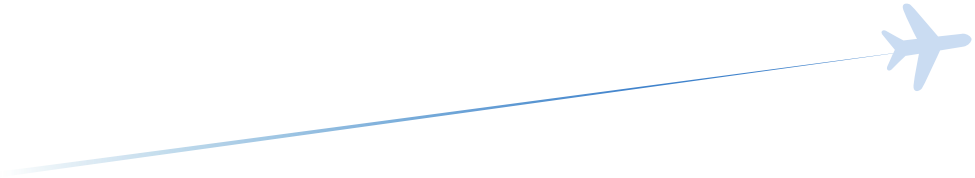

SESAR PJ.18-04b-02 CONTEXTUAL NOTE TRL6 Cb-global

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[PJ.18-04b]

IMPROVED MET INFORMATION

This Contextual Note is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 734161 under European Union's Horizon 2020 research and innovation programme.

Abstract

This TRL6 Contextual note provides SESAR Solution description for the solution Cb-global capability and Cb-global service proposed by PJ.18-04b.

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1 Purpose

This contextual note introduces the TRL6 solution Cb-global developed in PJ.18-04b Improved MET information. The document presents a summary of the results stemming from R&D activities and contribution to deployment. It provides to any interested reader (external and internal to the SESAR programme) an introduction to the Solution in terms of scope, main benefits, relevant system impacts as well as additional activities to be conducted during the industrialisation phase or as part of deployment. This contextual note complements the technical data pack comprising the SESAR deliverables required for further industrialisation/deployment.

2 Improvements in Air Traffic Management (ATM)

PJ.18-04b designs and develops improved Meteorological information (MET) services and capabilities that generate MET data and provide these data through information services, thereby contributing to enhanced information sharing. The activities of PJ.18-04b were organised with operational use in mind where the information services were developed based on the need of operational solutions within the SESAR 2020 Industrial Research (IR) programme.

At the end of Wave 1, PJ.18-04b proposes two TRL6 solutions that have been matured in the course of Wave 1. This contextual note presents the solution Cb-global activities which contain a capability and a service.

Cb-global capability uses data from geostationary satellites to detect, track, and nowcast thunderstorms in order to provide pilots an overview of the current weather hazard situation beyond the limited view of the on-board radar. It is relevant for the upper airspace en-route and enables a pilot to strategically plan a safe and smart flight route around the thunderstorms well ahead in time instead of flying tactical manoeuvres and searching for gaps between the thunder cells. Subsequently these Cb-global data are provided through the Cb-global service to be used in the cockpit. The service provides MET hazards information to the flight management operation of a civil airspace user operation centre.

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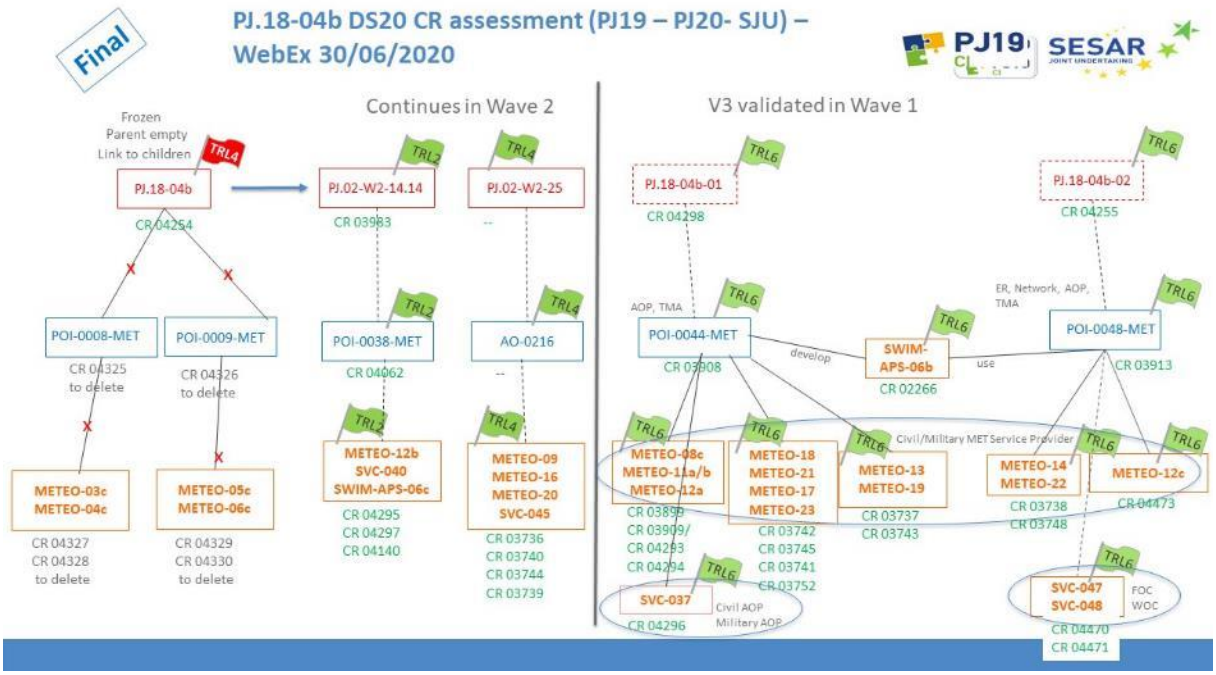
3 Operational Improvement Steps (OIs) & Enablers

The following OI and ENs have been considered to address the solution which have been created and endorsed in DS 20:

- POI-0048-MET
- METEO-14
- METEO-22
- SWIM-APS-06b
- METEO-12C
- SVC-047
- SVC-048

The following picture displays the structure of OIs and ENs of the two PJ.18-04b solutions that have been endorsed in DS20:



- **Figure 1: PJ.18-04b OIs and ENs**

4 Background and validation process

Both Cb-global capability and Cb-global service were not part of SESAR Wave 1. However, outside of SESAR, previous work was performed within the EU FP6 project “FLYSAFE” (Airborne integrated systems for safety improvement, flight hazard protection and all weather operations, 2005-2009, http://cordis.europa.eu/projects/rcn/75794_en.html) and within DLR internal research projects.

During these projects, both the Cb-global capability and the Cb-global yellow profile service have been intensively tested in cooperation with aviation stakeholders in several campaigns, e.g. at airports and in data link tests. Based on the feedback of the aviation stakeholders, the technologies have been further developed and had already reached TRL5 before the start of SESAR 2020. Within SESAR2020 PJ.18-04b the aim is to bring both the Cb global capability and the Cb-global yellow profile service to TRL6.

The Solution performed two technical validation exercises for the developed capability and service. The validation exercise addressing capability validated whether Cb-global is able to detect and nowcast thunderstorms (Cb), convectively induced turbulence (CIT), and high altitude ice-crystals (HAIC) and assessed contribution of Cb-global information in terms of potential performance benefit. The validation exercise focusing on the Cb-global service, validated whether the service is able to provide Cb-global data through a SWIM Technical Infrastructure Yellow Profile to the flight management operation at a civil airspace user operation centre. Both validation exercises were performed at the DLR premises.

5 Results and performance achievements

The technical validation exercises addressed the validation objectives and corresponding success criteria described in the PJ.18-04b technical validation report. The results shown that all validation objectives were met. In particular, regarding the Cb-global capability, the following performance achievements can be identified:

A statistics assessment was performed where real flown flight routes were compared with flight routes optimised on the basis of Cb-global information. Potentially, both show considerable fuel savings if Cb-global is used for the flight planning[1]:

- On average 0,548 tonnes of potential fuel savings per flight
- Some cases result in a fuel saving potential up to 3 tonnes per flight
- some avoidance manoeuvers were not necessary at all
- landings at alternates can be avoided

Regarding the Cb-global service, the validation results show that service was able to provide the data in the appropriate format in real time mode to the data consumer.

The following can be concluded:

The validation results with Cb-global highlight what can be done with satellite data today regarding the observation and nowcasting of hazardous phenomena like thunderstorms, convectively induced turbulence, and icing conditions for raising situational awareness in aviation. The Cb-global information gives an overview of the hazard situation and its severity. However, it also extends the limited view of the on-board radar by providing a broader picture of the areas that are free of hazards. It happens that a situation identified as hazardous by standard on-board means is exposed as harmless by the view of the satellite. That implies that the precautionary measures which have to be taken in hazardous situations can be optimized by using the satellite view as an additional information. The use of Cb-global as an additional strategic planning tool thus results in an operational benefit. This benefit will even increase if the Cb-global information is used both in the air and on the ground for a common information sharing (CIS) and common decision making (CDM).

[1] It should be emphasised that these are potential benefit that could be achieved resulted from the solution's assessment and these are not obtained from operational validation.

6 Recommendations and Additional activities

The following recommendations can be considered regarding the Cb-global activities:

- Training for pilots: They have to learn how to combine the on-board information with the information provided by Cb-global and include this in their decision making process.
- Design means for pilots: New beneficial measures for flight planning have to be defined that account for the availability of real time hazard information. This could be a task for SESAR2020 Wave 2 (e.g. within PJ18W2 Sol .57).
- Cb-global hazard data have to be disseminated and made available to pilots and other aviation stakeholders in order to enable the common evaluation of hazard information from different tools.
- Provision of tools that represent and display the hazard information and graphically enable the combination of the hazard information coming from different sources (Cb-global vs. on-board radar).
- Address safety related aspects in an operational context.

7 Actors impacted by the SESAR Solution

The following actors could be impacted by the Solution:

- Airspace User
- Civil airspace user operation centre
- Air Traffic Service Provider
- Meteorological Service Provider

8 Impact on Aircraft System

Aircraft should be equipped with systems that are able to receive and display the hazardous weather information provided by Cb-global.

9 Impact on Ground Systems

The solution considers the use of civil airspace user operation centre as an intermediate means for the transfer of the Cb-global data, therefore the operational centre is expected to be equipped with data filtering and processing systems for the reception, processing and further provision of the Cb-global data to the cockpit.

10 Regulatory Framework Considerations

No specific considerations on regulatory framework.

11 Standardization Framework Considerations

The solution applies the principles and guidance defined by SWIM Technical Infrastructure Yellow Profile.
Depending on further evolution of the solution, standardisation activities could be needed in future.

12 Solution Data pack

The Data pack for this Solution includes the following deliverables:

- TS/IRS D4.2.210 SESAR 2020 PJ.18-04b TRL6 Technical Specification, Edition 00.02.00.
- TVALR D4.2.200 SESAR 2020 PJ.18-04b TVALR forTRL6, Edition 00.01.07.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