

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 “Reducing landing minima in low visibility conditions using enhanced Flight vision systems (EFVS)” is intended for flight crews, and corresponds to the use of EFVS visual based technologies displayed in HUD to provide operational credit in approach as permitted per EASA EU 965/2012 to face to Low visibility conditions.

An EFVS vision system displays a real time image of the external scene that gives a visual advantage to the pilot and improves his capability to detect required visual references that may not otherwise be visible using natural vision in some degraded weather conditions. The image delivered by the EFVS is displayed conformal to the real world in Head Up.

While key main airports are capable of Type B landing operations (CATII or CATIII) with typical published minima of 100ft DH - RVR 300m, which allows facing to most adverse weather conditions that can be encountered in day to day operations, most of small/ medium airports are only capable of Type A landing operations with typical 300ft DA/ DH - RVR 800m minima, which potentially limit their access during winter period and early in the morning (see SESAR AAL LSD02.02).

A unique advantage of the EFVS on board solution is that it is mainly supported by the aircraft system instead of airports and the need of complex and costly ground infrastructures as those implemented in CATII/III airports.

From a global ATM network standpoint, the EFVS operation allows to retain traffic at most of secondary aerodromes by providing operational credit at most of runway ends with precision or non-precision landing minima (LPV, LNAV/ VNAV, ILS CAT1...). The operational credit provided by EFVS is particularly important regarding secondary aerodromes because they usually have CAT1 or higher than CAT 1 RVR – DA/DH minima and are therefore potentially more frequently impacted by adverse weather conditions.

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In addition, EFVS capability is a key operational advantage more especially for the business aviation community that is mainly composed of small/ medium operators with limited resources and operating frequently at small/ medium airports.

Beyond operational credit, the Vision Systems such as the EFVS improves situational awareness in all weather conditions for all operators at all airports contributing supporting decision making and increasing safety margin all the time.

On the aerodrome/ATC side, adaptations are necessary to allow these operations in low visibility conditions. Adaptations are comparable to those existing for low visibility take off and should be therefore financially affordable by small and medium aerodrome.

Enabling EFVS operations with operational credits provides a greater availability of suitable destination and alternate aerodromes during periods of reduced visibility.

This effectively reduces the number of weather-related delays, cancellations or diversions of flights to CAT II/III aerodromes, permits shorter routings and reduced fuel costs, a faster return to scheduled operations, and less passenger inconveniences.

Note: *Touchdown zone is defined as the first third of the runway.*

Operational Improvement Steps (OIs) & Enablers

The following Operational Improvement is under the scope of SESAR Solution #117:

- AUO-0403¹ — Enhanced Vision on Head Up display for the Pilot in Low Visibility Conditions

The following required enablers are supporting SESAR Solution #117:

- A/C-22 — Enhanced vision of external environment in low visibility conditions

Background and validation process

Solution #117 based on mature EFVS technology has been validated in SESAR 1 LSD02.02 (SESAR AAL) mainly through Full Flight Simulations activities and Live Trials using an experimental Falcon 7X modified aircraft.

¹ SESAR Solution, OI step and enabler to be created in DS18a (related CRs are CR 00989, CR 00990 and CR 00991).

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Although most of the validations were performed using Full flight Simulation in normal and in most adverse weather conditions (60 runs were performed in the F8X FFS), two flights in real low visibility conditions were also achieved, one of them being dedicated to the validation of the ATC / aerodrome part of the operation.

Flights were performed at Groeningen (6 approaches in RVR300m with F7X single HUD were performed in real operational environment) for the air part of the operation and in Bergerac/ Périgueux for the ground part of the operation.

In addition to simulation and flight exercises in real weather conditions:

- An aerodrome/ ATM impact study aiming at identifying the ATM requirements for EFVS with Ops credit operation was conducted jointly with DSNA.
- A performance prediction analysis supported by tests in fog chamber was conducted to support the benefit of the operation,
- A weather analysis taking into account 128 airports in Europe and frequently used by Bizjets was produced to demonstrate quantitatively how the EFVS with OPS credit operation would be beneficial.

Results and performance achievements

The above-mentioned validation exercises have provided the following main findings (SESAR AAL):

- A study conducted jointly between DASSAULT and DSNA and consolidated by a flight test demonstrated the adequacy of the aerodrome/ ATM procedure proposed for low visibility, even for small/ AFIS airports.
- 60 runs performed in the F8X full flight simulator by FLYING GROUP, DASSAULT and AIRBUS pilots in normal and abnormal conditions demonstrated the overall robustness of the EFVS with OPS credit operation, even in the most critical situations.
- 6 approaches flown by DASSAULT aviation falcon 7X experimental aircraft at one European regional airport in low visibility conditions demonstrated the benefits of the EFVS operation and confirmed that the operation is both feasible without any excessive difficulty and safe.
- Fog Chamber activities and flight test data confirm that EFVS performance prediction is achievable.
- In addition to trials, a broad weather analysis and an IFR procedure review have confirmed the potential benefit of the EFVS operation, and determined to what extent this concept could increase the access to secondary airports in low visibility conditions, and consequently decreased congestion at nearby main hubs.

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Recommendations and Additional activities

With respect to ground segment, SESAR AAL recommends to achieve the homologation/ approval of some controlled and AFIS aerodromes in cooperation with a CAA project leader to support, ease and speed up the deployment of the operation. The work done should be then shared with more European secondary aerodromes, including for example some with remote tower. As it was done in AAL, flights “check” should be achieved in real environment and low visibility conditions for validation.

Actors impacted by the SESAR Solution

Airspace Users (Pilots), Aerodrome operators, Air traffic controllers.

Impact on Aircraft System

Aircrafts need to be equipped with EFVS system composed of HUD and EVS IR/ visual based sensor.

A large number of business jets are already equipped with EFVS systems.

Impact on Ground Systems

SESAR AAL demonstrated that EFVS with Ops credit operation can be envisaged:

- at CATII/III airports with no change,
- at all other controlled IFR airport or uncontrolled IFR airport with AFIS, that are compliant with the recommendation proposed jointly with DSN (and considered in the ongoing EASA AWO regulation, see next section)

Regulatory Framework Considerations

SESAR AAL recommendations were shared with EASA.

The results have been used as a major input to support the ongoing rulemaking task RMT0379 dedicated to All Weather Operation, especially in defining the aerodrome-ATM criteria necessary for EFVS with Ops credit operations (AMC/GM of ADR part).

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On US side, recommendations were disseminated to both FAA certification and rulemaking offices.

Standardization Framework Considerations

The EFVS operation with Ops credit and associated requirements has been described by EUROCAE WG79 working group and RTCA SC123 committee in ED179 / DO315 document.

Considerations of Regulatory Oversight and Certification Activities

The aircraft solution can be certified through the current (EU) 965/2012 Regulation

Aerodrome recommendations identified by SESAR AAL will be considered in the frame of RMT0379 dedicated to low visibility operations.

Solution Data pack

The Data pack for this SESAR Solution includes the following documents:

- SESAR 1 LSD02.02 (SESAR AAL)

Intellectual Property Rights (foreground)

The foreground is owned by the SJU.

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