

### *Contextual note – SESAR Solution description form for deployment planning*

#### **Improvements in Air Traffic Management (ATM)**

The E-AMAN Common Service provides functions necessary to operate Arrival Management with an extended horizon in an environment where multiple actors are involved e.g. multiple Airports, AMANs, ACCs, UACs and other interested parties, e.g. NM (i.e. Cross Boarder Arrival Management).

There are two major drivers for implementing E-AMAN Operations.

- The need to deliver traffic approaching to an airport in an optimized sequence in order to minimize tactical intervention in the TMA
- The need to make best use of the airport capacity and the aim to reduce the resulting holding time by absorbing delay already in the en-route part of the flight or even before departure of the flight in case the departure airport is located within the eligibility horizon of the E-AMAN

Each airport has a different emphasis on the two drivers above, resulting from its specific situation, its layout and its operational environment. These major drivers listed above can be translated into economic savings due to reduction of cost of delay, fuel reduction and increased capacity.

E-AMAN is based on the calculation of scheduled times for runway thresholds and derived times for a Coordination Point and Metering-Fix.

Traditionally, the E-AMAN capability is delivered locally more or less integrated as part of the ER-APP ATC System.

Three scenarios of the E-AMAN Common Service were initially developed, “Generic”, “Co-location” and “Federation”.

The results of TRL2/V1 have led to discarding “Generic E-AMAN” for further work due to a very low probability to be implemented. Concerning Validation Exercises, for TRL6 (V3), the members of PJ.15-02 did a deeper examination and assessment of the “Federation” scenario.

The “E-AMAN Co-location” scenario, which had been subject to a Validation Activity in TRL4/V2 was not further developed in V3/TRL6 and no Validation Exercise specifically for Co-location was executed due to the following reasons:

- The basic capability of co-located hosting of separate E-AMAN systems and the combination of multiple E-AMAN outputs in a single Common Service interface was sufficiently validated to TRL4/V2 maturity.
- The TRL6/V3 Validation Exercise for the E-AMAN Federation Scenario was making use of co-located hosted E-AMAN instances.

## Federation of E-AMAN

The capability provided by the E-AMAN Federation Common Service is the capability of harmonising the output of local E-AMAN technical capabilities on different geographic or organisational levels (ECAC, FAB, however any other scaling could be considered in principle). The output of the Common Service is delivered to the end-users (e.g. adjacent ACCs / UACs). By this, relocation of functions between stakeholders is performed.

The E-AMAN Federation Common Service allows current systems to be transitioned to the new EUROCAE standard ED-254 based interfaces in a controlled way at minimal cost whilst maintaining current capabilities as required. The E-AMAN Federation Common Service allows transition from existing to new systems based on ED-254 in a cost effective and timely manner. This means ANSP's can choose when to invest in new systems/interfaces whilst meeting new standards at minimal cost.

### Operational Improvement Steps (OIs) & Enablers

- No Operational OIs
  - SDM-0402 E-AMAN Common Service (Business Improvement)
  - SVC-004 – Provision of cost-efficient E-AMAN capabilities using a Common Service
- Applicable Integrated Roadmap Dataset is DS19.

### Background and validation process

Due to the nature of the solutions within PJ.15, validations are “pure technical validations” proving technical feasibility. They do not directly address or validate Cost Efficiency, which is the overall goal of PJ.15's solutions. The proof of Cost Effectiveness is done with the CBA for the relevant Common Services for TRL6.

OCVM V3 maturity level corresponds to TRL 6, defined as Prototyping implementations on full-scale realistic problems using partial integration with existing systems. While limited documentation is available, the Engineering feasibility is fully demonstrated in actual system application.

This definition is fully aligned with the intended activities of PJ.15. The prototype (service interfaces) are defined, developed and integrated into appropriate Industry Based Platforms (IBP) and validated in a research (non-operational end-to-end) environment.

One Validation Activity has been performed by NATS / INDRA.



## NATS / INDRA Validation Activity

This exercise covers the Information Exchange of Arrival Management Information between the “Common Service Provider” and the “ER ACC” as described in the High Level Architecture of solution PJ.15-02. In this exercise, the provider and the consumer systems are from distinct manufacturers, in order to demonstrate the feasibility of using the Common Service interfaces to exchange the required data.

Recorded output data from the (co-located) Heathrow and Gatwick AMAN systems were sent to Snowflake’s Laminar application which acts as the Federator/Common Service Provider. The output from the Federator in ED-254 format was then published to the consumer, in this case Indra’s iTEC application and was displayed on the Controller Working Position.

## Results and performance achievements

### Technical Validation

The technical validation exercise demonstrated the feasibility of the Federator scenario of the E-AMAN Common Service in an operationally representative manner. The scenario has been validated with different partners and prototypes and by an operational Air Traffic Controller. The validation of the federated scenario has been validated using recorded live data.

The technical feasibility of an EUROCAE ED-254 Standard compliant E-AMAN Common Service distributing extended arrival management information of multiple airports to consumers based on the Federation scenario was demonstrated. Furthermore it was demonstrated that a client can subscribe to arrival data from two airports in the context of an operational scenario in the context of the Common Service Federator. The validation exercise also showed that defined QoS parameters e.g. Data Integrity which recorded for each message that correctly reached the consumer system, the percentage of attributes that have been received with no error or corruption.

### CBA

The business case for Extended AMAN common services is based purely on cost reduction. In particular, the Pilot Common Project (PCP) mandates E-AMAN deployment in 25 major European airfields (including Istanbul). The expectation is for a SWIM based solution. A small number of ANSPs have deployed AMAN systems and there have been a number of E-AMAN enhancements.

Assuming that providers are capable of a provision of E-AMAN, based on a SWIM foundation, deploying a common service results in:

- The requirement to deploy fewer (as opposed to 25) engineered capabilities - ANSPs will only bear a cost consistent with the services they receive.
- Service improvement roadmap across Europe is consistent and the associated costs are spread across common service ANSP consumers.

Consequently, the cost benefit relates to:

- Lower number of system deployments.
- Lower number of technical systems to be securely maintained in operation.
- Synchronisation of the evolutionary roadmap enabling consistency of concept.

There are no proposed primary benefits in terms of SESAR KPIs other than cost reduction. However, through the availability of an economically attractive Common Service, a quicker implementation of E-AMAN capabilities could be envisaged. Further, more ANSPs will be triggered to implement Extended Arrival Management. Both have a secondary effect on other SESAR KPIs than cost reduction.

### Recommendations and additional activities

- The feasibility of E-AMAN Common Service was validated on a technical and economical basis. Industrialisation of the E-AMAN Common Service can be started. Each Industry partner, ANSP or group of ANSPs (Corporations, FABs, Consortiums) should consider the Common Service approach for E-AMAN, validating the best deployment option (Federation, Co-location) based on their requirements and CBAs.
- The ED-254 Schema used between the Common Server Federator and the Consumer needs to be formally agreed and the mapping of data fields documented to ensure the correct values are propagated.
- It is recommended that any implementation has a module to monitor and manage the connection with the broker in order to deal with connection timeout issues.

### Actors impacted by the SESAR Solution

From a Business viewpoint, the Common Service Provider, ATS units (ACC, APP, TWR) and all further potential consumers of the data (AOC, NM, ...) are impacted. No change in concept of operations is envisaged.

### Impact on Aircraft System

n/a

### Impact on Ground Systems

As described in the High Level Architecture of the Common Service, the E-AMAN capability will be delivered by a Common Service provider who provides the service to consuming systems, i.e. mainly ATS Systems.



Main impact is on the adaptation of interfaces of the consuming systems if a connection to E-AMAN systems was in place before. For new E-AMAN exchanges between stakeholders new interfaces must be established and HMI capabilities need to be put in place.

### Regulatory Framework Considerations

Implementation of Arrival Management Extended to En-Route Airspace is required by regulation IR 716/2014 (PCP).

### Standardization Framework Considerations

The solution used the work of EUROCAE WG-104 (SWIM Service Standardisation on the example of an Arrival Sequence Service, ED-254).

### Considerations of Regulatory Oversight and Certification Activities

Arrival Management falls under Interoperability IR 552/2004, therefore, certification of the service provider will be necessary. AMAN Information is not seen as safety critical as AMAN is only used as a supporting tool by the ATCO.

### Solution Data pack

The Data pack for this Solution includes the following documents:

1. PJ\_15-02 - E-AMAN Service TRL6 Business Model v00.01.02
2. PJ15-02 E-AMAN Service TRL6 High Level Architecture Description v00.01.02
3. PJ15-02 E\_ AMAN Service TRL6 Service Description Document v00.01.01
4. PJ\_15-02 - E-AMAN Service TRL6 TVALP v00.01.01
5. PJ\_15-02- E-AMAN Service TRL6 AN v00.01.01
6. PJ\_15-02 - E-AMAN Service TRL6 TVALR v00.01.02
7. PJ.15-02 – E-AMAN Service TRL6 CBA v00.01.01
8. DEL-05 06 07-D53-Update of 5 6 4 SPR-INTEROP – Step 1 – Edition 2

### Intellectual Property Rights (foreground)

The foreground is owned by the SJU.