

SESAR Solution

Enhanced STCA with down-linked parameters

Contextual note

Purpose:

This contextual note is a vehicle to summarize the results stemming from Release delivery activities. It provides a summary of the SESAR Solution in terms of results of the Validation exercises and achievements as well as additional activities to be conducted before or as part of deployment.

This contextual note is part of a package prepared for each SESAR Solution for which exercise results are conclusive and sufficient to support a decision for industrialisation. It complements a technical data pack comprising available deliverables required for further industrialization.

Improvement in ATM Operations

The solution “Enhanced STCA with down-linked parameters” validated the benefit of using existing down-linked aircraft parameters (DAP) available through Mode S EnHanced Surveillance (EHS) (i.e. Selected Flight Level, Roll angle/Track angle rate) to increase the reliability and accuracy of the STCA. A comparative analysis of results demonstrated that the solution:

- improves warning times;
- decreases nuisance alerts rate; and
- maintains the genuine alerts rate.

The evaluative analysis highlighted:

- an increased ATCOs’ trust on the STCA tool; and
- a reduced ATCOs’ workload;

Operational Improvements – OI Steps

The OI addressed by this solution is:

- **CM-0807-A - Enhanced Ground-based Safety Nets using Mode S EHS data**

Background

STCA (Short Term Conflict Alert) is a ground system designed and deployed to act as ultimate safety net against the risk of having collisions between aircraft due to separation loss. STCA can be used in both en-route and TMA radar environments. The difficulty of STCA development lies in the need to avoid having a high false alert rate, while still making sure that real conflicts always trigger an appropriate and timely warning. Specific tuning is necessary for STCA to be effective in the TMA, in order to account for lower separation minima, as well as increased frequency of turns, climbs and descents.

STCA performance can be enhanced if Mode S downloaded airborne information is taken into account in order to better model future aircraft trajectories. This SESAR solution uses downlinked

information on both Selected Flight Level (SFL) and Track Angle Rate (TAR), as well as mode C trajectory data, and combines them to extrapolate what each aircraft's position will be in a 120 seconds look-ahead horizon. This makes it possible for the tool to detect any potential separation losses that may occur within that horizon.

SFL is the flight level that the flight crew has entered in the FMS, and therefore gives information on which flight level the aircraft is really climbing or descending to. It is particularly useful in cases of Radio Telephony (RT) misunderstanding, like readback errors or one flight having copied a vertical clearance that was for another flight. An aircraft's TAR is determined by its roll angle and True Air Speed (TAS), and indicates how fast the flight is turning. Knowledge of the TAR is particularly useful in the TMA, where aircraft manoeuvre more frequently than in an en-route environment.

This SESAR solution has been validated through Real Time Simulation (RTS) in a simulated Milan ACC (1 TMA sector and 1 en-route sector plus 1 feeder) airspace on the ENAV IBP (Rome, Experimental Centre) integrating a SELEX ES prototype developed on purpose, with scenarios using real data.

Results and performance achievements

The solution is supported by detailed analysis and feedback on the benefits and the potential advantages in detecting loss of separation minima linked to the implementation of STCA supported by the DAP in the simulated environment:

- the alert rate of the relevant conflicts was maintained, and in some cases increased;
- a relevant reduction of the nuisance alarms has been recorded; and
- there is evidence of improvements in the alert warning time within the En Route and TMA airspaces.

The validation results confirmed the benefits in terms of increased efficiency and work capability of Controllers. As a matter of fact, the increased confidence in the system triggers Controller's attention on real traffic conflicts only. In concrete terms:

- operational benefits related to significant reduction of nuisance alerts were identified, compared to the current STCA tools operating without DAP information;
- ATCOs perceived that the workload with this enhanced STCA tool, was reduced compared to current working with the STCA version currently in operation; and
- ATCOs reported significant higher trust values with DAP support compared to the current STCA version.

In summary, this SESAR solution provides positive impact on the following KPAs:

- Safety; and
- Human Performance.

In terms of confidence assessment, the use of STCA+DAP is globally rated quite high with a more significant effect recorded in the En-Route sector. From the system performance point of view, Both SFL and TAR provide improvements to the STCA tool, with Selected Flight Level (SFL) received from the DAP being the most effective and operationally relevant contribution to the improvement of the STCA in the reduction of non-operationally relevant alerts.

It is recommended to tune the STCA tool in order to filter the traffic below a certain altitude (3000 ft – minimum radar- has been suggested) to avoid nuisance alerts due to aircraft still on the ground. It is recommended as well to implement specific filters/volumes in the terminal area to allow customized tuning (e.g. according to the type of traffic or tasks).

Additional activities

The development and validation of a specific Controller's HMI to display both the Cleared Flight Level (CFL) and the Selected Flight Level (SFL) would be needed.

Actors involved

The involved actors are:

- ATCOs.

Impact on A/C system

A/C need to be equipped with Mode S EHS capability

Impact on ground systems

The STCA tool has to be improved and based on a multi-hypothesis algorithm, capable to receive and use Mode-S EHS down-linked aircraft parameters (Selected Flight Level, Roll angle/Track angle rate).

Dedicated ground HMI for the Controller Working Position to display on track label of CFL and SFL is also needed.

Consideration of Regulatory Framework

Results arisen from this validation activity do not impact the STCA concept itself. The results provide further support to the acceptability of the STCA use, in particular in the TMA. The concept related to STCA+DAPs, at this stage, has not impact on current Regulation and Standardisation activities.

Consideration of Standardisation Framework

The concept related to STCA+DAPs, at this stage, provides performance improvement to STCA currently in use and there is no impact on current Regulation and Standardisation activities.

Considerations of Regulatory Oversight and Certification Activities

The link between safety objectives, safety requirements, safety targets and functional systems should be establish to better evaluate performance of the system, as well as the interaction with airborne safety nets could be considered. The benefits of the concept could be refined through the analysis of recorded data, in particular on the headings. In the elaboration of safety arguments in operational sites, hazards derived from local conditions must be taken into account.

- Severity classifications in the safety assessments during deployment must take into consideration the particular effects on the concrete environment.

- As far as practicable, quantitative safety objectives for STCA performance should be determined at local level, in particular regarding software assurance.
- The consistency between the conflict prediction algorithms STCA performance shall be verified at the local operational scenario.
- At local implementation, the specific training objectives, and needs to train relevant staff associated to the operation of the solution has to be identified.

Concept Option reference (OFA and Validation Exercise titles)
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OFA 03.04.01 – Enhanced Ground Based safety Nets

EXE-04.08.01-VP-239 – enhanced STCA using existing down-link parameters