PJ.11-A3 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)

Solution PJ.11-A3 addresses a specific function of the ACAS X system, variant ACAS Xo which allows the use of alternative Collision Avoidance (CA) logic for specifically designated traffic while maintaining normal ACAS Xa alerting against all other aircraft. ACAS Xo is a supplement to ACAS Xa to allow special operations such as parallel approaches that would otherwise be likely to trigger ACAS Xa alerts. Both ACAS Xa and Xo were developed in parallel and share the same standard released in September 2018 (RTCA DO-385/EUROCAE ED-256).

ACAS Xo is integrated with ACAS Xa systems, but activation of the ACAS Xo functionality is optional (through dedicated HMI). It provides additional collision avoidance logic modes designed to support closely-spaced flight operations and allows specifically designated traffic to be monitored by an alternative ACAS logic more compatible with the flight operation than the standard ACAS Xa logic. So far, there are two Xo modes defined by EUROCAE/RTCA in MOPS:

1. For Closely Spaced Parallel Operations to a runway pair with 4,300ft down to 3,000ft runway separation, ACAS Xo mode (**CSPO-3000**) associates designated traffic with modified CA logic monitoring more appropriate for parallel operations; applicable in both visual and instrument conditions. ACAS Xa protection is maintained on all other cooperative traffic.

2. For Closely Spaced Parallel Operations to a runway pair with less than 3,000ft runway separation, Designated No Alerts mode (**DNA**) can suppress all alerts and guidance (except during multi-threat encounters) on the specifically designated traffic; this requires the flight crew to visually acquire the desired traffic before designating it while maintaining visual separation from the DNA-designated aircraft. This mode is intended for use in closely-spaced operations on visual conditions, where ACAS Xa alerts could otherwise be a nuisance, then ignored, and/or disruptive. DNA mode may be used instead of placing ACAS Xa into TA-only mode, preventing alerts on the designated traffic but still allowing full ACAS Xa protection from all other cooperative traffic.

Additional ACAS Xo modes are expected in the future, however only CSPO-3000 and DNA are defined in ACAS Xa/Xo MOPS published in 2018.

Operational Improvement Steps (OIs) & Enablers

The PJ.11-A3 solution covers the OI step **CM-0808-o**: Collision Avoidance for commercial air transport Adapted to New Separation Modes, addressing the Enabler **A/C-54a**: Enhanced Airborne Collision Avoidance, Enabler **A/C-54b**: ACAS adaptation to new separation modes and Enabler **HENA01094**: ACAS Xo functions to be performed by the Flight Crew. There are CRs in the EATMA model V13.0 Draft / DS20 Draft.

Background and validation process

"ACAS" is a generic acronym used by ICAO for the specific line of avionics that is certified to provide decision support to pilots during encounters with other aircraft when there is an imminent risk of collision.

Since 2008, the FAA's TCAS Program Office (PO) initiated a research and development program under RTCA SC-147 of a new approach to collision avoidance – ACAS X. The work is done in cooperation with SJU, under aegis of FAA-SJU Coordination Plan 4.1. ACAS X has several variants which share an underlying common design, but have hardware, surveillance, and collision avoidance logic tailored for different user groups.

Solution PJ.11-A3, address a specific function of the ACAS X system, variant ACAS Xo which allows the use of alternative CA logic for specifically designated traffic while maintaining normal ACAS Xa alerting against all other aircraft. ACAS Xo is a supplement to ACAS Xa to allow special operations such as parallel approaches that would otherwise be likely to trigger nuisance ACAS Xa alerts.

These two ACAS Xo modes were subject to an evaluation in the Real-time simulations in Airbus and also during an operation workshop with airspace users was organized by Honeywell.

Results and performance achievements

From the validations performed in this PJ.11-A3 project, we can conclude that ACAS Xo as defined in the ACAS Xa/Xo MOPS (RTCA DO-385/ EUROCAE ED-256 published in October 2018) is technically feasible since no technical blocking point was observed (pilots were able to perform approaches with ACAS Xo activation). However, from operational point of view, the validation results don't fully support achieving V2 maturity for EU airspace:

- While ACAS Xo system requirements are specified in ACAS Xa/Xo MOPS, there is no detailed operational definition published for ACAS Xo procedures, only a high level Concept of Operation being currently available. No obvious procedure of stand-alone designation by crews was identified (i.e. without the help of controller). The principle of reducing the safety net in DNA mode was also argued.

- Currently, there is no use cases identified in Europe for the two ACAS Xo modes (CSPO and DNA) as defined in the ACAS Xa+Xo MOPS, from operational point the ACAS Xo benefit in Europe is not obvious.

Founding Members

Recommendations and Additional activities

As the next steps, the following major topics should be addressed:

- A new operational concept needs to be defined with focus on agreement between pilots and ATC on the procedure how the pilots identify and designate the right aircraft for correct ACAS Xo mode. It should respect the principle of independence between airborne safety nets and ground operations.
- Definition of appropriate cockpit procedures for pilots about the use of ACAS Xo.
- The need to maintain safety net needs to be carefully investigated for each proposed procedure.
- Investigations to identify, where
  - numerous nuisance RAs are generated or pilots ignore RAs in Europe
  - further use cases for DNA mode are in Europe
  - CSPO-3000 mode is useful – which minimal and maximal distance between parallel runways is applicable for modified RA thresholds

Actors impacted by the SESAR Solution

The assumption was that roles and responsibilities remain unchanged for both flight crew (FC) and controllers. Specific additional tasks are allocated to the crew:

- To designate the relevant aircraft for ACAS Xo. Flight Crew asked for guidance from ATC.
- To select the mode (CSPO 3000 or DNA). Some guidance to select the correct mode is also expected.

Otherwise, no specific task is requested from the crew with this new function because ACAS Xo is not intended to be used for guidance but only as a safety net. However, maintaining visual separation remains even more necessary due to the absence of ACAS alert in case of DNA ACAS Xo mode.

Impact on Aircraft System

Operating aircraft should be equipped with the following equipment:

- ACAS Xa anti-collision system with active and passive surveillance to ensure collision avoidance with surrounding traffic, to recover ADS-B in messages coming from paired aircraft (associated aircraft with which the parallel operation is performed) and to support ACAS Xo.
- ACAS Xo which is a supplement to ACAS Xa to support special operations on specifically designated traffic, such as parallel approaches, that would otherwise be likely to trigger ACAS Xa nuisance alerts.
- ASA System that includes a surveillance and application processing function (ASSAP), and a Control and Display of Traffic Information function (CDTI). ASA system will allow the pilot to designate/undesignate the paired aircraft as well as to select the operational ACAS Xo mode: DNA (designated No Alert) or CSPO3000 (Closely Spaced Parallel Operation for runway down to 3000ft). ASA system will also offer the identification of the paired aircraft on the Display. It is integrated with ACAS X and relies on ADS-B messages.
- Mode S transponder (DO-260A/B compliant)

Impact on Ground Systems

The assumption was that the solution PJ.11-A3 has no impact on ground systems. Nevertheless, flight crews were asking for ATC support.

Regulatory Framework Considerations

The key regulations related to the PJ.11-A3 are the European Commission Regulations laying down requirements for the performance and the interoperability of surveillance for the single European sky. These regulations related primarily to Mode S and ADS-B Out mandates are:

- Commission Implementing Regulation (EU) No 1207/2011, published on 22/11/2011;
- Commission Implementing Regulation (EU) No 1028/2014, published on 26/09/2014, amending EU Regulation 1207/2011.
- Commission Implementing Regulation (EU) No 2017/386, published on 06/03/2017 amending EU Regulation 1207/2011.

Standardization Framework Considerations

Elements of the technical architecture designed have been linked to existing standards:

- The *Functional Block* Airborne Collision Avoidance (ACAS Xa/Xo) (PJ.11-A3) is linked to:
  - RTCA DO-317B / EUROCAE ED194A
  - RTCA DO-385 / EUROCAE ED-256
- The *Data Element* ADS-B report is linked to:
  - RTCA DO-260B / EUROCAE ED-102A

Considerations of Regulatory Oversight and Certification Activities

EASA and FAA are working on the ETSO/TSO for ACAS Xa/Xo systems based on the ED-256/DO-385 MOPS.

Solution Data pack

The Data pack for this Solution includes the following documents:
- V2 VALR – D5.1.040 edition 01.00.01
- V2 OSED – D5.1.050 edition 01.00.02
- V2 TS/IRS – D5.1.060 edition 01.00.01
- V2 CBA – D5.1.070 edition 01.00.02

Intellectual Property Rights (foreground)

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