Contextual note – SESAR Solution description form for deployment planning

Purpose:

This contextual note introduces a SESAR Solution (for which maturity has been assessed as sufficient to support a decision for industrialization) with a summary of the results stemming from R&D activities contributing to deliver it. It provides to any interested reader (external and internal to the SESAR programme) an introduction to the SESAR Solution in terms of scope, main operational and performance benefits, relevant system impacts as well as additional activities to be conducted during the industrialization phase or as part of deployment. This contextual note complements the technical data pack comprising the SESAR deliverables required for further industrialization/deployment.

Improvements in Air Traffic Management (ATM)

The SESAR Solution "Single remote tower operations for medium traffic volumes" enables Air Traffic Control (ATC) services to be provided at medium size aerodromes

The main change to today's current operations is that the Air Traffic Control Officer (ATCO) is no longer located at the aerodrome in a conventional tower facility. Instead he/she can be located remotely, e.g. in a Remote Tower Centre (RTC).

The aerodrome view is captured by cameras and reproduced in the Remote Tower Module (RTM). With the visual reproduction used in the demonstrations supporting the solution, the size of the aircraft appeared smaller than in the Out-of-The-Window (OTW) view and along with this, the visual range for detecting aircraft was also lower than in the OTW view. While this is still sufficient to provide Air Traffic Services (ATS) at small aerodromes, it might limit capacity at medium size aerodromes. For medium size aerodromes, depending on the specific local needs, this should be compensated by means like the use of a Pan-Tilt-Zoom (PTZ) camera (using manual and automatic tracking), object bounding or other surveillance information (display of radar data in the OTW view).
It should be noted that in all the validations and demonstrations supporting the solution at medium size aerodromes, radar displays (air surveillance) and electronic flight strips were part of the RTM. In none of the demonstrations ground surveillance information was available.

The visual reproduction of the aerodrome view can be enhanced through technology, for use in all visibility conditions (e.g. infrared camera).

In addition, the controllers have access to all the necessary controls, including communications, lighting and traffic light controls, and access to flight and meteorological information.

This solution can be applied to medium size airports. In contrast to small size aerodromes, medium size aerodromes are characterised by frequently having more than one movement simultaneously.

At the aerodromes for which the solution was validated and demonstrated, there was no general limitation to traffic volumes. Depending on the specific local conditions there might be a need for a procedural change (e.g. for complex interdependent traffic patterns) if specific items cannot be solved by adjustments of the RTM (e.g. use of additional cameras/PTZ).

Operational Improvement Steps (OIs) & Enablers

SDM-0201 Remotely Provided ATS for Single Aerodromes

The Aerodrome Control Service or Aerodrome Flight Information Service for a specific aerodrome is provided from a remote location, i.e. not from a control tower local to the aerodrome. The ATCO (or AFISO) in this facility performs the remote ATS for the concerned aerodrome. The main targets for the Single Remote Aerodrome ATS concept are both small rural airports (which today are struggling with low business margins) and medium-size airports.

The enablers for this solution are given in the table below

Relevant Enablers from integrated road map for OI step	Enabler Description
AERODROME-ATC-52	Provide Remote Tower Controller position with visual presentation of both remote aerodrome views and other sensor data
AERODROME-ATC-53	Remote Tower controller position enhanced with additional sources for low visibility conditions
CTE-S02d	Video Surveillance
REF-0509	Regulatory Provisions for the harmonised deployment of Remote Towers Operations
CTE-C05b (optional)	Digital voice/VoIP for ground segment Air-Ground voice
CTE-C05a (optional)	VoIP for ground telephony

Applicable Integrated Roadmap Dataset is DS16.

This solution is the extension of solution #71 'ATC and AFIS service in a single low density aerodrome from a remote CWP' to medium size aerodromes.

Background and validation process

This SESAR Solution has been validated through two successive passive shadow mode trials at Saarbrücken airport. The exercises validated the remote provision of ATS to a medium-size single aerodrome. While the main driver of the concept is increased cost efficiency, this Key Performance Area (KPA) was not directly addressed in the validations as this is based on more efficient use of ATCO resources (e.g. by improved rostering). Instead the validation focussed on the enablers of the concept and assessed the aspects of human performance, safety and capacity.

By chartering additional traffic it was possible for the first time ever to investigate defined scenarios having continuous simultaneous movements in the traffic pattern as well as near the runway. It should be noted that the chartered traffic was VFR traffic that puts the highest requirements on the remote tower concept due to the small size of the aircraft and the more variable procedures and traffic flow.

The trials therefore focussed on validating the sequencing and integration of VFR and IFR traffic, including non-nominal situations such as go-arounds. Daytime as well as night operations were validated.

As these validation exercises could not lead the solution to full V3 maturity due to technical limitations of the validation platforms, especially the object bounding and automated PTZ-tracking, two SESAR Large Scale Demonstration Projects also addressing remote tower for medium-sized airports (RTO and Remote Towers) were used to investigate these issues at the following locations: Saarbrücken (under DFS lead), Eelde and Groningen (under LVNL lead), and Cork and Shannon (under IAA lead).

All the demonstrations were run in active shadow mode (with a backup controller in the local tower) allowing, for the first time at medium-sized airports, ATCOs to experience the live provision of ATS from a remote facility.

The issues detected after the passive shadow mode validations were solved in the demonstrations.

It should be noted that all the validations and demonstrations have taken place in airports equipped with air surveillance means. Further analysis may be required for non-equipped airports as air surveillance display became more important than in the conventional tower.

Results and performance achievements

The main benefit of the solution is increased Cost Efficiency. It is expected that the number of staff can be reduced by 10-25% if an airport is operated from a remote tower centre, allowing more efficient ATCO rostering (calculation based on more than two remote towers co-located). Remote ATS facilities will be cheaper to maintain, able to operate for longer periods (due to reduced staffing costs) and enable lower staffing costs (through centralised resource pools) and training/re-training costs, by large scale effects. It will also significantly reduce the requirement to operate and maintain actual control tower buildings and

infrastructure, leading to further cost savings, as well as eliminating the need to build conventional towers when replacing old facilities.

The large scale demonstrations on remote towers proved that ATS can be remotely provided to medium size aerodromes. In the active shadow mode trials the ATCOs were able to provide safe and orderly air traffic service with frequently having more than one movement at a time. Even complex situations with up to 6 movements could be managed.

The demonstrations showed that the concept for the Remote Provision of ATS to single medium size aerodromes is acceptable to controllers and is operationally feasible. The validation of the remote tower concept has shown that a proper implementation of the requirements providing the visual presentation and its associated functionalities with sufficient quality is essential for the ATCOs to accept it (during the first validations based on initial implementations, the ATCOs rating was rather low but finally significantly increased with improved quality and reliability of the implementation).

It could be proven that sequencing of traffic can be done as in current operations without any significant delay. Airspace users also evaluated the remote tower service as comparable to current ATS.

With the visual reproduction used in the demonstrations, the size of the aircraft appeared smaller than in the OTW view and along with this the visual range for detecting aircraft was also lower than in the OTW view. While this is still sufficient to provide ATS at small aerodromes, it might limit capacity at medium size aerodromes. For medium size aerodromes, depending on the specific local needs, this should be compensated by means like use of PTZ (using manual and automatic tracking), object bounding or use of other surveillance information (display of radar data in the OTW view).

In addition to the basic functionality, controllers were provided with IR images for PTZ and panoramic displays. These functions were well received by the controllers and might be used according to local needs for medium size airports.

Recommendations and Additional activities

The following recommendations based on the validations and demonstrations are given for future implementation:

- During all demonstrations operators (ATCO and/or AFISO) were able to stick to current rules and regulations for management of Air Traffic Service, therefore the recommendation is to keep current rules and regulations and only adapt local methods.

- Recommendation is to work on a high quality visual reproduction system and/or to implement enhanced tools and features, such as visual tracking, overlays or radar for medium size aerodromes. A better image, more similar to a conventional tower, reduces the need for adapted methods for ATCOs and AFISOs.

- Regarding ratings, endorsements and licensing, no changes are suggested. The ATCOs and AFISOs should hold a license for the requested service. In addition to that a local endorsement for the appropriate aerodromes.

- The requirements for ATCO training and qualification are unchanged from the current requirements for each airport controlled, except for those aspects specific to the remoting of that service provision.

- The position of the camera tower is crucial. This to ensure that all relevant areas such as runways, taxiways, aprons and airspace (e.g. VFR patterns, relevant waypoint, entry and exit points) are visible for the controller. Local circumstances such as runway layout and geographical orientation of the camera mast can differ for every site.

- The vertical viewing angle must ensure that all relevant areas are covered in the visual representation. This must be considered especially if the cameras are placed in landscape orientation. Additional cameras might be used to cover manoeuvring area or other areas of interest.

- PTZ is a replacement for a binocular in a conventional tower and its operation must be easy and intuitive. Automatic PTZ tracking and focus enables an easier usage but it was still shown that manual inputs were needed at times. Recommendation is to have both automatic and manual possibility.

- All working positions within a future remote tower centre might be universal or at least have the same functionalities so the controller working position are suitable for any type of air traffic service; air traffic control and flight information service.

- Initial CBAs have shown positive results but for each aerodrome a specific CBA considering the local factors is required being the baseline for a deployment decision.

Actors impacted by the SESAR Solution

Actors involved in operations are the same as for regular operations, i.e Tower Controllers.

Impact on Aircraft System

None

Impact on Ground Systems

The visual reproduction in the Remote Tower replaces the OTW view from the local tower building. The OTW view is obtained by a number of cameras, mounted on top of a suitably located or designed structure, covering relevant areas of the aerodrome vicinity and of the aerodrome movement area. Those cameras capture the image at the local aerodrome which is then reproduced on display screens located around the controller.

A mixture of basic and advanced technical features was highlighted as increasing the ATCO situational awareness:

- Basic features shall be provided:
    - Visual reproduction
    - Pan-Tilt Zoom (PTZ) camera

- Advanced Features are features that should be provided to augment the tools available in the basic configuration. They include:
    - infrared images
    - Automatic PTZ-Tracking
      the PTZ camera can be used for the automatic tracking of moving objects
    - Object bounding
      the object bounding overlay increases the ATCO's ability to spot and follow relevant moving objects

All systems used in a conventional tower need to be provided at the remote tower (e.g. electronic flight strips and radar).

Regulatory Framework Considerations

The regulatory framework is set with the guidance material provided by EASA Decision 2015/014/R.
EUROCAE published the ED-240 document on 'Minimum Aviation System Performance Specification for Remote Tower Optical Systems'.
While regulation and standardisation are covered for Europe by EASA and EUROCAE, equivalent guidelines should be provided by ICAO to facilitate worldwide implementation.

Standardization Framework Considerations

The standardisation work is ongoing within EASA and EUROCAE WG-100 and is based on the requirements developed for small sized aerodromes. The solution data pack will contribute to these standardisation activities with some aspects regarding advanced functionality (e.g. object bounding and automatic PTZ-tracking) to be considered for medium size aerodromes.

Considerations of Regulatory Oversight and Certification Activities

The integration of the Remote Tower with the rest of existing systems and equipment should be subject to a local safety assessment.

Solution Data pack

The Data pack for this Solution includes the following documents:

- 06.08.04 D94 OSED – Operational Service and Environment Description
  Edition 00.07.01 (15/07/2016)
- 06.08.04 D108 SAR – Safety Assessment Report
  Edition 00.02.01 (26/07/2016)
- 06.08.04 D109 HF – Human Factors Assessment Report
  Edition 00.02.01 (26/07/2016)
- 12.04.07 D09 TS – Technical Specification
  Edition 01.00.00 (07.03.2016)
- LSD.02.04 D03 – Remote Towers Demonstration Report
  Edition 00.02.00, (24.10.2016)
- LSD.02.05 D03 – RTO Demonstration Report.
  Edition 00.02.00 (28.10.2016)

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