Contextual note – SESAR Solution description form for deployment planning

Improvements in Air Traffic Management (ATM)

The PJ.16-03 solution "Enabling rationalisation of infrastructure using virtual centre based technology" developed a concept for separating the data centre where the data is produced (the ATM Data Service Provider ADSP) from the ATCOs location (the Virtual Centre ATSU). 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 ADSP 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 ensure service continuity.

Firstly, the objective of this activity was to define the Virtual Centre concept.

The definition of a Virtual Centre is:

> *A grouping of Air Traffic Service Units (ATSU), possibly geographically separated, sharing ATC operations amongst themselves using data services provided by one or more ATM Data Service Providers (ADSPs) through interfaces defined in Service Level Agreements, in a safe and secure manner.*
>
> *This decoupling delivers the flexibility and performance aspects of the services to ensure the ability of the virtual centre solution to at least support or to improve the operational performance.*

Based on this definition, a comprehensive set of use cases have been identified and a selection of the most interesting ones have to be developed with the entire community. This result has been transferred to the solution PJ.15-09.

Secondly, showstoppers (linked to safety, security, regulation, etc.) were also identified, studied and, when necessary, mitigated to ensure the feasibility of the implementation.

Finally, on the technical side, the objective was to model and then validate services between the 2 new entities: ADSP and Virtual Centre ATSU. Based on the selection of services identified from the current system exchanges and based also on partially modelled services developed by SESAR1 B.04.04, the TRL4 activities modelled an expanded set of services. These services went through a technical validation process for TRL6. To conduct these technical validations of the services, platforms from different suppliers were provided.

Operational Improvement Steps (OIs) & Enablers

Status of the OI and EN

Reference and Title	Dataset	Status
POI-0002-SDM: Supporting rationalisation of infrastructure by using the Virtual Centre concept	DS 19	Validated
ER APP ATC 184: ATM Data Service Provider for ATC services in a Virtual Centre context	DS 19	Validated
ER APP ATC 185: ATM Data Service Provider for Voice services in a Virtual Centre context	DS 19	Validated
ER APP ATC 186: Virtual Centre ATSU	DS 19	Validated
SVC-008: Provision and Consumption of FlightDataDistribution Service in the context of Virtual Centres.	DS 19	Validated
SVC-009: Provision and Consumption of FlightDataManagement Service in the context of Virtual Centres	DS 19	Validated
SVC-010: Provision and Consumption of CoordinationAndTransferManagement Service in the context of Virtual Centres	DS 19	Validated
SVC-013: Provision and Consumption of Airspace Status Distribution Service	DS 19	Validated
SVC-014: Provision and Consumption of Arrival Sequence Distribution Service	DS 19	Not Validated
SVC-015: Provision and Consumption of Arrival Sequence Management Service	DS 19	Not Validated
SVC-016: Provision and Consumption of Correlation Distribution Service	DS 19	Validated
SVC-017: Provision and Consumption of Correlation Management Service	DS 19	Validated
SVC-018: Provision and Consumption of Medium Term Conflict Detection Distribution Service	DS 19	Not Validated

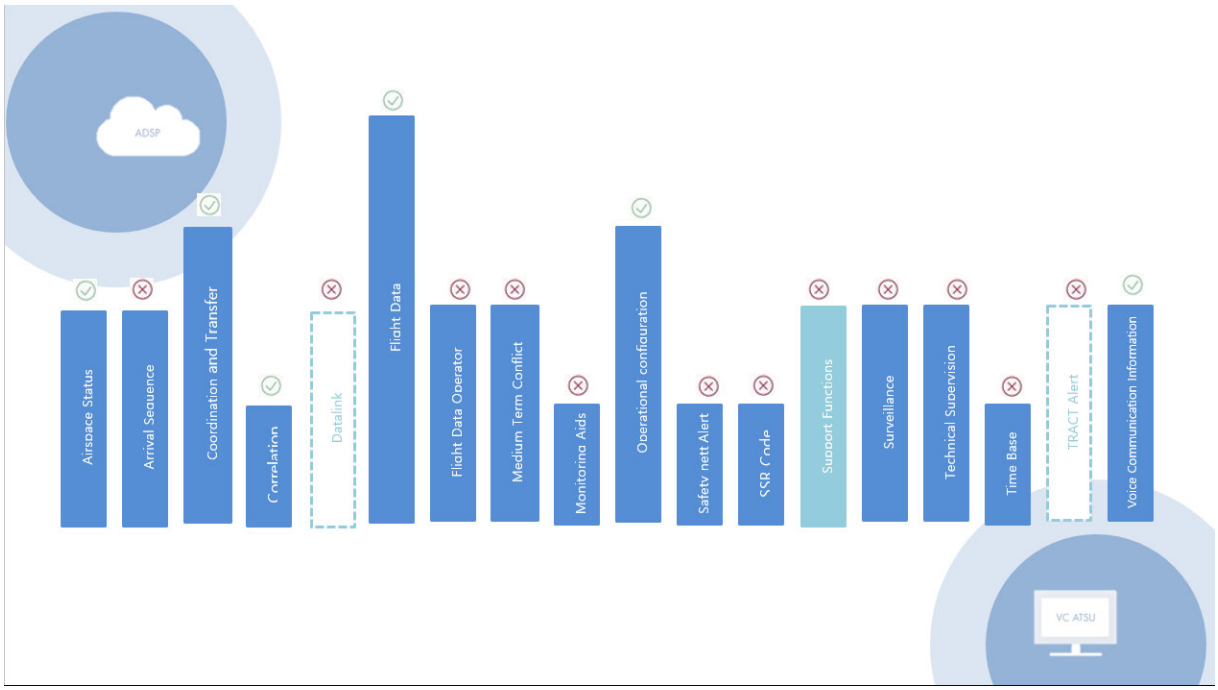
Reference and Title	Dataset	Status
SVC-019: Provision and Consumption of Medium Term Conflict Management Service	DS 19	Not Validated
SVC-020: Provision and Consumption of Monitoring Aids Distribution Service	DS 19	Not Validated
SVC-021: Provision and Consumption of Operational Configuration Distribution Service	DS 19	Not Validated
SVC-022: Provision and Consumption of Operational Configuration Management Service	DS 19	Not Validated
SVC-023: Provision and Consumption of Safety Net (SNET) Alert Distribution Service	DS 19	Not Validated
SVC-024: Provision and Consumption of SSR Code Distribution Service	DS 19	Not Validated
SVC-025: Provision and Consumption of SSR Code Management Service	DS 19	Not Validated
SVC-028: Provision and Consumption of Surveillance Data Distribution Service	DS 19	Not Validated
SVC-031: Provision and Consumption of Time-based Separation Distribution Service	DS 19	Not Validated
SVC-032: Provision and Consumption of Time-based Separation Management Service	DS 19	Not Validated
SVC-033: Provision and Consumption of Voice Comm Information Distribution Service	DS 19	Validated
SVC-034: Provision and Consumption of Voice Comm Management Service	DS 19	Validated
SVC-026: Provision and Consumption of Support Functions Distribution Service	DS 20 Not Approved	Not Validated
SVC-027: Provision and Consumption of Support Functions Management Service	DS 20 Not Approved	Not Validated
SVC-029: Provision and Consumption of Technical Supervision Distribution Service	DS 20 Not Approved	Not Validated

These Enablers are mandatory for the deployment of the SOA architecture promoted by this Solution.

There is no prerequisite solution for PJ.16-03.

Services specification status and validation status could be illustrative as follow:

- Specification is illustrative by the box:
  - size of the box indicating the relative complexity one service to another,
  - this colour indicates the service is completely defined,
  - this colour indicates the service is partially defined,
  - this colour indicates the service is identified.
- Validation status is illustrative as: ✓ Indicates the service is validated (based on validation of some operations), ⊗ indicates the service is not validated



Background and validation process

The SESAR Solution has been validated through five validation exercises at the TRL4 level and two validation exercises at the TRL6 level, addressing different aspects of Virtual Centre concept implementation:

Validation exercise	TRL4 Exe #1	TRL4 Exe #2	TRL4 Exe #3	TRL4 Exe #4	TRL4 Exe #5	TRL6 Exe #1	TRL6 Exe #2
Service Orientation	X		X	X	X	X	
Multi-vendors	X		X		X	X	
CWP Cross-validation	X		X			X	
ADSP Cross-validation	X				X	X	
Remote usage	X	X	X	X	X	X	X
QoS expectations	X	X	X	X		X	
Mapping of the technical enabler to the delegation operational need	Not in TRL 4 objectives					X	X
Mapping of the technical enabler to the contingency operational need						X	

Results and performance achievements

The following milestones have been successfully achieved by the solution PJ.16-03:

- Virtual Centre definition: this definition has been proposed by the solution and is now endorsed by the community. It is important to have this common definition for a new concept.
- VC Architecture for Rationalization of Infrastructure: this architecture has been developed by partners as the reference architecture. As a result, this architecture has been analysed in detail and modelled in EATMA.
- Design of VC Services: Service orientation is one of the pillars of the ATM Master plan. The solution has defined most of the services down to a level of detail that is needed for implementing the developed VC architecture.
- Convergence in the choice of technologies: this solution is a technical solution and it is a significant achievement to have a convergence in the choice of technologies among the industrial partners. AMQP, being part of the SWIM Yellow Profile, was chosen as the core technology for implementing the validation exercises.

- Validation of the concept: Five TRL4 exercises and two TRL6 exercises were conducted. The validation objectives, defined by partners and agreed by SJU at each maturity level, were achieved.
- Reach TRL6 level: TRL2, TRL4 and TRL6 Gates passed successfully during the Wave 1 period over the course of 3 years.

Recommendations and Additional activities

Recommendations for next phase

For further improvement, in particular the follow-up research activities in SESAR2020W2 PJ.10-w2-93, PJ.16-03 makes the following recommendations:

- Continue to extend the services and operations coverage to further improve the capabilities of the ATM and Voice systems.
- Build upon the TRL6 validation exercises Exe #1 and Exe #2 and continue to demonstrate the operational use cases of PJ.15-09/PJ.10-w2-93.
- Continue having operational representativeness e.g. by involving ATCOs
- Have more complex or dense scenario in the Exercises based on realistic data.
- Continue the analysis of Quality of Service.
- Plan sufficient time for developing the validation exercises in order to address the complexity of the integration and of the deployment generated by the high number of partners.

Recommendations on regulation and standardisation initiatives

To improve the implementations in the TRL6 phase, it is recommended that the semantic definitions of the service operations are improved in the SDD. Currently, SDDs describe the syntax of the service interfaces and service operations as well as examples of their dynamic behaviour. However, during the preparation of the technical validation exercises, there were some misalignments between partners about the precise semantics of some operations, which increased the effort for developing the prototypes.

Actors impacted by the SESAR Solution

Following stakeholders are impacted by SESAR Solution PJ16-03

- Air Navigation Service Providers (ANSPs)
- New stakeholder: Air Data Service Provider (ADSP).
- Ground manufacturers

Impact on Aircraft System

No impact on Aircraft Systems

Impact on Ground Systems

The final impacts of the Ground system depend on the final architecture.

Regulatory Framework Considerations

No regulatory framework consideration has been identified.

Standardization Framework Considerations

One of the main goals of PJ.16-03, as described by the grant, was to define services that 'are ready for standardisation'. Within the solution, 25 services were defined and introduced into EATMA by corresponding Change Requests. Due to the large number of services developed by the solution, their maturities are different: some services are quite mature while others are at an early stage of development. PJ.16-03 has put extra effort into the development of the FlightDataDistribution, FlightDataManagement and CoordinationAndTransferManagement services which together define the very core of the ATS systems. The work on these services had already started in SESAR1 B.04.04, and as a result of the work in PJ.16-03, the services were harmonised to a great extent, so that they are the first candidates for a standardisation at EUROCAE. The CR3386 has been raised in order to indicate the need for these three services.

Considerations of Regulatory Oversight and Certification Activities

Safety considerations and security considerations were identified and are available within the specific reports.

Solution Data pack

The TRL6 Data pack for this Solution has been delivered the 9th December 2019.

Intellectual Property Rights (foreground)

The foreground is owned by the SJU.