**LHDC rTWR Visualization Air Traffic Control System User Specification**

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# Introduction

HungaroControl Hungarian Air Navigation Services Pte. Ltd. Co. (hereafter referred to as HC), the Air Navigation Service Provider (ANSP) of Hungary is in the course of implementing remote control tower at the International Airport of Debrecen (LHDC) to serve its traffic. The rTWR shall be capable of operating during “all weather condition” with same capacity as it was controlled from existing tower. To fulfill this requirement for the above mentioned purpose, all equipment’s image and/or control **shall** be provided into the building of HC ANS III (in Budapest) and a new Visualization and Surveillance System will be established.

Im this document the following standard terminology is used in order to classify the intensity of operating conditions:

* The word of “**shall**” and the term of **„shall not”** indicate mandatory requirements.
* The word of **“should”** and the term of **„should not”** indicate preferred requirements.
* The items indicated “**as an option**” **shall** be priced separately.

# General

## Content

### The LHDC rTWR Visualization Air Traffic Control System **shall** consist of the following elements:

1. Camera system
2. Processing system
3. Display system

### An ADS-B receiver **shall** be delivered and installed together with the system as well.

## Installation

### The Supplier **shall** deliver and install the whole system.

### HC will provide the followings:

1. Uninterruptible Power Supply (UPS) (see Chapter 8.2 Mains Power Supply)
2. Grounding points
3. Network capacity of 1Gbp between LHDC airport container and HC Budapest ANS III building from which maximum 400 Mbps is available for video system.
4. Network equipments and cables (see Chapter 7)
5. KVM switches and extensions
6. Mouse and keyboard
7. Tower/s for holding cameras
8. Container including rack cabinets at the airport
9. Rack cabinets in air-conditioned container (LHDC) and in air-conditioned room of HC ANS III building
10. NTP
11. Controller working places

The Supplier **shall** provide all other equipments, materials or tools required for installation.

## Site survey

### A site inspection **shall** be carried out by the Supplier during the negotiation period.

### The results of the site inspection **shall** be recorded in the final tender.

### The site inspection riport **shall** contain descriptions of all necessary works (for example modification of tower and container, communication and electrical wiring, etc) required to be done prior to installation.

### The documentation **shall** be in accordance with the Hungarian standards related.

## Training

### Training **shall** be provided by Supplier for maximum number of twenty (20) employees of the Caller for Tender at the premises of Supplier.

### The course of Camera system **shall** be provided after installation, partly at the site of installation.

### Training **shall** cover following sections:

1. operational functionality of the system (handling HMI)
2. system installation
3. system settings up
4. system maintenance
5. system control

### Separated courses **shall** be provided on each of the following sections:

1. Camera system
2. Processing and Display system (including interfaces)
3. ADS-B receiver
4. Presentation of operational functions

### All trainings **shall** be organized prior to the system Factory Acceptance Test (FAT) and prior to the Site Acceptance Test (SAT) in case of Camera sytem.

## Factory Acceptance Tests (FAT)

### There **shall** be a Factory Acceptance Test (FAT) at the Supplier premises on the Visualization Air Traffic Control System.

### There **shall** be Factory Acceptance Test (FAT) at the Supplier premises on every further integrated system, they could be for example: AGL, ILS, MET etc.

## Site Acceptance Tests (SAT)

### There **shall** be a Site Acceptance Test (SAT) at Hungarocontrol premises on the fully delivered, installed and implemented Camera system.

### There **shall** be a Site Acceptance Test (SAT) at Hungarocontrol premises on the fully delivered, installed and implemented ADS-B receiver.

### There **shall** be a Site Acceptance Test (SAT) at Hungarocontrol premises on the fully delivered, installed and implemented Processing and Display system.

### There **shall** be a Site Acceptance Test (SAT) at Hungarocontrol premises on every further integrated system, they could be for example: AGL, ILS, MET etc.

## System Safety and Protection

### Access to rTWR system and its particular functions (such as system configuration) **shall** be able to access for authorized personnel only.

### The rTWR system **shall** be password-protected.

### The rTWR system **shall** have „fail-safe” and „fail-soft” capability. (The term of “fail-safe” in this context means that in the event of a mailfunction of particular components of the system displayed data has to be provided applying sufficient redundancy. The term of „fail-soft”in this context means that if there is a loss of data caused by a sub-system failure such sufficient data remain on the display that operational function can continue.)

### The rTWR system **shall** have sufficient redundancy, fault tolerance and error correction to ensure continuous operational function in a safe way in case of degraded mode conditions. This requirement applies to both hardware and software failures have an impact on continuous operations.

### Emergency procedure **shall** be implemented for all possible failures known.

### System design **shall** comprise self test system (BITE) with adequate fault indications.

### The system **shall** allow for a reversion to adequate back-up procedures if failures in excess of the operationally significant period occur.

### If a failure makes operational function impossible this condition **shall** be clearly indicated to both air traffic controller and any other user concerned.

### Self-test **shall** be performed in case of any sub-system is turned on including data quality checking.

### After finishing self test system **shall** be capable of providing operational service with minimum intervention by the user.

### The operating systems of servers and clients **shall** be hardened.

### The operating systems of servers and clients **should** have a local firewall which with communication will be limited to services required.

### In case of „well-known” services are used by the system, encrypted version of these services **shall** be applied (for example SSH instead of telnet, HTTPS instead of http, etc.)

### The system **shall** have adequate logging capability to support traceability and controllability.

### Communication between every server, client, host and camera **should** be encrypted.

### Supplier **shall** provide prompt/fast repairs and safety revisions for the system software components.

# Standards and Regulations Applicable

### The system performance **shall** comply with or exceed requirements and recommandations as stated in the adequate chapters of the following standards in all respects and under the circumstances:

1. ICAO Annex 2 To The Convention On International Civil Aviation (Rules of the Air)(until the latest amendment)
2. ICAO Annex 10 To The Convention On International Civil Aviation (Aeronautical Telecommunication)( until the latest amendment)
3. ICAO Annex 14 To The Convention On International Civil Aviation (Aerodromes) (until the latest amendment)
4. ICAO Document 8071 Manual on the Performance Testing of ATC Radar Systems
5. ICAO Document 9476 Manual of Surface Movement Guidance and Control Systems (SMGCS)
6. ICAO Document 9830 Advanced Surface Movement and Guidance Control Systems (A-SMGCS) Manual
7. Next parts of EUROCONTROL Standard Document for Radar Data Exchange, Part 1-17, SUR.ET1.ST05.2000-STD-xx-xx:
   * 1. Part 1: All Purpose Structured EUROCONTROL Surveillance Information Exchange (ASTERIX) Edition: 2.3 – Edition dated: 12/11/2015
     2. Part 2a: Transmission of Monoradar Data Target Reports (category 001) – Edition dated: August 2011
     3. Part 2b: Transmission of Monoradar Service Messages (category 002) – Edition dated: November 1997
     4. Part 2b: Transmission of Monoradar Service Messages (category 34, next version of Cat 002) – Edition dated: May 2007
     5. Part 4: Transmission of Monoradar Target Reports (category 048, next version of Cat 001) Edition: 1.21 – Edition dated: July 2012
     6. Part 4 Appendix A: Coding rules for “Reserved Expansion Field” (category 048) – Edition dated: April 2008
     7. Part 12: ADS-B Reports (category 021) – Edition dated: May 2011
     8. Part 12: ADS-B Target Reports (category 021) Edition: 2.4 – Edition dated: 15/06/2015
     9. Part 12 Appendix A: Coding rules for “Reserved Expansion Field” (category 021) Editon:1.3 – Edition dated: 04/09/2015
8. EN60204 Standard on Shock Hazard Protection
9. IEC62305-4 and NFPA780 Standards on Lightning Protection
10. 55011, 55015 and EN60215 Standards on EM Emission
11. ED-111 FUNCTIONAL SPECIFICATIONS FOR CNS/ATM GROUND RECORDING - Edition dated: July 2002
12. ED-129B Technical Specification for a 1090 MHz Extended Squitter ADS-B Ground Station- Edition dated: April 2016
13. ED-161 SAFETY, PERFORMANCE AND INTEROPERABILITY REQUIREMENTS DOCUMENT FOR ADS-B-RAD APPLICATION- Edition dated: 01/09/2009
14. ED-163 - Safety, Performance and Interoperability Requirements Document for ADS-B Airport Surface Surveillance Application (ADS-B-APT) - Edition dated: December 2010
15. ED-240 MINIMUM AVIATION SYSTEM PERFORMANCE SPECIFICATION FOR REMOTE TOWER OPTICAL SYSTEMS- Edition dated: September 2016
16. EUROCONTROL-SPEC-107- EUROCONTROL Specification for ATS Data Exchange Presentation (ADEXP)- Edition: 3.1- Edition dated: 25/10/2011

# Visualization Air Traffic Control System

## General

### The system **shall not** impair operation of aircrafts or ground vehicles under no circumstances (not even during normal or faulty operation) in the aerodrome or its vicinity.

### The protected / restricted areas of the aerodrome and its obstacle free zoning **shall not** be adversely affected by the elements of the system.

### The system **shall not** impair or disable any communication, navigation or surveillance system under no circumstances (not even during normal or faulty operation).

### The system **shall** be implemented in such a way that operating in any order or combination of the controls used for normal operations **shall not** cause erroneous functioning or failure of data integrity or reliability of the system.

### For all elements of the system a 24/7 continuous service capability **shall** be fulfilled.

### All elements of the system **shall** comply with standards mentioned above.

### System **shall** provide data recording of 62 days covering every data and log file which enable checking up of technical and operational events.

## Operational Requirements

### Cameras **shall** provide real time video images in the visible spectrum.

### The image provided by cameras **shall** be stabilized mechanically and/or electronically to be able to avoid image trembling coused by external effects (for example wind, etc.).

### The system coverage range **shall** be extended to the whole area of the aircraft movement (according to ICAO Annex 14), from the surface until the height of at least 100 feet.

### The image of objects s**hall** **not** be distorted in order to avoid distance between objects seems to be larger or smaller compared with distance of visual inspection using the human eye.

### The system **shall** be able to display targets and target areas in such a way that area and objects within area **shall** be recognizable for the operator.

### Objects moved into observed area **shall** be displayed immediately by the system.

### Initiated movement of any earlier stationary object within observed area **shall** be displayed immediately by the system.

### The following observations **shall** be enabled by the optical resolution of the system:

1. Things before and after the object to be monitored and the relative position of the object to be monitored relative to the airdrome environment (holding points, taxiway and runway intersections, eprons, etc.).
2. Displaying any colour and contrast condition on visible range by human eyes in VMC at daytime.

### Displaying objects in lighting conditions equivalent to “Morning Civil Twilight” and“Evening Civil Twilight”.

### Operation in all kind of weather conditions:

### The system **shall** not be affected mechanically or electronically, nor be degraded in optical quality and capacity by any environmental conditions normally expected for the site (all weather operation), such as:

1. Direct sunlight
2. Rain
3. Freezing rain
4. Ice
5. Snow
6. Wind
7. Dust
8. Hail
9. Fog

### The system **shall be** protected against covering caused by sludges on the sensors, such as:

1. Bird droppings
2. Insect contamination
3. Sensor fogging
4. Enclosure fogging
5. Hazing

### The cameras **shall** be supplied with housing according to weather conditions so as to be able to operate continuously from -40°C to +50°C.

## Cameras to be Installed to Fixed Position

### The system **shall** provide two panorama images.

### Cameras generate panorama images **shall** be installed onto pillar provided by HC on the next geographical location:

### Latitude: N47°29’23”

### Longitude: E021°36’38”

### Height: 25,00 m AGL

### The horizontal angle of view towards TWR and APRON **shall** provide panorama image of 160° wide.

### The vertical angle of view towards TWR and APRON **should** provide panorama image of 40° wide.

### The vertical angle of view towards TWR and APRON **shall** be at least 25°.

### The horizontal angle of view towards RWY **shall** provide panorama image of 220° wide.

### The vertical angle of view towards RWY **shall** be at least 40°.

### Overlapping of 10-10° **shall** be provided between two panorama images on both sides.

### Image of the cameras installed onto fixed position **shall** have at least 1920x1080 pixel resolution.

### Cameras **shall** have optical image stabilization.

### Cameras **shall** be capable of providing frame rate of 30 fps at least.

### The value of digital zoom used for generating panorama images **shall not** be greater than 1,0.

### Cameras **shall** have automatic cleaning capability (for example windscreen wiper, compressed air, high-pressure air water mixture).

### Automatic cleaning capability **shall** have continuous and occasional cleaning mode as well.

### Cleaning of cameras **shall** be able to control from CWPs.

### The function of camera cleaning **shall** be protected against accidental switch on.

### Matching images of cameras installed onto fixed position into panorama images **shall** be able to modify on maintenance level.

### Matching images of cameras installed onto fixed position into panorama images **should** be able to do it automatically, for example fine-tuning after camera replacement.

### Within a panorama picture a given object **shall** **not** be presented more than once whether that part or the whole object can be seen by more cameras at the same time.

### Object **shall** be displayed in the panorama pictures in their entirety in particular on the overlapping area of neighboring cameras’ pictures.

### Video codec applied **should** be H.265.

### Video codec applied **shall** be H.264 at least.

### The system **shall** be able to provide pincushion distortion, in order to make a seen impression (OTW) display.

### The system **shall** be able to provide an image in no way inferior to perceptible to the human eyes from camera positions given.

### Cameras **shall** use IP.

### The cameras **shall** have the capability to be accessed and modified from remote site.

### The system **shall** contain a second camera position as an **option** next to threshold 05R, its geographical location is:

### Latitude: N47°29’01”

### Longitude: E021°36’11”

### Height: 20,00 m AGL

### Cameras installed to fixed position of pillar 05R **shall** correspond to the following conditions:

### They provide the observation of the final approach.

### Within at least 5NM calculated from the threshold they let the operator to decide unequivocally the release state of the landing gear under weather condition of VMC at daylight.

### They visualize continuously the whole body of the arriving aircraft within 10NM calculated from the threshold down to the touchdown zone.

### Their technical parameters are not worse than cameras’ used for generating panorama images.

### Cameras installed to fixed position of pillar 05R **should** have different lens fitted.

### The system **shall** be capable of displaying thirty (30) predefined Hot-Spot areas at least.

### Hot-Spot areas **shall** be configurable on maintenance level.

### Hot-Spot areas **shall** have the capability of independent selection from each CWP.

### Image of every Hot-Spot area **shall** be accessible on each CWP.

### PTZ cameras **shall not** be used for displaying Hot-Spot areas.

### Cameras **shall** have an environmental lighting dependent adaptive brightness control.

## PTZ Cameras

### Total number of two (2) pieces of PTZ cameras **shall** be installed onto the same pillar where fixed cameras for panoramic images are.

### Cameras **shall** use IP.

### The cameras **shall** have the capability to be accessed and parameterized from remote site.

### Cameras **shall** have an environmental lighting dependent adaptive brightness control.

### For giving visual information as well one (1) piece of PTZ camera **shall** be applied which with a light gun is collimated (it lights where camera is directed).

### Light gun **shall** comply with ICAO Annex 2 To The Convention On International Civil Aviation (Rules of the Air) (until the latest amendment).

### For giving visual information as well one (1) piece of PTZ camera **shall** be applied which with a thermal camera is collimated.

### Visual part of the PTZ cameras **shall** be capable of handling optical zoom of 30 at least.

### Visual part of the PTZ cameras **shall** have pixel resolution of 1920x1080 at least.

### Visual part of the PTZ cameras **shall** cover the angle of view (FOV) of 2,5° - 60° range at least.

### PTZ cameras **shall** be capable of tracking automatically based on radar information, after manual designation.

### PTZ cameras **shall** be capable of tracking automatically based on video information, after manual designation.

### During automatic tracking the whole target **shall** be visible on the PTZ camera picture.

### PTZ cameras **should** have mechanical or electronic stabilizer.

### PTZ cameras **should** have continuous cleaning sollution.

## Processing System

### Processing system **shall** be redundant.

### In case of failure an automatic switchover **shall** be executed to the hot backup processing unit, during this process the system **shall** remain in full operational mode.

### Processing system **shall** be capable of handling row and tracked data entering from surveillance devices in format of ASTERIX.

### Processing system **shall** be capable of providing outputs of ASTERIX CAT11 and CAT62.

### Processing system **shall** be capable of handling and processing information of at least 3 radar and a minimum of two ADS-B receiver.

### The system **shall** be capable of processing AFTN messages and different tagging of departing and arriving aircrafts derived from this data.

### The system **shall** be capable of integration with meteorological system.

### The system **shall** be capable of displaying system condition and failures on dedicated technical positions.

### The system **shall** be capable of providing Boxing (motion detection and tracking with frame on the panorama picture).

### The function of Boxing **shall** be switchable on/off.

### The system **shall** be capable of classifying aircrafts based on AFTN messages or in case of lack of these on manual inputs into arriving/departing/unknown traffic regarding to LHDC airport.

### The system **shall** be capable of matching integrated target data with flight plan if it is available.

### Association flight plans with integrated target data **shall** be performed based on call sign in particular, namely based on equality of downloaded call sign and the loaded call sign in the flight plan.

### If association is not feasible based on call sign, then it **shall** be implemented based on SSR code. It is based on equality of downloaded Mode-3/A code and the loaded Mode-3/A code in the flight plan.

### Existing relevant data from arriving aircrafts **shall** be able to display in the list of ‘Arriving’ on CWP.

### Existing relevant data from departing aircrafts **shall** be able to display in the list of ‘Departing’ on CWP.

### Data existing in the lists **shall** correspond to data of flight plan on system level all time if it is available.

### On CWP-s there **shall** be a possibility of editing system level flight plans manually.

### The system **shall** have database for identification of ground vehicles. This database can be edited on maintenance level.

### System **shall** be able to apply labels with different appearance and data content for departing, arriving, not identified and ground vehicle traffic.

### The colour and the data content of the labels **shall** be configurable on maintenance level.

### System **shall** provide such functionality which allows operative personnel to assign or even remove flight plan manually for target detected by surveillance system.

### Moreover, system **shall** provide functionality with which operative personnel can perform labelling manually with free text.

### In case of departing flight from Debrecen sytem **shall** display automatically the established system level flight plan in the list of ‘Departing’ not later than 30 minutes before estimated off-block time (EOBT).

### When flight plan message arrives less than 30 minutes before estimated off-block time (EOBT), than it **shall** be displayed in the list ’Departing’ immediately after processing.

### In case of arriving flight to Debrecen system **shall** display automatically the established system level flight plan in the list of ‘Arriving’ not later than 30 minutes before estimated time of arrival (ETA).

### When flight plan message arrives less than 30 minutes before estimated time of arrival (ETA), than it **shall** be displayed in the list ’Arriving’ immediately after processing.

### In case an aircraft is within the surveillance area and has system level flight plan it **shall** be displayed in the list of “Arriving/Departing” together with the proper labeling independently the value of ETA/EOBT existing in the flight plan.

## Display System

### The system **shall** be able to provide KVM cooperative ability for all periphery.

### Display system **shall** consist of two (2) CWPs and one (1) video wall.

### The processed and displayed camera pictures **shall** have 28 fps reflesh rate at least.

### The 2 CWPs **shall** operate in parallel with full functionality including in particular controlling PTZ cameras and video wall.

### On CWPs it **shall** be possible to switch given CWP into look only mode and back to fully operational one.

### On CWP switched into look only mode such inputs **shall not** be able to process which could have any influence on other parts of the system in particular controlling PTZ cameras and the picture of video wall.

### Switchover CWP on look only mode into fully operational mode **should** be possible within 10 sec.

### On CWPs possibilities **shall** be provided for the followings:

### manual controlling of the PTZ cameras including lightgun,

### automatic radar based tracking function on PTZ cameras in case of maximum zoom as well, considering chapter 4.4.13.

### video based tracking with manual selection on PTZ cameras in case of maximum zoom as well, considering chapter 4.4.13.

### automatic zoom of PTZ cameras for points a) and b),

### switching between points b) and c),

### modifying zoom manually during automatic tracking (based on radar and video), keeping automatic tracking as well,

### displaying pictures of both PTZ cameras simultaneously together with a Hot-Spot area,

### displaying total panorama picture in case of zoom out from Hot-Spot area,

### controlling video functions, such as switching labels, layers.

### Hot-Spot windows **shall** have switchable labels.

### Video wall independent digital zoom possibility **shall** be provided on CWPs in case of displaying panorama pictures and Hot-Spot areas cropped from them.

### Controlling Hot-Spot areas it **shall** be aspired to evolve space-saving HMI solution.

### On CWPs it **shall** be possible to display a zoom in/out ground/air situational image according to the following requirements:

### Transition between ground and air situational image can be available with continuous zoom.

### Scale of the displayed area can be adjusted gradually between at least 100 m and 500 km.

### The ground and air situational image contains different map elements.

### Map elements of the ground and air situational image can be switched by operator.

### Map elements of the ground and air situational image can be edited on maintenance level.

### A zoom range can be given for map elements of ground and air situational image separetaly in which they can be seen in case of switched on.

### The system can handle at least 150 pieces of such map elements simultaneously.

### Acting distance measurement function with opcional unit (meters, nautical miles) on ground and air situational image operating between 2 aircrafts, 2 fix points or 1 aircraft and 1 fix point.

### Function displaying WGS-84 coordinates of cursor acting on both ground and air situational image.

### On the CWPs there **should** be a possibility of displaying at least two (2) ground/air situational images with same functionality at the same time.

### Orientation and angle of view of the PTZ cameras **shall** be displayed on the ground situational image regarding their momentary state in such a way that this can be switched individually on each CWPs.

### On the ground situational image there **shall** be a possibility of controlling PTZ cameras in such a way that PTZ automatically turns and make a zoom to the point of the map was manually selected.

### Functions of chapter 4.6.13 and 4.6.14 **shall** be switchable on CWP.

### The system **shall** have a manual drawing tool which can be used on ground/air situational images and be able to draw provisional map elements and text comments.

### The drawing tool **shall** have the following functions:

#### drawing lines

#### drawing slash

#### drawing closed polygon

#### drawing circle

#### copy formations/groups within layer

#### copy formations/groups between layers

#### post editing formations/groups

#### setting outline of formations/groups and fill colour of closed formation

#### setting line thickness

### There **shall** be a possibility creating formations/groups with setting coordinates or typical dimensions as well, for example: specifying origo and radius of a circle.

### The system shall be able to handle the followings made by manual drawing tool:

#### store 50 layers at least

#### share between CWPs automaticaly

#### erase

#### switch

### Elements created by drawing tool **shall** be displayed on ground/air situational image of all CWPs.

### Data content of labels of the ground/air situational images and the data content of labels displayed on the camera pictures **shall** be parameterized independently from each other.

### On CWPs it **shall** be possible to switch system into night mode.

### Night mode **shall** be switchable both automatically and manually.

### In case of fixed cameras night mode **shall** use different settings from daily mode which is optimized for night visibilities.

### On CWPs it **should** be possible to display RWY status when integrated ILS and AGL functions will be developed.

### The system **shall** include a sign switchable at operator level and moves continuously which appears on the corner of every monitor at power on, indicating that displays of the system including CWPs and video wall are not frozen.

### Windows openable on CWPs **should** be movable dynamically.

### For each CWPs 1 piece of at least 40” touch screen **shall** be used.

### The touch screen **shall** be able to be mounted to VESA console.

### By means of using USB mouse and keyboard CWPs **shall** be fully operational as well.

### In case of defects of the user input devices system **shall** continue its operation as it was before the error occurred.

### CWPs **shall** provide a software function for resetting HMI into default state.

### CWPs **shall** be able to display labelled ground and departing - arriving aircrafts.

### CWPs **shall** be able to display failures affecting air traffic controller’s work.

### The following parameters **shall** be adjusted at least on the CWPs by operator:

### Global brightness

### Map element brightness

### Menu brightness

### Font size

### Size of labels

### Brightness of labels

### Video wall **shall** consists of 5 (five) pieces of 55” monitors.

### Video wall **shall** be installed onto a computer holder platform behind the console.

### Monitors **should** have frame of maximum 2 mm.

### Monitors **shall** have frame of maximum 5 mm.

### Video wall **shall** be able to display 2 panorama pictures in 2 rows under one another.

### Instantaneous orientation of the PTZ cameras **shall** be displayed on the video wall with switchable variable size frame.

### MET information **shall** be displayed as a switchable layer.

### There **shall** be a possibility on the video wall to display identical colour coded labels as ground/air situational image has in a switchable manner for different types of targets (arriving, departing, unindentified and ground vehicle traffic).

### Labels displayed on video wall **shall** move together with targets belong to close to them but not to cover them.

### On the video wall static layers can be defined in the database **shall** be displayed (for example closed runway/taxiway, stands, runway/taxiway edgelines, finals etc.).

### Static layers **should** be able to be defined by user.

### Colour, shape and transparency of static layers **shall** be adjustable.

### In case of camera failure or frozen picture system **shall** monitor fault indication or alarm on the control and monitoring sub-system and on CWPs.

### Image from faulty camera **shall** **not** be displayed neither on CWP nor video wall.

### The following status (available or failed) and warning messages **shall** be displayed on the monitors of the users:

1. Total system failure
2. Failure of any sensors.

### It **shall not** be possible to display frozen or false picture for users.

### If more than three (3) seconds have passed before receiving a new frame then system **shall** react as follows:

1. Stops displaying the last received video frame.
2. Displays gray image panel in place of an image for that camera.
3. Displays fault alarm.
4. Writes the event into log file.

### The system **shall** be able to display graphical overlays both on video wall and monitors of controller working places.

### Graphical overlays **shall** be configurable on maintenance level.

### Layers containing graphical contours of runways and taxiways **shall** be activated:

1. Automatically at night and/or below visibility of 800 meters
2. Manually at SV level.

### The image provided by source operating on visual wavelength range **shall** be displayed as a colour picture under night conditions as well.

### On CWPs it **shall** be possible for users to display free text notes inside a dedicated window which can be displayed and edited on each CWP monitor and share between them.

### The text of notes **shall** have changeable font size and colour.

## Hardware

### Supplier **shall** provide devices mentioned above including touchscreens of CWPs, video wall monitors, system servers, cameras and their physical fixing.

### Hungarocontrol provides mouse and keyboard. Supplier **shall** inform HC about the number and type of mouse and keyboard required.

### Hungarocontrol provides all required KVM extensions and switches. Supplier **shall** inform HC about requirements regarding to KVM.

### Hungarocontrol provides all kind of network equipments and cables required for proper functioning of the system. Supplier **shall** specify network requirements in accordance with written in Chapter 7.

### Every user HMI **shall** be built up of commercial off-the-shelf (COTS) elements and **shall** consist of following functions at least: windows, menu control, pointer, drag and drop, online help.

### Every user HMI **shall** be available in English language.

### Swapping same type of elements **shall** not influence system operation and performance.

### 10% per type of system elements but minimum 1 piece as a spare **shall** be provided.

## Expandability

### System **shall** be designed to be capable of expansion to accommodate if required:

1. Bandwidth.
2. Additional air traffic controller and maintenance working places.
3. Additional sensor inputs.
4. Additional data and control interfaces.

### The system **shall** be able to serve at least 5 air traffic controller working places.

## Resistance against Environmental Effects

### System operation **shall** **not** be affected by:

1. Lighting of the airport
2. Lighting of the aircrafts
3. Lighting of the ground vehicles

### The system operation **shall not** be affectted by sun movement, twinkling or reflection:

1. sunrise conditions
2. sunset conditions
3. glare
4. reflection

### The system as a whole and display of images in particular **shall not** be influenced by weather conditions in such a way that the picture displayed would be blurry or convulse.

### System **shall not** be affected by:

1. Electromagnetic interference
2. Electrical surges
3. Lightning

### Outdoor units **shall** be resistant to corrosion for at least 20 years.

### Camera accessories including protective housing **shall** be made of such material with surface treatment in order to resist industrial pollution, such as sulphur dioxides and/or nitric oxides.

### Camera accessories including protective housing **shall** be made of such material with surface treatment in order to resist the rodents and birds.

### Minimal lifetime of the materials and surface treatment **shall** be at least twenty (20) years long.

### Camera houses **shall** be supplied with heating and temperature control thermostat if necessary to permit operation in the full environmental temperature range.

### Camera houses **shall** be supplied with protection against overheating including alarm function as well.

## Start-up and Restart

### After cold start system **shall** be fully operational as soon as possible but not exceeding ten (10) minutes.

### After start-up system **shall** be in fully operational state automatically.

### In case of power supply disruption, transients or outages system **shall** restart automatically without manual intervention once disruption of service ended.

### System **shall** be recovered automatically without manual intervention once any missing or interrupted data link is re-established.

### System or its any subsystem **shall** be re-established into normal state automatically after ceasing of error.

## Availability

### System **shall** be able to perform continuous (7/24) operation between periods of preventive maintenances during the whole operational lifetime of the equipment.

### Operational availability of the system **shall** be equal or higher (≥) than 0.9996.

### Index of Mean Time Between Critical Failures (MTBCF) of the system **shall** reach or exceed 20.000 hours. An error is qualified as a critical failure when data provided by the system are inadequate for air traffic controlling.

### Scheduled lifetime of the system **shall** be at least 20 years.

## Control and Monitoring

### Configuration, Control and Monitor sub-system **shall** be provided for system controlling and displaying status of each component (serviceable, degraded, faulty).

### All essential and critical system parameters **shall** be monitored and displayed on adequate and easy to understand way allowing system diagnostic and troubleshooting.

### Accessing of monitoring and control functions **shall** be available on COTS based workstations (Maintenance Display and Control Workstation (MDC)).

### System **shall** indicate functional status of the whole system, its sub-systems, its main elements and other components.

### Actual status of each sub-system affecting the continuity of air traffic controll **shall** be monitored.

### Actual status of every sensor, receiver, interface and other sub-system **shall** be monitored and reported.

### The following status (serviceable or faulty) and warning indications **shall** be implemented:

1. Total system failure.
2. Failure of any video sensor.
3. Failure or partial error of any sensor.
4. Failure of any receiver.
5. Failure of any interconnection.

### All control and maintenance actions and alerts **shall** be logged, recording followings: time, source, system message and event associated to it.

### The control and monitoring system **shall** have the capability to generate and display overall status and alarm signals coming from major functional units of the system.

### The system s**hall** have the possibility of remote control and monitoring for all cameras.

### The system **shall** have the capability to control and monitor multiple cameras simultaneously.

### The control and monitoring system **shall** have the capability to remote control the followings:

1. To restart a device installed at remote site.
2. To change the configuration of a system element.

### The control and monitoring system can be integrated into workstations/equipments supplied to perform remote maintenance.

## Maintenance and Built in Test Equipment (BITE)

### Maintenance functions **shall** check and display the status of system elements.

### Maintenance function **shall** identify problems occurred in the system and the lowest replaceable unit (LRU) responsible for that problem.

### Maintenance function **shall** record and archive every alarms, events, parameter errors or any other action which have negative impact to the system operation.

### Maintenance personnel **shall** have the ability to recall or execute all maintenance functions using remote access except if physical/mechanical activity has to be done on that system element.

### All maintenance functions **shall** be capable of being invoked and executed at the equipment location.

### All units **shall** include functions of BITE in order to minimize maintenance and repair time.

### Sensors powered on **shall** be capable of extraction and insertion without causing any damage or failure in any elements of the system or risk of electric shock.

### All maintenance activity **shall** be able to be performed by a single person.

### Maintenance personnel **shall not** be allowed to lift any item weighing more than 15kg during system maintenance.

### Supplier **shall** define a preventive maintenance plan to provide continuous system operation.

### There **shall** be a possibility to execute a preventive maintenance without interfering system operation.

### Supplier **shall** specify the corrective maintenance actions for all malfunction foreseen. The corrective maintenance actions **shall** be detailed down to replacement level of LRU.

### Usage special tool, device, or instrument **should not** be allowed for corrective and preventive maintenance. If any special tools, devices and instruments necessary these **shall** be supplied with the system.

## Recording and Playback

### The system shall contain duplicated data recording and playback system in order to record and archive system data continuously.

### The following data **shall** be recorded:

1. Picture of every display of video wall and CWPs with refreshment rate of at least 5 picture-frame per second.
2. All information displayed, display settings, operator actions for each of the operational display.
3. Events, status, control data, log files related to the entire system.

### Coordinated Universal Time (UTC) based timestamp **shall** be associated to every data recorded.

### The time of recording **shall** be indicated during playback.

### The system **shall** keep the recorded data for at least 62 days.

### Recorded data **shall** be protected against modifying and erasing for the specified archive period.

### Playback function s**hall** be implemented in order to playback data recorded. The function of playback **shall** be fully identical to the display during recording except mouse cursor.

### The following data **shall** be adjustable during playback:

1. Site identification.
2. Date and time of start/stop of recording.

# ADS-B receiver

## General

### An ADS-B (Automatic Dependent Surveillance Broadcast) receiver **shall** be installed and integrated into LHDC rTWR Visualization Air Traffic Control System and further ATM (Air Traffic Management) system(s).

## General Requirements

### The ADS-B receiver **shall** be installed onto HC owned pillar, described in Chapter 4.3.2.

### Supplier **shall** provide all kind of mounting materials such as antenna mount, cables and ADS-B device with accessories.

### HungaroControl will provide mounting materials, tools and equipage, described in Chapter 2.2.2.

### HungaroControl is responsible for data transmission between container in Debrecen and Hungarocontrol building.

## Technical Requirements

### Operational range of ADS-B station **shall** be at least 250NM;

### Output data of ADS-B **shall** be provided in ASTERIX format Cat021;

### Device **shall** be able to identify, process and transmit at least 300 targets;

### Maximum delay of output data **shall not** be more than 400 ms;

### Refresh rate of output data **shall not** be more than 0.5 Hz;

### Omnidirectional antenna **shall** be applied;

### UTC **shall** be used as a reference time;

### System availability **shall** be at least 99.99% except pre-arranged maintenance periodes;

### Mean Time Between Failures -MTBF (reliability) **shall** be greater than 10,000 hours;

### Device **shall** provide 2 x RJ45 – TCP/UDP outputs;

### ADS-B system **shall** be inserted into a 19” standard rack;

### ADS-B sysem **shall** be able to control user’s access with password-controlled login;

### ADS-B system **shall** be able to prevent parallel access for more technical personnel simultaneouly on the same system element;

### Function of Control and Monitoring System (CMS) **shall** provide following sub-functions:

### Control and monitoring the status of system units;

### System configuration;

### Target riport quality check;

### Displaying air situational picture;

### ADS-B system **shall** resist against harmful effects such as radio interference including affects originated from standard radio navigation, telecommunication and radar equipments;

### ADS-B system **shall** **not** generate interference in standard radio navigation, telecommunication and radar equipments;

### Device **shall** be capable to operate using power supply in order to be resistant on the AC power line as follows:

### Mains power supply: 230V ± 10%,

### Frequency: 50 Hz ± 6%

### Supplier as a part of the offer **shall** provide detailed informations on devices, system units delivered as part of ADS-B system including those exchangeability;

### ADS-B station **shall** have hot standby redundant configuration. In case of active channel failure automatic switchover **shall** be executed to the standby channel. During switchover data loss **shall not** be allowed.

### ADS-B station **shall** be designed based on the concept of Lowest Replacement Unit (LRU). All functionality of the ADS-B ground station such as power supply, signal transmitting and processing unit **shall** be built up on the concept of LRU in order to achieve easy maintenance;

### ADS-B system **shall** be able to increase, modify operative coverage or performance with adding or relocating receiver unit;

### Supplier **shall** demonstrate in detail method and hypothesis applied by him during analysis of coverage (antenna height, sensor sensitivity, etc.);

### Supplier **shall** represent ADS-B system performance with coverage diagram;

The results of the coverage analysis **shall** be presented for every height showing on separated maps;

### Interface Control Document (ICD) **shall** be delivered in electronic and in paper form in English language.

### A set of spare parts **shall** be provided by Supplier at least 2 year LRU concept has to be taken into account;

### Supplier **shall** deliver at least 5 ground squitters as a part of the system.

# Interfaces

## Meteorology

### The existing meteorological system of LHDC **shall** be integrated into this system so as to display actual meteorological information on CWPs and on video wall as well.

## AFTN

### The system **shall** be able to decode and process messages coming through AFTN.

### The system **shall** handle/send at least the following messages related to flight plan:

### FPL/IFPL - (INDIVIDUAL) FLIGHT PLAN MESSAGE

### CHG/ICHG - (INDIVIDUAL) CHANGE MESSAGE

### CNL/ICNL - (INDIVIDUAL) CANCEL MESSAGE

### DLA/IDLA - (INDIVIDUAL) DELAY MESSAGE

### SAM - SLOT ALLOCATION MESSAGE

### SRM - SLOT REVISION MESSAGE

### SLC – SLOT CANCELLATION MESSAGE

### FLS – FLIGHT PLAN SUSPENDED MESSAGE

### DES - DESUSPENDED MESSAGE

### DEP – DEPARTURE MESSAGE

### ARR – ARRIVAL MESSAGE

### REA – READY MESSAGE

### The system **shall** be able to handle ICAO and ADEXP format messages.

### The system **shall** be able to process NOTAM and METAR messages coming through AFTN.

### The system **shall** be able to display all AFTN messages on CWPs in a separated window with capability of organizing and filtering.

### AFTN messages **shall** be displayed on CWPs as a whole and without abbreviation as well.

### The system **shall** be able to make flight plan on system level affected by incoming flight plan message.

### The system **shall** be able to associate existing flight plans in the system with AFTN messages freshly came and processed and to refresh it with relevant data of messages as required.

### The system **shall** be able to look for between messages based on user defined AFTN message type, 4-letter ICAO airport identification code, callsign or SSR code and display the result of the search on the CWP for still active and processed messages in the system.

### The system shall be able to apply searches detailed in Chapter 6.2.9 in a combined manner.

### The system **shall** be able to delete messages related to finished flights automatically after the expiration of the time to be set in the system.

## Radar

En-route radar in Püspökladány **shall** be integrated into this system. Radar complies with standard as stated in the following document „EUROCONTROL STANDARD DOCUMENT FOR RADAR SURVEILLANCE IN EN-ROUTE AIRSPACE AND MAJOR TERMINAL AREAS” (SUR.ET1.ST01.1000-STD-01-01), edition dated: 1997.

### The system **shall** be able to process standard CAT 34 and CAT 48 ASTERIX messages coming from radars.

### The system **shall** support en-route radar data processing and updating based on 8 sec rotation.

### The system **shall** be able to process primery and secundery data as well.

### The system **shall** support processing of radar data in UDP (multicast) data packet running on TCP/IP protocol.

### The system s**hall** comply with requirements and recommandations as stated in the adequate chapters of the following standard (latest issuing of ESSAP): EUROCONTROL Specification for ATM Surveillance System Performance.

## ADS-B

### Data of ADS-B receiver specified in Chapter 5 **shall** be integrated into the system.

## ILS

### CAT II ILS system to be built at LHDC airport **shall** be integrated into the system including status feedback and control.

## AGL

### CAT II AGL system to be built at LHDC airport **shall** be integrated into the system including status feedback, map visualization and control.

# Network

## General

### Supplier **shall** provide necessary network requirements not later than milestone of „Design Complete” so that Call for Tender can prepair network as required.

### Network system plan **shall** be approved by Hungarocontrol.

### Hungarocontrol provides every network element required system operation including cabling, optical fiber cables and active elements (routers, switches, etc.). Supplier **shall** specify the network connection requirements for all system elements.

### Supplier **shall** provide copper and fiber optic patch cabling from the service delivery point of the network infrastructure to the equipment. Cable types, lengths, labelling, physical layout **shall** be included in network design.

### The system **shall** provide Ethernet hardware interface for every component, which has to communicate via the network.

### The IP addressing scheme **shall** be designed according to HC requirements. The addressing scheme (included in the network design) **shall** be approved by HC.

### The IP addresses of the system **should** be configurable at maintenance level.

## Communication

### The system **shall** utilize Call for Tender’s network. The network operation will provide a dedicated network segment for the system. Separation is at Layer 3 level. Connections to other systems and the internet **shall** only be possible if documented in the related ICD and configured accordingly in the firewalls operated by Call for Tender.

### In case there is a need for the Supplier to access the system remotely for supporting purposes it **shall** be designed and implemented by using Call for Tender’s network security infrastructure. All related technical and security details **shal**l be agreed at latest by the Design Complete milestone.

## Standards

### The following standards and regulations **shall** be kept as minimum:

|  |  |
| --- | --- |
| Telecommunication | RFC 793 Transmission Control Protocol (TCP) |
| RFC 791 (IPv4) |
| RFC 768 User Datagram Protocol (UDP) |
| RFC 1228 SNMP-DPI: Simple Network Management Protocol Distributed Program Interface |
| ISO/IEC 8877 (RJ45) |
| IEEE 802 (Medium Access Control – MAC) |
| ISO/IEC 8802-3 (Ethernet) |
| ISO/IEC 8802-3u (Fast Ethernet) |
| IEEE 802.3ab (Gigabit Ethernet – 1000 Base-T) |
| RFC 792 (ICMP) |
| Electromagnetic Compatibility (EMC). | EN 50081-1 and EN 50081-2 |
| EN 50082-1 and EN 50082-2 |

# Infrastructure

## Equipment Cabinets

### Cabinets for all equipment will be provided by HC. Supplier **shall** specify the amount of space required for the system.

### All system elements **shall** be installed into standard 19” racks.

### If any system element requires special brackets/fittings in order to fit into a standard 19” rack, Supplier **shall** provide the necessary brackets/fittings.

### If shelters, radomes or any other protective housing / cover will be required for outdoor elements, these **shall** be provided by the Supplier.

## Mains Power Supply

### As a general requirement, all equipment **shall** be operated from 230V/50Hz AC power supply.

### All power connectors **shall** be DIN (European) type.

### US or British standard connectors **shall** **not** be used.

### System elements to be installed in ANS-III equipment room **shall** be able to operate from 2 x 230V/25A UPS power supply. Supplier **shall** indicate if this is insufficient.

## Environmental conditions

### Any equipment housed indoor equipment room(s) **shall** operate and maintain its full operational performance under the following conditions:

1. Temperature: 0°C-to +40°C-ig
2. Relative Humidity: up to 90% (non-condensing at +25°C)

### Any equipment element installed outdoors and not housed within radome or remote equipment shelter **shall** operate and maintain its full operational performance under the following conditions:

1. Ambient Air Temperature: -40°C to +50°);
2. Relative Humidity: Up to 100% (Lower than 90% at 40°C);
3. Driving Rain: Up to 60 mm/h;
4. Snow load: Up to 200 kg/m2 (in or out of operations);
5. Solar radiation: 1300 W/m2h during 8 hours;
6. Hail: Up to 10 mm particle size at 18 m/s;
7. Wind resistance:
8. In operation, bursts up to 160 km/h without frost or ice; up to 130 km/h with 12 mm frost or ice;
9. In survival, bursts up to 220km/h, without frost or ice, up to 180 km/h with 12 mm ice or frost.

### Full, individual environmental specifications for all external equipment **shall** be provided in the proposal.