1 Travel D.2 Equipment D.3 Other goods and services D.4 Costs of large research infrastructure						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 EU funding
Form of costs[6]	Actual	Unit[7]	Unit[8]		Actual	Actual	Actual	Flat-rate[9] 25%							
	(a)	Total (b)	No hours	Total (c)	(d)	(e)	(f)	(g)=0,25x ((a)+(b)+ (c)+(f) +[(h1)+(h2)]- (m))	(i)= (a)+(b)+(c)+ (d)+(e)+(f)+ (g)+(h1)+(h2)+(h3)	(j)	(k)	(l)	(m)	Yes/No	
1. THALES AIR SYS	2735114.00	0.00	0	0.00	212192.00	0.00	303132.00	759561.50	4009999.50	70.00	2806999.65	569329.65	0.00	No	
2. ANS CR (B4)	254459.00	0.00	0	0.00	0.00	0.00	42000.00	74114.75	370573.75	70.00	259401.63	52613.13	0.00	No	
- Integra[14]	72000.00	0.00	0	0.00	0.00	0.00	4000.00	19000.00	95000.00	70.00	66500.00	13487.86	0.00	No	
Total beneficiary 2	326459.00	0.00	0.00	0.00	0.00	0.00	46000.00	93114.75	465573.75		325901.63	66100.99	0.00		
3. LPS SR (B4)	394073.00	0.00	0	0.00	0.00	0.00	57010.00	112770.75	563853.75	70.00	394697.63	80054.54	0.00	No	
4. ACG/COOPANS	88506.00	0.00	0	0.00	0.00	0.00	35007.00	30878.25	154391.25	70.00	108073.88	21920.08	0.00	No	
5. CCL/COOPANS	41058.00	0.00	0	0.00	0.00	0.00	6142.00	11800.00	59000.00	70.00	41300.00	8376.67	0.00	No	
6. IAA/COOPANS	95777.00	0.00	0	0.00	0.00	0.00	14271.00	27512.00	137560.00	70.00	96292.00	19530.42	0.00	No	
7. LFV/COOPANS	90768.00	0.00	0	0.00	0.00	0.00	25192.00	28990.00	144950.00	70.00	101465.00	20574.79	0.00	No	
8. Naviair/ COOPANS	128841.00	0.00	0	0.00	0.00	0.00	19213.00	37013.50	185067.50	70.00	129547.25	26275.42	0.00	No	
9. DFS	728933.00	0.00	0	0.00	300000.00	0.00	80800.00	202433.25	1312166.25	70.00	918516.38	186298.07	0.00	No	
10. DSNA	355875.00	0.00	0	0.00	120000.00	0.00	11325.00	91800.00	579000.00	70.00	405300.00	82204.96	0.00	No	
11. ENAIRE	164291.46	0.00	0	0.00	0.00	0.00	8585.54	23694.25	196571.25	70.00	137599.88	27908.69	78100.00	No	
- CRIDA[14]	162609.54	0.00	0	0.00	0.00	0.00	9390.46	43000.00	215000.00	70.00	150500.00	30525.16	0.00	No	
Total beneficiary 11	326901.00	0.00			0.00	0.00	17976.00	66694.25	411571.25		288099.88	58433.85	78100.00		
12. ENAV	121778.28	0.00	0	0.00	0.00	0.00	13530.92	33827.30	169136.50	70.00	118395.55	24013.54	0.00	No	
- SICTA[14]	120727.72	0.00	0	0.00	0.00	0.00	14581.08	33827.20	169136.00	70.00	118395.20	24013.50	0.00	No	
- Bulatsa[14]	86400.00	0.00	0	0.00	0.00	0.00	9600.00	24000.00	120000.00	70.00	84000.00	17037.30	0.00	No	
- NAIS[14]	86400.00	0.00	0	0.00	0.00	0.00	9600.00	24000.00	120000.00	70.00	84000.00	17037.30	0.00	No	
Total beneficiary 12	415306.00	0.00	0.00	0.00	0.00	0.00	47312.00	115654.50	578272.50		404790.75	82101.64	0.00		
13. NATS	876859.00	0.00	0	0.00	0.00	0.00	43141.00	230000.00	1150000.00	70.00	805000.00	163274.11	0.00	No	
- Avinor ANS[14]	109250.00	0.00	0	0.00	0.00	0.00	10750.00	30000.00	150000.00	70.00	105000.00	21296.62	0.00	No	
Total beneficiary 13	986109.00	0.00			0.00	0.00	53891.00	260000.00	1300000.00		910000.00	184570.73	0.00		
14. SKYGUIDE	461428.50	0.00	0	0.00	0.00	0.00	55371.50	129200.00	646000.00	70.00	452200.00	91717.46	0.00	No	

ESTIMATED BUDGET FOR THE ACTION (page 2 of 3)

	Estimated eligible[1] costs (per budget category)									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[2]	Total costs	Reimbursement rate %	Maximum EU contribution[3]	Maximum grant amount[4]	Information for indirect costs	Information for auditors	Other information:
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons [A.6 Personnel for providing access to research infrastructure]		A.4 SME owners without salary A.5 Beneficiaries that are natural persons without salary				D.1 Travel D.2 Equipment D.3 Other goods and services D.4 Costs of large research infrastructure						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 EU funding
Form of costs[6]	Actual	Unit[7]	Unit[8]		Actual	Actual	Actual	Flat-rate[9] 25%							
	(a)	Total (b)	No hours	Total (c)	(d)	(e)	(f)	(g)=0,25x ((a)+(b)+ (c)+(f) +[(h1)+(h2)]- (m))	(i)= (a)+(b)+(c)+ (d)+(e)+(f)+ (g)+(h1)+(h2)+(h3)	(j)	(k)	(l)	(m)	Yes/No	
- SKYSOFTATM[14]	461428.50	0.00	0	0.00	0.00	0.00	55371.50	129200.00	646000.00	70.00	452200.00	91717.46	0.00	No	
Total beneficiary 14	922857.00	0.00			0.00	0.00	110743.00	258400.00	1292000.00		904400.00	183434.92	0.00		
15. EUROCONTROL															3211050.00
16. DLR (AT-One)	467387.00	0.00	0	0.00	0.00	0.00	64407.00	132948.50	664742.50	70.00	465319.75	94378.47	0.00	No	
17. FRQ (FSP)	721074.14	0.00	0	0.00	0.00	0.00	119840.00	210228.54	1051142.68	70.00	735799.88	149238.60	0.00	No	
- PDTS[14]	141142.86	0.00	0	0.00	0.00	0.00	0.00	35285.71	176428.57	70.00	123500.00	25048.89	0.00	No	
Total beneficiary 17	862217.00	0.00			0.00	0.00	119840.00	245514.25	1227571.25		859299.88	174287.49	0.00		
18. HC (FSP)	235241.00	0.00	0	0.00	0.00	0.00	32188.00	66857.25	334286.25	70.00	234000.38	47461.12	0.00	No	
19. SINTEF (NATMIG)	274857.00	0.00	0	0.00	0.00	0.00	22286.00	74285.75	371428.75	70.00	260000.13	52734.52	0.00	No	
20. INDRA	2078903.12	0.00	0	0.00	0.00	0.00	103926.87	545707.50	2728537.49	70.00	1909976.24	387390.89	0.00	No	
- ROMATSA[14]	391096.88	0.00	0	0.00	0.00	0.00	26073.13	104292.50	521462.51	70.00	365023.76	74035.94	0.00	No	
Total beneficiary 20	2470000.00	0.00			0.00	0.00	130000.00	650000.00	3250000.00		2275000.00	461426.83	0.00		
21. FINMECCANICA	950400.00	0.00	0	0.00	132000.00	0.00	10000.00	240100.00	1332500.00	70.00	932750.00	189185.00	0.00	No	
22. ON (B4)	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	70.00	0.00	0.00	0.00	No	
23. PANSA (B4)	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	70.00	0.00	0.00	0.00	No	
24. NLR (AT-One)	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	70.00	0.00	0.00	0.00	No	
25. ATOS (FSP)	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	70.00	0.00	0.00	0.00	No	
26. AIRTEL (NATMIG)	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	70.00	0.00	0.00	0.00	No	
27. SAAB (NATMIG)	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	70.00	0.00	0.00	0.00	No	
Total consortium	12896679.00	0.00		0.00	764192.00	0.00	1206735.00	3506328.50	18373934.50		12861754.19	2608680.16	78100.00		3211050.00

ESTIMATED BUDGET FOR THE ACTION (page 3 of 3)

(1) See Article 6 for the eligibility conditions
(2) The indirect costs covered by the operating grant (received under any EU or Euratom funding programme; see Article 6.5.(b)) are ineligible under the GA. Therefore, a beneficiary 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 (see Article 6.2.E).
(3) This is the theoretical amount of EU 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 Commission/Agency decided to grant for the action) (see Article 5.1).
(4) The 'maximum grant amount' is the maximum grant amount decided by the Commission/Agency. It normally corresponds to the requested grant, but may be lower.
(5) 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.
(6) See Article 5 for the forms of costs
(7) Unit : hours worked on the action; costs per unit (hourly rate) : calculated according to beneficiary's usual accounting practice
(8) See Annex 2a 'Additional information on the estimated budget' for the details (costs per hour (hourly rate)).
(9) 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
(10) See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit).
(11) See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit, estimated number of units, etc)
(12) Only specific unit costs that do not include indirect costs
(13) See Article 9 for beneficiaries not receiving EU funding
(14) Only for linked third parties that receive EU funding

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK (ANS CR (B4)) SP, 49710371, established in Navigacni 787, Jenec 25261, Czech Republic, VAT number CZ49710371, ('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 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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)) SK9, 35778458, 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 ('3')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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) GMBH, FN71000M, 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 ('4')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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) DOO, 080328617, 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 ('5')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Alen SAJKO with ECAS id nsajalen signed in the Participant Portal on 27/10/2016 at 08:32:52 (transaction id SigId-68004-F8viptVaQ8Y9nVQvBhN6MZzkzzNRcPGziPmIJVtYzydfPzesuzyp6W2ga3HvvHqCYkkVKC5AhwiZkQ48KLXavGvK-Jj71zxYb8yrkmoAceBIUCa-FZuELDtthJiQioSQ8ifSjHRO4tbKSAU3oMkL7TRgTEq). Timestamp by third party at
Thu Oct 27 09:33:10 CEST 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UDARAS EITLIOCHTA NA HEIREANN THE IRISH AVIATION AUTHORITY (IAA/ COOPANS) LTD, 211082, 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 ('6')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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), 2021000795, 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 ('7')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Björn WAHLSTRÖM with ECAS id nwahlsbj signed in the Participant Portal on 27/10/2016 at 14:20:12 (transaction id SigId-76659-Hf5KIghNnoOXuggMswbfYOOA8rcvZuGNbJ2ymWHNvFFzMHxd8WgJCgPEEg2HVQN8cqZ55rCxUrJSXmob12Pl5q-Jj71zxYb8yrkmoAceBIUCa-ATi6GgadczxwY40ZTPo90UD68GdzRoT4K058MDhqqXQm). Timestamp by third party at Thu Oct 27 15:20:25 CEST 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

NAVIAIR (Naviair/COOPANS) DK18, 26059763, 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 ('8')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Susanne ISAKSEN with ECAS id nisakssu signed in the Participant Portal on 01/11/2016 at 11:22:16 (transaction id SigId-10904-cCzpravmsAsgarTOoQUR3SPaiBzSczn O1gAqe66RLfvFe7r0obJjusAm146uRWKnJnrqJIGdk0s40jYYZ3kzM3q-Jj71zxYb8yrI8GmV4asVNa-THN3mMKKG03SlRuB2AMzPgr5o9lv7mkilEp9fJ2nIHq). Timestamp by third party at Tue Nov 01 11:22:42 CET 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

DFS DEUTSCHE FLUGSICHERUNG GMBH (DFS) GMBH, HRB34977, established in AM DFS CAMPUS 10, LANGEN 63225, Germany, VAT number DE114110232, ('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 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Gerhard TAUSS with ECAS id ntaussge signed in the Participant Portal on 31/10/2016 at 15:28:53 (transaction id SigId-6999-Jlac1LuohOpH5kGK0mwpmP23LmKWFfgVl8mzfUTBzKaZNY3udRzyY0t8ddd68F9TKd1aRddeylFzISmkbzyD4iT-Jj71zxYb8yrI8GmV4asVNa-5sdzJG2eoXaal8uzSWszftb3B5cE06YIG6MccZLi039y). Timestamp by third party at
Mon Oct 31 15:29:15 CET 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

DIRECTION DES SERVICES DE LA NAVIGATION AERIENNE (DSNA), 120064019, 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 ('10')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Maurice GEORGES with ECAS id ngeormau signed in the Participant Portal on 27/10/2016 at 11:04:49 (transaction id SigId-71993-3wazkJS07zzGDcCjka7cZa7HFI8HHtWzayA9S1nPDbqLzI80XP6NZDmrMS5ydjRRKrzqv0C6QzMSPZ2DQOj6c9cC-Jj71zxYb8yrkmoAceBIUCa-Isi3MC9VuQw0WNTXKmkDTf4E2V8RuGTi3wBRzO4OHxQ).
Timestamp by third party at
Thu Oct 27 12:04:58 CEST 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ENTIDAD PUBLICA EMPRESARIAL ENAIRE (ENAIRE), established in CALLE ARTURO SORIA 109, MADRID 28043, Spain, VAT number ESQ2822001J, ('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 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Angel Luis ARIAS SERRANO with ECAS id nariagel signed in the Participant Portal on 31/10/2016 at 12:32:10 (transaction id SigId-4939-4frizdcDwLSkRf3QHbUX50nvkcGYURa3lbGyJqHyP2R25TmFDxGnvmN67I2AtVy3cqxnFx0xBrr9L7lbf0h4zN-Jj71zxYb8yrI8GmV4asVNa-9sIIrB8Ak0ReQegzWYPRKykMA0ZzzTDLplbcRcj4ztsy). Timestamp by third party at
Mon Oct 31 12:32:35 CET 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ENAV SPA (ENAV) SPA, 965162/CF97016000586, 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 ('12')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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) LTD, 04129273, 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 ('13')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Alison ROBERTS with ECAS id nrobeais signed in the Participant Portal on 27/10/2016 at 08:13:18 (transaction id SigId-67762-mmQ7oOeGSSWtGjCGAE4iDOyuLvtTZHcZSTvk9h5kMWzy5ZNbKjvzyOozs3wm51WfikmQzzyotzuYtgftMDyuGV50-Jj71zxYb8yrkmoAceBIUCa-Jhv8uu3KnOEbbORQbuYruFyuZNrxV5xWlpjnFLeoDn4). Timestamp by third party at
Thu Oct 27 09:13:26 CEST 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIENNE CIVILS ET MILITAIRES (SKYGUIDE) SA, CH03530005515, 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 ('14')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Thomas BUCHANAN with ECAS id nbuchath signed in the Participant Portal on 28/10/2016 at 12:48:38 (transaction id SigId-8004-wzQwRl7sIczulxQMGZXNbWw3F3w9Li68Ps2Cw3P8GBR3SA49xXF8N4fiP20f5jmOYH1AOpccWtlLTSsYReBh4X-PHslUMVSXYCSODP6fhoRgS-yzgLjFQbjUBOSGytFsqzmnzWHf8CL0McOIkwTBzzxSu6W). Timestamp by third party at Fri Oct 28 13:49:03 CEST 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

EUROCONTROL - EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION (EUROCONTROL), N/A, 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 ('15')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV (DLR (AT-One)) EV, VR2780, established in Linder Hoehe, KOELN 51147, Germany, VAT number DE121965658, ('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 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Richter THOMAS with ECAS id nthomari signed in the Participant Portal on 27/10/2016 at 08:58:40 (transaction id SigId-68569-zGTrLKi1tOs6FqdKua4xBXve6dmwcQIhtU9AoQ9LUHMUiSRwl8gHoRxJVUgLdt5g0VyALjlLFHrTN04UMd6YCy-Jj71zxYb8yrkmoAceBIUCa-sJKuiamrTQ3K2UIhB3ZGzzLT5BxYRzregZIsCMAytVZe). Timestamp by third party at Thu Oct 27 09:58:48 CEST 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FREQUENTIS AG (FRQ (FSP)) AG, FN72115B, 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 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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 LEGIFORGALMI SZOLGALAT ZARTKORUEN MUKODO RESZVENYTARSASAG (HC (FSP)) RT, 0110045570, 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 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

STIFTELSEN SINTEF (SINTEF (NATMIG)) NO1, 948007029, established in STRINDVEIEN 4, TRONDHEIM 7034, Norway, VAT number NO948007029MVA, ('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 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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) SA, M11339, 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 ('20')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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 - FINMECCANICA SPA (FINMECCANICA) SPA, 7031/CF00401990585, 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 ('21')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Ernesto DE PIERI with ECAS id npierern signed in the Participant Portal on 27/10/2016 at 14:30:43 (transaction id SigId-77008-SWnAZxmpHr91hpHxZyOPWPsUgTtdMS6pFTpEku2Vyy6oUDbAnJUaodxNMAWgsBf61sQ4kzdRDCZFlRpftJ93TS-Jj71zxYb8yrkmoAceBIUCa-zo7glAzUEDmLqdyTzkOZhgTma4oVfQ2yj1jJzp2uwx1e). Timestamp by third party at
Thu Oct 27 15:30:52 CEST 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

VALSTYBES IMONE ORO NAVIGACIJA (ON (B4)) LT7, 210060460, 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 ('22')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Algimantas RAŠIUS with ECAS id nrascial signed in the Participant Portal on 28/10/2016 at 07:06:34 (transaction id SigId-1327-k1LJRzpMxQHUCqkk5E823wHr8c59cbwOFJzXj4C2oB7aL1y6o1RqnVuErbKArU7lzl5ktFfbIOZzZD50Vkh1doO-PHslUMVSXYCSODP6fhoRgS-IqnvnPUXWpKOp3BzM4ji319FNjStvkO6g6mVcaWRxGd). Timestamp by third party at Fri Oct 28 08:06:49 CEST 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

POLSKA AGENCJA ZEGLUGI POWIETRZNEJ (PANSA (B4)), 140886771, 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 ('23')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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 (AT-One)) NL6, 41150373, 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 ('24')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

L.W. ESSELMAN with ECAS id nessellw signed in the Participant Portal on 27/10/2016 at 13:02:06 (transaction id SigId-74238-wCk9YILzkSTcGiJzzrzV798pinlBqzmrPVzzznlMR7eNI6azagwXnDmr0A0yD5ni0b961J6cb9YsnrFIqWrdiwOxm-Jj71zxYb8yrkmoAceBIUCa-zNcUBfufMiDhfl35RCoEREjlcXkmMpR57w58H8ngUQZ). Timestamp by third party at Thu Oct 27 14:02:14 CEST 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ATOS BELGIUM (ATOS (FSP)) NV, 401848135, 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 ('25')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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)) LTD, 287698, 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 ('26')

in Grant Agreement No 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Norman STEWART with ECAS id nstewano signed in the Participant Portal on 27/10/2016 at 15:36:14 (transaction id SigId-78816-22WXI8M5ARm2jSP2a6xrUFSFo5vne2ZqcR5jR7lri2FcuKdy8Y1ZLJzrFXfFigjwf1gqOuqQRV3J2QwYU7wSF4-Jj71zxYb8yrkmoAceBIUCa-AWnWg5DzzWsbhSKP3VK8eSTxX5buxFpPBQy547NZzP7O).
Timestamp by third party at
Thu Oct 27 16:36:26 CEST 2016

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SAAB AKTIEBOLAG (SAAB (NATMIG)) AB, 5560360793, established in ., LINKOPING 58188, Sweden, VAT number SE556036079301, ('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 734141 ('the Agreement')

between THALES AIR SYSTEMS SAS **and** the Single European Sky ATM Research Joint Undertaking ('the JU'),

for the action entitled 'Controller Working Position / Human Machine Interface - CWP/HMI (PJ16 CWP HMI)'.

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

Lars SJÖSTRÖM with ECAS id nsjoestl signed in the Participant Portal on 28/10/2016 at 13:00:35 (transaction id SigId-8227-rG9HyGzohhuEztGWSOzKOiTE6YUknBJLevAH6pivnMJMZzJlGkuPIAGxkM1wHLGiONvWWBzXhyquO5YrIORg3HB-PHslUMVSXYCSODP6fhoRgS-OcI6ROCzQ0qMfXMWM4S6N9RJzzUZzr8GRKK42mL3MTIh). Timestamp by third party at Fri Oct 28 14:01:03 CEST 2016

ANNEX 3a

DECLARATION ON JOINT AND SEVERAL LIABILITY OF LINKED THIRD PARTIES

CENTRO DE REFERENCIA INVESTIGACION DESARROLLO E INNOVACION ATM, A.I.E. (CRIDA) AIE, M458110, established in AVDA DE ARAGON 402 4 EDIFICIO ALLENDE, MADRID, 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 11 **ENTIDAD PUBLICA EMPRESARIAL ENAIRE (ENAIRE)**, established in CALLE ARTURO SORIA 109, MADRID 28043, Spain, VAT number ESQ2822001J, ('the beneficiary'),

hereby accepts joint and several liability with the beneficiary

for any amount owed to the Commission by the beneficiary under Grant Agreement No 734141 (PJ16 CWP HMI), up to the maximum EU 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 Commission, 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

CONSORZIO SICTA SISTEMI INNOVATIVIPER IL CONTROLLO DELTRAFFICO AEREO (SICTA) IT4, 516936/CF02790511212, established in VIA FULCO RUFFO DI CALABRIA, NAPOLI 80144, Italy, VAT number IT02790511212, ('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 12 **ENAV SPA (ENAV)** SPA, 965162/CF97016000586, 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 Commission by the beneficiary under Grant Agreement No 734141 (PJ16 CWP HMI), up to the maximum EU 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 Commission, 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

SKYSOFT-ATM SA (SKYSOFTATM) SA, CHE101803663, 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 14 **SKYGUIDE, SA SUISSE POUR LES SERVICES DE LA NAVIGATION AERIENNE CIVILS ET MILITAIRES (SKYGUIDE)** SA, CH03530005515, 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 Commission by the beneficiary under Grant Agreement No 734141 (PJ16 CWP HMI), up to the maximum EU 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 Commission, 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

ADMINISTRATIA ROMANA A SERVICIILOR DE TRAFIC AERIAN (ROMATSA), J40101212031991/CF1589932, established in BLD ION IONESCU DE LA BRAD 10, BUCURESTI 013813, Romania, VAT number RO1589932, ('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 20 **INDRA SISTEMAS SA (INDRA)** SA, M11339, established in AVENIDA DE BRUSELAS 35, ALCOBENDAS MADRID 28108, Spain, VAT number ESA28599033, ('the beneficiary'),

hereby accepts joint and several liability with the beneficiary

for any amount owed to the Commission by the beneficiary under Grant Agreement No 734141 (PJ16 CWP HMI), up to the maximum EU 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 Commission, immediately and at first demand.

For the linked third party
[forename/surname/function]

Done in English at [place], on [date]

ⓘ print format A4 landscape

MODEL ANNEX 4 FOR H2020 GENERAL MGA — MULTI

FINANCIAL STATEMENT FOR *[BENEFICIARY [name]/ LINKED THIRD PARTY [name]]* FOR REPORTING PERIOD [reporting period]

	Eligible[1] 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[2]	*[F. Costs of …]*		Total costs	Receipts	Reimbursement rate %	Maximum EU contribution[3]	Requested EU contribution	Information for indirect costs :
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons *[A.6 Personnel for providing access to research infrastructure]*		A.4 SME owners without salary A.5 Beneficiaries that are natural persons without salary				D.1 Travel D.2 Equipment D.3 Other goods and services	*[D.4 Costs of large research infrastructure]*		*[F.1 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
Form of costs[4]	Actual	Unit	Unit		Actual	Actual	Actual	Actual	Flat-rate[5] 25%	Unit	Unit						
	a	Total b	No hours	Total c	d	*[e]*	f	*[g]*	h=0,25 x (a+b+ c+f+*[g]* + *[i1]*[6] +*[i2]*[6] - o)	No units	Total *[i1]*	Total *[i2]*	j = a+b+c+d+*[e]* +f +*[g]* +h+*[i1]* +*[i2]*	k	l	m	n	o
[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.

[1] See Article 6 for the eligibility conditions

[2] 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 any indirect costs.

[3] 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 have to be less (e.g. if you and the other beneficiaries are above budget, if the 90% limit (see Article 21) is reached, etc).

[4] See Article 5 for the form of costs

[5] 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)

[6] 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 by the [BBI][Clean Sky 2][ECSEL][FCH][IMI2] Joint Undertaking 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)[1] 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 Commission.

The Agreement has been concluded under the Horizon 2020 Research and Innovation Framework Programme (H2020) between the Beneficiary and *[the [Bio Based Industries][Clean Sky 2][ECSEL][Fuel Cells and Hydrogen 2][Innovative Medicines Initiative 2] Joint Undertaking (the "JU"), which receives funding under the Horizon 2020 Research and Innovation Framework Programme (H2020)]*.

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;
- 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.

[1] By which costs under the Agreement are declared (see template 'Model Financial Statements' in Annex 4 to the Grant Agreement).

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[2]:

- 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]*

[2] 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 [BBI][Clean Sky 2][ECSEL][FCH][IMI2] 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)[3] 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 'direct personnel costs declared as 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

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.

[3] By which the Beneficiary declares costs under the Agreement (see template 'Model Financial Statement' in Annex 4 to the Agreement).

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 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]* or 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[4] 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]
[name and function of an authorised representative]
[dd Month yyyy]
Signature of the Auditor

[4] 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.

Agreed-upon procedures to be performed and standard factual findings to be confirmed by the Auditor

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	**ACTUAL PERSONNEL COSTS AND UNIT COSTS CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICE**		
	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. (*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)* The Auditor sampled _____ people out of the total of _____ people.		

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A.1	**PERSONNEL COSTS** 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) To confirm standard factual findings 1-5 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary: o 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; o the payslips of the employees included in the sample; o reconciliation of the personnel costs declared in the Financial Statement(s) with the accounting system (project accounting and general ledger) and payroll system; o information concerning the employment status and employment conditions of personnel included in the sample, in particular their employment contracts or equivalent; o the Beneficiary's usual policy regarding payroll matters (e.g. salary policy, overtime policy, variable pay); o applicable national law on taxes, labour and social security and o any other document that supports the personnel costs declared. 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.	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.	
	Further procedures if 'additional remuneration' is paid To confirm standard factual findings 6-9 listed in the next column, the Auditor: o reviewed relevant documents provided by the Beneficiary (legal form, legal/statutory	6) The Beneficiary paying "additional remuneration" was a non-profit legal entity.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	obligations, the Beneficiary's usual policy on additional remuneration, criteria used for its calculation…); o 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, etc.) 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').	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.	
	IF ANY PART OF THE REMUNERATION PAID TO THE EMPLOYEE IS NOT MANDATORY ACCORDING TO THE NATIONAL LAW OR THE EMPLOYMENT CONTRACT ("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: *(A) IF THE PERSON WORKS FULL TIME AND EXCLUSIVELY ON THE ACTION DURING THE FULL YEAR: UP TO EUR 8 000/YEAR;* *(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 IN ACCORDANCE TO ARTICLE 6.2.A.1.*	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).	
	Additional procedures in case "unit costs calculated by the Beneficiary in accordance with its usual cost accounting practices" is applied: 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	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.)
	factual findings 10-13 listed in the next column: o obtained a description of the Beneficiary's usual cost accounting practice to calculate unit costs;. o reviewed whether the Beneficiary's usual cost accounting practice was applied for the Financial Statements subject of the present CFS; o 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; o 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; o 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.	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.	
	<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> To confirm standard factual findings 14-18 listed in the next column the Auditor reviewed following information/documents provided by the Beneficiary: o the contracts, especially the cost, contract duration, work description, place of work, ownership of the results and reporting obligations to the Beneficiary; o the employment conditions of staff in the same category to compare costs and; o any other document that supports the costs declared and its registration (e.g. invoices,	14) The natural persons reported to the Beneficiary (worked under the Beneficiary's instructions).	
		15) They worked on the Beneficiary's premises (unless otherwise agreed with the Beneficiary).	
		16) The results of work carried out belong to the Beneficiary.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	accounting records, etc.).	17) Their costs were not significantly different from those for staff who performed similar tasks under an employment contract with the Beneficiary.	
		18) 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 19-22 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary: o their secondment contract(s) notably regarding costs, duration, work description, place of work and ownership of the results; o 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; o 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; o any other document that supports the costs declared (e.g. invoices, etc.).	19) Seconded personnel reported to the Beneficiary and worked on the Beneficiary's premises (unless otherwise agreed with the Beneficiary).	
		20) The results of work carried out belong to the Beneficiary.	
		If personnel is seconded against payment: 21) The costs declared were supported with documentation and recorded in the Beneficiary's accounts. The third party did not include any profit.	
		If personnel is seconded free of charge: 22) The costs declared did not exceed the third party's cost as	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
		recorded in the accounts of the third party and were supported with documentation.	
A.2	**PRODUCTIVE HOURS** To confirm standard factual findings 23-28 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: o the annual productive hours applied were calculated in accordance with one of the methods described below, o the full-time equivalent (FTEs) ratios for employees not working full-time were correctly calculated. 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 hours can be supported by records, such as national legislation, labour agreements, and contracts. *BENEFICIARY'S PRODUCTIVE HOURS' FOR PERSONS WORKING FULL TIME SHALL BE ONE OF THE FOLLOWING METHODS:* ***A.*** *1720 ANNUAL PRODUCTIVE HOURS (PRO-RATA FOR PERSONS NOT WORKING FULL-TIME)* ***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*	23) The Beneficiary applied method [*choose one option and delete the others*] [**A**: 1720 hours] [**B**: the 'total number of hours worked'] [**C**: 'annual productive hours' used correspond to usual accounting practices]	
		24) Productive hours were calculated annually.	
		25) For employees not working full-time the full-time equivalent (FTE) ratio was correctly applied.	
		If the Beneficiary applied method B. 26) The calculation of the number of 'annual workable hours', overtime and absences was verifiable based on the documents provided by the Beneficiary.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	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). ***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 'TOTAL ANNUAL PRODUCTIVE HOURS' IN THE NEXT COLUMN). THIS NUMBER MUST BE AT LEAST 90% OF THE STANDARD ANNUAL WORKABLE HOURS.* *'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 Beneficiary applied method C.* 27) The calculation of the number of 'standard annual workable hours' was verifiable based on the documents provided by the Beneficiary.	
		28) 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	**HOURLY PERSONNEL RATES** <u>I) For unit costs calculated in accordance to the Beneficiary's usual cost accounting practice (unit costs):</u> 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. 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:	29) The Beneficiary applied [*choose one option and delete the other*]: [Option I: "Unit costs (hourly rates) were calculated in accordance with the Beneficiary's usual cost accounting practices"] [Option II: Individual hourly rates were applied]	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	○ reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates; ○ 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. II) For individual hourly rates: The Auditor: ○ reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates; ○ recalculated the hourly rates of staff included in the sample following the results of the procedures carried out in A.1 and A.2. *"UNIT COSTS CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICES":* *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.* *HOURLY RATE FOR INDIVIDUAL ACTUAL PERSONAL COSTS:* *IT IS CALCULATED BY DIVIDING THE TOTAL 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.*	*For option I concerning unit costs and if the Beneficiary applies the methodology approved by the Commission (CoMUC):* 30) 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 activities irrespective of the source of funding.	
		For option I concerning unit costs and if the Beneficiary applies a methodology not approved by the Commission: 31) The unit costs re-calculated by the Auditor were the same as the rates applied by the Beneficiary.	
		For option II concerning individual hourly rates: 32) The individual rates re-calculated by the Auditor were the same as the rates applied by the Beneficiary.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A.4	**TIME RECORDING SYSTEM** 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: o description of the time recording system provided by the Beneficiary (registration, authorisation, processing in the HR-system); o its actual implementation; o time records were signed at least monthly by the employees (on paper or electronically) and authorised by the project manager or another manager; o the hours declared were worked within the project period; o 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) ; o the hours charged to the action matched those in the time recording system. *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).*	33) All persons recorded their time dedicated to the action on a **daily/ weekly/ monthly** basis using a **paper/computer-based** system. (*delete the answers that are not applicable)*	
		34) Their time-records were authorised at least monthly by the project manager or other superior.	
		35) Hours declared were worked within the project period and were consistent with the presences/absences recorded in HR-records.	
		36) There were no discrepancies between the number of hours charged to the action and the number of hours recorded.	
	<u>If the persons are working exclusively for the action and without time records</u> 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.	37) The exclusive dedication is supported by a declaration signed by the Beneficiary's and by any other evidence gathered.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
B	**COSTS OF SUBCONTRACTING**		
B.1	**The Auditor obtained the detail/breakdown of subcontracting costs and sampled _____ cost items selected randomly** (*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*). To confirm standard factual findings 38-42 listed in the next column, the Auditor reviewed the following for the items included in the sample: o the use of subcontractors was foreseen in Annex 1; o subcontracting costs were declared in the subcontracting category of the Financial Statement; o supporting documents on the selection and award procedure were followed; o 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). In particular, i. if the Beneficiary acted as a contracting authority within the meaning of Directive 2004/18/EC or of Directive 2004/17/EC, 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. ii. 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..	38) The use of claimed subcontracting costs was foreseen in Annex I and costs were declared in the Financial Statements under the subcontracting category.	
		39) 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. *(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)*	
		40) The subcontracts were not awarded to other Beneficiaries	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	For the items included in the sample the Auditor also verified that: o the subcontracts were not awarded to other Beneficiaries in the consortium; o there were signed agreements between the Beneficiary and the subcontractor; o there was evidence that the services were provided by subcontractor;	of the consortium.	
		41) All subcontracts were supported by signed agreements between the Beneficiary and the subcontractor.	
		42) There was evidence that the services were provided by the subcontractors.	
C	**COSTS OF PROVIDING FINANCIAL SUPPORT TO THIRD PARTIES**		
C.1	**The Auditor obtained the detail/breakdown of the costs of providing financial support to third parties and sampled _____ cost items selected randomly** (*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*). The Auditor verified that the following minimum conditions were met: a) the maximum amount of financial support for each third party did not exceed EUR 60 000, unless explicitly mentioned in Annex 1; 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.	43) All minimum conditions were met	

D	OTHER ACTUAL DIRECT COSTS		
D.1	**COSTS OF TRAVEL AND RELATED SUBSISTENCE ALLOWANCES** **The Auditor sampled _____ cost items selected randomly** (*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*). The Auditor inspected the sample and verified that: o 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; o 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; o no ineligible costs or excessive or reckless expenditure was declared.	44) Costs were incurred, approved and reimbursed in line with the Beneficiary's usual policy for travels.	
		45) There was a link between the trip and the action.	
		46) The supporting documents were consistent with each other regarding subject of the trip, dates, duration and reconciled with time records and accounting.	
		47) No ineligible costs or excessive or reckless expenditure was declared.	
D.2	**DEPRECIATION COSTS FOR EQUIPMENT, INFRASTRUCTURE OR OTHER ASSETS** **The Auditor sampled _____ cost items selected randomly** (*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*). For "equipment, infrastructure or other assets" [from now on called "asset(s)"] selected in the sample the Auditor verified that: o the assets were acquired in conformity with the Beneficiary's internal guidelines and procedures; o they were correctly allocated to the action (with supporting documents such as delivery	48) Procurement rules, principles and guides were followed.	
		49) There was a link between the grant agreement and the asset charged to the action.	
		50) The asset charged to the action was traceable to the accounting records and the underlying documents.	

	note invoice or any other proof demonstrating the link to the action) o they were entered in the accounting system; o the extent to which the assets were used for the action (as a percentage) was supported by reliable documentation (e.g. usage overview table); 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). 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).	51) 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.	
		52) The amount charged corresponded to the actual usage for the action.	
		53) No ineligible costs or excessive or reckless expenditure were declared.	
D.3	**COSTS OF OTHER GOODS AND SERVICES** **The Auditor sampled _____ cost items selected randomly** (*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*). For the purchase of goods, works or services included in the sample the Auditor verified that: o the contracts did not cover tasks described in Annex 1; o 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); o the goods were not placed in the inventory of durable equipment; o the costs charged to the action were accounted in line with the Beneficiary's usual accounting practices; o no ineligible costs or excessive or reckless expenditure were declared (see Article 6 GA). In addition, the Auditor verified that these goods and services were acquired in conformity with the Beneficiary's internal guidelines and procedures, in particular: o if Beneficiary acted as a contracting authority within the meaning of Directive	54) Contracts for works or services did not cover tasks described in Annex 1.	
		55) Costs were allocated to the correct action and the goods were not placed in the inventory of durable equipment.	
		56) The costs were charged in line with the Beneficiary's accounting policy and were adequately supported.	
		57) No ineligible costs or excessive or reckless expenditure were declared. For internal invoices/charges only the cost element was charged, without any mark-ups.	

	2004/18/EC or of Directive 2004/17/EC, 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. o 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. For the items included in the sample the Auditor also verified that: o 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); *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.*	58) 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. *(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)*	
D.4	**AGGREGATED CAPITALISED AND OPERATING COSTS OF RESEARCH INFRASTRUCTURE** 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. ***In the cases that a positive ex-ante assessment has been issued*** *(see the standard factual findings 59-60 on the next column)**,***	59) 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.	

	The Auditor ensured that the beneficiary has applied consistently the methodology that is explained and approved in the positive ex ante assessment; ***In the cases that a positive ex-ante assessment has NOT been issued*** *(see the standard factual findings 61 on the next column),* The Auditor verified that no costs of Large Research Infrastructure have been charged as direct costs in any costs category; ***In the cases that a draft ex-ante assessment report has been issued with recommendation for further changes*** *(see the standard factual findings 61 on the next column),* • 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.	60) Any difference between the methodology applied and the one positively assessed was extensively described and adjusted accordingly. 61) The direct costs declared were free from any indirect costs items related to the Large Research Infrastructure.	
E	**USE OF EXCHANGE RATES**		
E.1	a) For Beneficiaries with accounts established in a currency other than euros **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** (*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)*: *COSTS INCURRED IN ANOTHER CURRENCY 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 (https://www.ecb.int/stats/exchange/eurofxref/html/index.en.html), DETERMINED 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, CONVERSION SHALL BE MADE AT THE AVERAGE OF THE MONTHLY ACCOUNTING RATES ESTABLISHED BY THE COMMISSION AND PUBLISHED ON ITS WEBSITE (http://ec.europa.eu/budget/contracts_grants/info_contracts/inforeuro/inforeuro_en.cfm), DETERMINED OVER THE CORRESPONDING REPORTING PERIOD.*	62) 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.	

	b) For Beneficiaries with accounts established in euros **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** (*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)*: *COSTS INCURRED IN ANOTHER CURRENCY SHALL BE CONVERTED INTO EURO BY APPLYING THE BENEFICIARY'S USUAL ACCOUNTING PRACTICES.*	63) The Beneficiary applied its usual accounting practices.	

[legal name of the audit firm]
[name and function of an authorised representative]
[dd Month yyyy]
<Signature of the Auditor>

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.**

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Terms of reference for an audit engagement for a methodology certificate in connection with one or more grant agreements financed by [BBI][Clean Sky 2][ECSEL][FCH][IMI2] 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 [Bio Based Industries][Clean Sky 2][ECSEL][Fuel Cells and Hydrogen 2][Innovative Medicines Initiative 2] 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 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[1]:

- 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 claimed 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]	[legal name of the [Beneficiary] [Linked Third Party]]
[name & title of authorised representative]	[name & title of authorised representative]
[dd Month yyyy]	[dd Month yyyy]
Signature of the Auditor Signature	Signature of the *[Beneficiary] [Linked Third Party]*

[1] 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 the [BBI][Clean Sky 2][ECSEL][FCH][IMI2] 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 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[2] 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:

1. Brief description of the methodology for calculating personnel costs, productive hours and hourly rates;

[2] Financial Statement in this context refers solely to Annex 4 of the Agreement by which the Beneficiary declares costs under the Agreement.

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 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[3] 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

[3] 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 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'.

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
A. Use of the Methodology 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*]*.	**Procedure:** ✓ The Auditor checked these dates against the documentation the Beneficiary has provided. **Factual finding:** 1. The dates provided by the Beneficiary were consistent with the documentation.
B. Description of the Methodology III. The methodology to calculate unit costs is being used in a consistent manner and is reflected in the relevant procedures. *[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]* *[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:* - *...]*	**Procedure:** ✓ The Auditor reviewed the description, the relevant manuals and/or internal guidance documents describing the methodology. **Factual finding:** 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.
C. **Personnel costs** <u>General</u>	**Procedure:** *The Auditor draws a sample of employees to carry out the procedures indicated in*

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
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; 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. *[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]*. 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 budget). <u>If additional remuneration as referred to in the grant agreement(s) is paid</u>	*this section C and the following sections D to F.* *[The Auditor has drawn a random sample of 10 full-time equivalents made up of employees assigned to the action(s). If fewer than 10 full-time equivalents are assigned to the action(s), the Auditor has selected a sample of 10 full-time equivalents consisting of all employees assigned to the action(s), complemented by other employees irrespective of their assignments.]*. For this sample: ✓ 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; ✓ in particular, the Auditor reviewed the employment contracts of the employees in the sample to verify that: i. they were employed directly by the Beneficiary in accordance with applicable national legislation; ii. they were working under the sole technical supervision and responsibility of the latter; iii. they were remunerated in accordance with the Beneficiary's usual practices; 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; ✓ 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; ✓ 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. ✓ 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;

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
XII. The Beneficiary is a non-profit legal entity; XIII. The additional remuneration is part of the beneficiary's usual remuneration practices and paid consistently whenever the relevant work or expertise is required; XIV. The criteria used to calculate the additional remuneration are objective and generally applied regardless of the source of funding; 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). *[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:* *- ...]*	✓ 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). ✓ the Auditor recalculated the personnel costs for the employees in the sample. **Factual finding:** 4. All the components of the remuneration that have been claimed as personnel costs are supported by underlying documentation. 5. 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. 6. Their employment contracts were in line with the Beneficiary's usual policy; 7. 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.); 8. The totals used to calculate the personnel unit costs are consistent with those registered in the payroll and accounting records; 9. 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). 10. Personnel costs contained no ineligible elements; 11. 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

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
	action full-time during the year or did not work exclusively on the action).
D. Productive hours XVI. The number of productive hours per full-time employee applied is *[delete as appropriate]*: A. 1720 productive hours per year for a person working full-time (corresponding pro-rata for persons not working full time). B. the total number of hours worked in the year by a person for the Beneficiary 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. <u>If method B is applied</u> 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). 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. XIX. The contract (applicable collective labour agreement or national working time legislation) do specify the working time enabling to calculate the annual workable hours. <u>If method C is applied</u> XX. The standard number of productive hours per year is that of a full-time equivalent; for employees not assigned exclusively to the action(s) this number is reduced proportionately. 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.	**Procedure (same sample basis as for Section C: Personnel costs):** ✓ The Auditor verified that the number of productive hours applied is in accordance with method A, B or C. ✓ The Auditor checked that the number of productive hours per full-time employee is correct and that it is reduced proportionately for employees not exclusively assigned to the action(s). ✓ 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. ✓ 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. **Factual finding:** <u>General</u> 12. The Beneficiary applied a number of productive hours consistent with method A, B or C detailed in the left-hand column. 13. The number of productive hours per year per full-time employee was accurate and was proportionately reduced for employees not working full-time or exclusively for the action. <u>If method B is applied</u> 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. 15. The contract specified the working time enabling to calculate the annual workable hours.

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
XXII. Standard workable (working) hours are hours during which personnel are at the Beneficiary's disposal preforming 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. *[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:* - *...]*	If method C is applied 16. The calculation of the number of productive hours per year corresponded to the usual costs accounting practice of the Beneficiary. 17. The calculation of the standard number of workable (working) hours per year was corroborated by the documents presented by the Beneficiary. 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.
E. Hourly rates The hourly rates are correct because: 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. *[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:* - *...]*	**Procedure** ✓ The Auditor has obtained a list of all personnel rates calculated by the Beneficiary in accordance with the methodology used. ✓ The Auditor has obtained a list of all the relevant employees, based on which the personnel rate(s) are calculated. For 10 full-time equivalent employees selected at random (same sample basis as Section C: Personnel costs): ✓ The Auditor recalculated the hourly rates. ✓ 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. **Factual finding:** 19. No differences arose from the recalculation of the hourly rate for the employees included in the sample.
F. Time recording 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 **daily/weekly/monthly** basis *[delete as appropriate]* using a **paper/computer-based system** *[delete as appropriate]*; XXV. For persons exclusively assigned to one Horizon 2020 activity the Beneficiary has either signed a declaration to that effect or has put arrangements in place	**Procedure** ✓ The Auditor reviewed the brief description, all relevant manuals and/or internal guidance describing the methodology used to record time. The Auditor reviewed the time records of the random sample of 10 full-time equivalents referred to under Section C: Personnel costs, and verified in particular:

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
to record their working time; 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; XXVII. Measures are in place to prevent staff from: i. recording the same hours twice, ii. recording working hours during absence periods (e.g. holidays, sick leave), iii. recording more than the number of productive hours per year used to calculate the hourly rates, and iv. recording hours worked outside the action period. XXVIII. No working time was recorded outside the action period; XXIX. No more hours were claimed than the productive hours used to calculate the hourly personnel rates. *[Please provide a brief description of the time recording system in place together with the measures applied to ensure its reliability to the Auditor and annex it to the present certificate[4]].* *[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:* *- ...]*	✓ that time records were available for all persons with not exclusive assignment to the action; ✓ 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; ✓ that time records were signed and approved in due time and that all minimum requirements were fulfilled; ✓ that the persons worked for the action in the periods claimed; ✓ that no more hours were claimed than the productive hours used to calculate the hourly personnel rates; ✓ 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; ✓ 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. **Factual finding:** 20. The brief description, manuals and/or internal guidance on time recording provided by the Beneficiary were consistent with management

[4] 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 it information flow up to its use for the preparation of the Financial Statements.

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	**Procedures to be carried out and Findings to be confirmed by the Auditor**
	reports/records and other documents reviewed and were generally applied by the Beneficiary to produce the financial statements. 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; 22. For the random sample the time records were signed by the employee and the action manager/line manager, at least monthly. 23. Working time claimed for the action occurred in the periods claimed; 24. No more hours were claimed than the number productive hours used to calculate the hourly personnel rates; 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. 26. Working time claimed is consistent with that on record at the human-resources department.
[official name of the** [Beneficiary] [Linked Third Party]**]	***[official name of the Auditor]***
[name and title of authorised representative]	***[name and title of authorised representative]***
[dd Month yyyy]	***[dd Month yyyy]***
<***Signature of the** [Beneficiary] [Linked Third Party]*>	<***Signature** of the Auditor*>

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