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 Technological Solution 'De-icing management tool' refers to a system capable of improving the predictability of aircraft de-icing operations at European airports where Airport Collaborative Decision Making (A-CDM) is already deployed. The procedure of applying required de-icing fluids to aircraft at most airports is primarily a business process that takes place between an airline and a specialised ground handling agent. The Solution increases the accuracy of information related to when the procedure is going to take place, how long it will take and when the aircraft will be ready to taxi for departure, which is currently calculated at best by predetermined estimates. The Solution means that air traffic controllers will have greater situational awareness of de-icing activities and no longer need to make their own estimates of when aircraft are ready for departure. The Solution envisages that de-icing operations are no longer characterised by the A-CDM concept as 'adverse conditions', i.e. a state that is in need of collaborative recovery procedures, but rather a part of normal operations in the winter period.

The winter season at European airports can last from a few days to many months and during this time de-icing services may need to be provided. The starting point for the De-Icing Management Tool is the principle that performance improvements can be made by introducing new tools and methods that take data inputs from meteorological service providers and involve the relevant airport stakeholders. The process can therefore become predictable under certain weather conditions and treated as a regular procedure in normal operations.

The SESAR Solution is a De-Icing Management Tool (DIMT) which allows for the scheduling and monitoring of de-icing operations. To date it has been developed as an internet browser-based tool but other implementation choices are possible depending on the architecture of the deployment environment. It addresses three distinct procedures for de-icing:

- Remote de-icing, which occurs at a specific location on the airport away from the parking stand;
- On-stand de-icing, which occurs just before the aircraft leaves its stand; and

- After-push de-icing, which occurs after the aircraft has pushed back from the stand and is positioned to start taxiing after de-icing.

The tool has two key functions, the first of which is to accurately estimate the duration of the de-icing and/or anti-icing procedures for a given airframe. This elapsed time is dependent on three parameters: the aircraft type, the prevailing weather conditions at the airport during the aircraft's visit and the number of de-icing rigs used for the application of de-icing and anti-icing fluids.

The second function is to calculate a de-icing sequence that optimises available resources and allocates them to slots in a timeline while taking into account the constraining variables that limit how the problem can be optimised. For on-stand and after-push operations de-icing rigs are assigned to these slots, while remote de-icing considers the track availability at the designated location, i.e. the de-icing pad.

The De-icing Coordinator and the De-icing Agent can refine the sequence through the DIMT user interface to account for any *ad hoc* situations that are not handled by the tool.

The DIMT produces Estimated De-icing Time (EDIT), Estimated Commencement of De-icing Time (ECZT) and Estimated End of De-icing Time (EEZT) time stamps and publishes these to the A-CDM platform, both improving the quality of de-icing milestone information and increasing common situational awareness for other airport actors.

Operational Improvement Steps (OIs) & Enablers

- AIRPORT-04: De-icing support tool in a A-CDM environment[1] (TRL6)

The applicable Integrated Roadmap Dataset is DS16.

Background and validation process

The De-icing Management Tool supported two SESAR validation exercises. The first exercise was conducted at the V2 level of maturity and tested the calculation of estimated de-icing times for each aircraft. It was trialled in laboratory conditions using recorded data as inputs.

A more advanced V3 exercise was conducted in live trial conditions at Oslo and Stockholm Arlanda Airports. The DIMT used live operational data provided by the Airport Operations Database (AODB) as inputs at both locations. The tool was tested in shadow mode before execution in order to confirm its correct functionality.

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[1] A CR is in progress to amend the description of the AIRPORT-04 Enabler to make it clear that the tool is proposed for use in an A-CDM environment and has not currently shown to be integrated with the Airport Operations Plan (AOP) concept proposed in Solution #21. The CR also proposes amendments to V-cycle dates with V3 End achieved on 31 December 2016.

The DIMT prototype could not be trialled extensively owing to the mild winter conditions that were experienced during the planned exercise periods, but the positive results were nevertheless encouraging to support further development and deployment of the tool.

Results and performance achievements

The validation activities produced the following main findings:

- The DIMT can calculate the estimated de-icing time for specific flights within a three minute interval;

- The DIMT can present an optimised de-icing sequence that takes existing constraints into account, with a planning horizon two hours in advance; and

- The DIMT offers a view of the evolving requirement for de-icing operations which provides an increased common situational awareness for the relevant airport actors.

The Solution provides the following benefits:

- Increased adherence to target take-off times, on the basis that individual de-icing times are now calculated for each flight and therefore the predictability of the taxi-out phase is increased;

- Increased predictability during de-icing weather conditions, owing to the de-icing sequence being planned two hours in advance; and

- Increased situational awareness for airport actors due to the availability of de-icing time stamps and the de-icing sequence being published in the A-CDM platform.

Recommendations and Additional activities

The following activities are relevant when transitioning towards industrialisation (V4):

- Develop appropriate training processes for the involved airport stakeholders, particularly De-icing Coordinators and De-Icing Agents;

- Develop stronger integration with existing operational dispatch systems used by De-icing Agents;

- Develop operational and technical procedures to mitigate and manage system failures;

- Consider developing stronger integration with other tactical planning functions (e.g. DMAN);

- Consider the future development of functionality for the increasing use of integrated and dynamic meteorological information, e.g. 4DWxCube provided by SESAR Solution #35; and

- Consider the future development of functionality for integration with the Airport Operations Plan (AOP), provided by SESAR Solution #21.

Actors impacted by the SESAR Solution

Actors impacted by the De-Icing Management Tool are:

- De-icing Agents (including De-icing Coordinators) who provide de-icing operations services at airports; and

- Air Traffic Controllers (ATCOs) who will have access to enhanced A-CDM information.

Other airport actors can benefit from the Solution through the increased quality of A-CDM de-icing time stamps, allowing for improved decision making against their individual business objectives.

Impact on Aircraft System

This Solution has no impact on aircraft systems.

Impact on Ground Systems

The De-Icing Management Tool is a new tool for use by De-icing Agents. A-CDM de-icing time stamps should be published to the A-CDM platform through dedicated interfaces for full benefit.

Regulatory Framework Considerations

This Solution has no impact on regulatory framework considerations.

Standardization Framework Considerations

Estimated De-icing Time (EDIT) is currently a defined metric in the EUROCONTROL A-CDM implementation manual. It is the difference between the Estimated Commencement of De-icing Time (ECZT) and the Estimated End of De-icing Time (EEZT). The results from validation exercises imply that EDIT can be a constituent component in itself and work as an input for

the calculation of ECZT and EEZT. Therefore it is proposed that the definition of EDIT is altered to "Estimated Time Duration for the De-icing/Anti-icing of an Aircraft".

Considerations of Regulatory Oversight and Certification Activities

This Solution requires no consideration of regulatory oversight and certification activities.

Solution Data pack

The data pack for this Solution includes the following document:

- **Technical Specification[2]**: Project 06.06.02 D32 Edition 00.01.02 (01.12.2016). This document provides the functional analysis for the final system requirements of the De-icing Management Tool (DIMT);

Intellectual Property Rights (foreground)

The foreground is owned by the SJU.

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[2] All requirements in the Technical Specifications but one (REQ-06.06.02-TS-INEX.0003, related to a feature (cancellation of de-icing request) that is not implemented in the publishing system yet) are implemented in the V3 prototype and are covered by the verification exercises/test cases