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ERICA

ENABLE RPAS INSERTION IN CONTROLLED AIRSPACE (ERICA)

This Contextual Note (CN) is part of a project that has received funding from the SESAR3 Joint Undertaking under grant agreement No 874474 under European Union's Horizon 2020 research and innovation programme.

Abstract

This V3 Contextual note provides SESAR Solution 115 (RPAS Accommodation) description for industrialisation consideration.

Initial demand from existing MALE RPAS (Medium Altitude Long Endurance Remotely Piloted Aircraft Systems) operators is to rapidly access and to transit through controlled airspace. They expect Air Traffic Control services to the RPAS IFR (Instrument Flight Rules) flights as general air traffic (GAT). This solution focussed on a method responding to that need – it has built, based on actual experience, a concept to accommodate this RPAS demand in the current European ATM system.

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1 Purpose

This contextual note provides an introduction to the SESAR Solution 115 (RPAS Accommodation) solution in terms of scope, main operational and performance benefits, relevant impacts and recommendations.

It is supported by a datapack which comprises:

1. SPR-INTEROP/OSED
    a. Part I v 01.00.01 the RPAS accommodation Operational concept and associated requirements
    b. Part II – SAR (Safety Assessment)
    c. Part III – ENVAR (Environmental Assessment)
    d. Part IV – HPAR (Human Performance Assessment)
    e. Part V – PAR (Performance Assessment)
2. VALR – Validation Report
3. CBA – Cost Benefit Assessment

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2 Improvements in Air Traffic Management (ATM)

Identify and describe the ATM improvements which the solution brings compared to reference status of ATM operations. For this purpose, the contextual note can make reference to ATM problems that the solution will contribute to solve;

2.1 Solution Description

SESAR solution 115 addresses IFR RPAS accommodation in controlled airspace.

The accommodation concern is for existing and initial Remotely Piloted Aircraft Systems (RPAS). Mid-Altitude Long endurance (MALE) RPAS, although already in use (State operations) , operate under specific bi-lateral arrangements, and under restriction being segregated from civil traffic, for example flying predefined reserved corridors .

The RPAS accommodation need is a short/mid-term concept to allow all RPAS type (existing State and future civil RPAS) to have flexible access to and to transit as non-segregated general air traffic (GAT) through available published controlled class A-C airspace as Instrument Flight Rules (IFR) controlled flights. Thus, the IFR GAT RPAS in this solution is accommodated as an IFR flights in controlled and non-segregated airspace mixed with manned aviation and under GAT/Civil Air Traffic control, where RPAS comply with flight rules, airspace requirements/procedures and are interoperable with the CNS/ATM system.

RPAS accommodation relies on the existing mechanisms and systems already in place with minor improvements if necessary. The solution has define specific provisions on flight planning and RPAS management by Air Traffic Control (ATC) establishing harmonized procedures.

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2.2 Operational environment

Remotely Piloted Aircraft Systems (RPAS) considered in this solution are principally fixed wing Mid-Altitude Long-Endurance (MALE) vehicles. RPAS are characterised by a distinct physical separation of the airborne vehicle (the Remotely Piloted Aircraft: RPA) managed remotely by ground based pilots from a ground based “cockpit” (the Remote Pilot Station: RPS).

Although, in general it is foreseen that ATC manages the accommodated RPAS similarly to manned IFR GAT traffic, due to the specificity, adapted operating methods have been defined for certain RPAS situations. The RPAS specificity due to the separate RPA from the remote ground based pilots (RP) and RPS, leads to the how a specific contingency cases to manage a rare case of loss of the control command link (C2 link) during which the RPA is on automatic control. The definition of the operational procedures, also took into account where possible, ongoing standards (ICAO RPAS Panel).

ATM and Flight environment

- En-Route controlled airspace classes A to C with civil traffic

- Low to medium traffic density

- During climb, En-route and descent phases of the RPAS flight. Management of departure and arrival-landing is outside the solution's scope (and remains mains as currently performed – dedicated segregated airfields/zone for those phases)

RPAS accommodation implies some limitations

- One RPAS in a control sector

  For specific cases where RPAS are operating in pairs, the RPAS Operators (single operator for the two RPAS) shall guarantee through strategic-agreement with the ANSP that two RPAs under the responsibility of one sector and suffering a C2LL will not have crossing trajectories (in space or in time) at any time during the contingency

- Lowest transit Flight level: Above ~ FL100 where most recreational VFR (which are the majority of aircraft, which could infringe controlled airspace) do not fly.

- Highest Flight Level: Below ~ FL300 to avoid dense and high-speed jet traffic streams.

- The target Operating Environment (OE) is Low/Medium complexity European airspace En-Route operating environments (OE) with low-medium traffic density and low RPAS numbers..

  However, the solution findings indicate that a number of Terminal OEs (with high ceilings) across the European airspace are also concerned by RPAS transit.. The Solution is validated for low and medium complexity. Nonetheless, there is no known reason why the Solution should not be applicable for more complex airspace under certain condition i.e. low levels of traffic.

- No technological change. Existing/initial RPAS flay as equipped, the existing ATM system relies on the current technologies – the solution's concept is based on procedural improvement.

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3 Operational Improvement Steps (OIs) & Enablers

Operational Improvement Step:

AUO-0619: RPAS accommodation in class A-C airspace is fully covered by this solution.

Enablers :

PRO-263: ATC/Remote Pilot C2 Link Loss Procedure for accommodating IFR RPAS transiting in Class A-C airspaceis developed and fully covered by this solution.

REG-0535: IFR RPAS Accommodation as General Air Traffic (GAT) Standards & Regulations is required and used by this solution.

Deployment the short /mid-term : as soon as 2025.

The solution IOC / FOC is : 2025 – 2030

Applicable Integrated Roadmap Dataset : DS23

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4 Background and validation process

Operational validation of the RPAS accommodation concept using standard separation was performed through Real Time Simulation (RTS) including controller and Remote pilot questionnaires, as well as expert analysis workshops. The RTS was run by DSNA at Clermont-Ferrand (centre of France) with their ATC controllers and an experience qualified Remote Pilot from Dassault Aviation. External coordination also provided correlation on RPAS experimental flight trails.

In a separate validation stream, validation was also conducted on the complete RPAS Flight Plan filing encompassing RPAS specific information in existing ICAO FPL2012 format & fields.with the European Network Manager's (NM) - IFPS system, and processing/acceptation through the existing French ANSP (DSNA) Flight Planning systems.

This airspace environment is a realistic medium traffic density TMA environment in which the traffic scenario was derived from regenerated real manned traffic taken from real flights in Clermont-Ferrand airspace with the additional RPAS added. It evaluated how the accommodation concept for RPAS IFR traffic in controlled class A-C airspace, with no segregation, impacted ATC working methods, in both nominal conditions, using standard IFR practices and standard separation, and in non-nominal situations, particularly the procedure to provide the C2 link loss information to the ATCO. Later the RPAS C2 link–loss event was launched which triggered the automated C2LL state and trajectory of the RPAS.

RPAS Emergency Operations (deemed equivalent to manned aircraft in an equivalent emergency) were only addressed through the S115 group workshops, and documented in the OSED use-case.

SESAR 2020 PJ13 Solution 115 VALR D3.1.030 provides full details.

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5 Results and performance achievements

The overall performance achievement with regard to solution's objective is to improve accessibility of existing/initial Medium Altitude Long Endurance Remotely Piloted Aircraft System (MALE RPAS) to access and fly transit routes in controlled class A-C airspace as General Air Traffic (GAT) under Instrument Flight Rules (IFR) with no segregation and no technical change to the ATM systems.

The solution validation confirms:

• That the existing ICAO FPL 2012 can be used, and its existing fields allow for RPAS specificity

• That V3 (deployment) of MALE RPAS transit as GAT, per the S115 concept, in the Operating environment and conditions is feasible in IFR class A-C controlled airspace. ATCs are able to start accommodation and gain experience in managing RPAS flights

• Standard separation minima can be used

• The initial contact information indicating a RPAS ("REMOTE") and sharing C2 link loss behaviour (2 additional elements : DIVERSION Waypoint and Contingency DESTINATION) is useful to the ATCO and provides flexibility to the RPAS operator.

• ATCOs feedback and observations performed during the validation exercise show negligible impact on Human Performance and no impact on Safety.

• Airspace capacity and equity to all airspace users is not impacted by RPAS transit flight

• The solution has beneficial impact by allowing non-segregated operations this not reserving (thus increasing) the available airspace

• Access and equity are provided to the RPAS operator, RPAS can easily file/modify its IFR FPLN to the regular available IFR airspaces – this simplifies and provides more flexibility in flight preparation.

The validation target is met :

- the ATC controller can manage the MALE RPAS transit flight as just another IFR flight with neutral impacts on safety (SAF) and on human performance (HP).

- No other Key Performance Areas are allocated to the solution, thus no specific Key Performance Indicators (KPI) are established. However, the solutions' cost benefit mechanism also provides positive impacts (benefits) on the following :

• RPAS airspace user accessibility

  - reduced planning lead-time to "file and fly"

  - regular routine RPAS GAT flight access to the whole IFR airspace

• Equity is ensured to all airspace users, RPAS included

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6 Recommendations and Additional activities

The following activities are recommended relevant once transitioned to industrialization (V4):

Flight Plan (FPLN)

- Limitations and bounds of individual national flight data processing systems FPDS, and access to certain data
- Cross border FPLNs through the entire IFPS filing to ATC ACC/TMA multi-state FDPS
- Future iOAT interface, planned to be released by NM/IFPS in 2023, to take into account RPAS specificities
- Per individual ANSP safety assessment outcomes (e.g. regarding capacity, potential RPAS trajectory complexity), sector complexity metrics / DCB process should be adjusted if needed with respect to RPAS..

C2 link-loss procedure

- Suitable C2LL transponder code to be selected during the accommodation period depending on ATC systems support and type of operation (national, cross-border)
- As likelihood of permanent C2LL is very low (i.e. high likelihood that C2 link will be regained)
    - ATCO should initiate C2LL coordination over backup telephone line - calling the remote pilot ; ATCO CWP has telephone access and the concept provides means ATC to have the pilot telephone number through the FPLN data; That data must be easily accessible in the ATC control centre.
    - Most suitable option - revert to and maintain original FPLN
    - If diversion is required by the RPAS operator => Recommendation that the Diversion WPT as far downstream as possible
    - Suitable Diversion WPT(s) may be defined though a strategic-agreement well before flight plan filing between the RPAS Operator & the ANSP. A suggested method is that waypoints that shall not be used as diversion point are published by ANSPs. This will avoid unnecessary strategic coordination actions requiring RPAS operators to contact ANSPs
    - If the RPAS has multiple pre-planned diversion strategies WPT(s), pre-programming next one must be ensured before overflying existing Diversion WPT (and at minimum 2 minutes before)C2LL contingency trajectory maintains flight level where possible

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- Emergency management (main propulsion loss)Emergency flight and profile ASAP to an emergency airfield/termination area should be further investigated, including cases where the emergency trajectory can no longer be maintained in class A to C airspace.

- Regulatory
    - Further specific regulatory initiatives for certified civil RPAS will have to be linked to the EASA RMT.0230
- Safety
    - Conflict detection tools or controller support tools are assumed used when already used within each particular airspace. It is recommended that conflict detection tools, if used in the airspace, should be verified by the ANSP considering RPAS performance related data and if necessary should be tuned for RPAS operating in the airspace so that they are valid supporting tools. In those airspaces in which these tools are not used, the existing related safety case, with the addition of RPAS, needs to be verified to maintain the safety level.
    - For specific cases where RPAS are operating in pairs, the RPAS Operators (same unique operator for the two RPAS) shall guarantee through strategic-agreement with the ANSP that two RPAs under the responsibility of one sector and suffering a C2LL will not have crossing trajectories at any time during the contingency. The exact ATM procedure for checking between the ANSP and operator will have to be defined in the V4 phase for each of such specific implementations.
    - It is recommended that when the ANSP does the safety assessment for the deployment of the Solution that the impact on sector capacity should be assessed.

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7 Actors impacted by the SESAR Solution

ANSP – ATS Unit (ACC, and APP)

ATCO nominal management of the RPAS is as any other IFR traffic; C2LL is not a frequent occurrence and does not generate additional workload for the awareness procedure (during nominal flight at initial contact. If an infrequent C2 LL would occur, the increase of workload of ATCO managing the C2LL contingency is equivalent to the increase of workload due to a radio-comm. loss (PLOC) in manned aviation.

In the operational conditions of the solution, latency (which is low, under 2 seconds) and possible stepped-on communications do not play a significant role in the management of aircraft nor in conflict management. The effects and the methods of managing these communications are the same as for manned aviation, reported as non-significant. Feedback from parallel external trials performed in this operational environment reported the same

WOC / AOC (Flight Planning)

RPAS Operations (Operator).

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8 Impact on Aircraft System

NONE: initial RPAS are assumed available and used as-is.

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9 Impact on Ground Systems

NONE: existing ATM systems are used as-is.

A minor update for a specific transponder code indicating C2 Link Loss (7400), depending on ANSP deployment strategy could be implemented, in which case it will be part of the regular ANSP upgrade strategy.

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10 Regulatory Framework Considerations

The Solution is applicable to all types of users – initial MIL/state users as well as future Civil users.

OSED part I section 3.2.4 Applicable standards and regulations, and associated Appendix D.1 highlights regulatory considerations:

The overall **regulatory environment that will be associated with all RPAS (civil & state) operations managed within civil ATM expected at the accommodation timeframe**, until circa 2030 is the following:

- **Initial existing state/MIL RPAS: GAT/IFR transit operations (Departure/Arrival segregated, OAT)**

  National competent authority specific certification (equivalence and/or evidence) IFR/GAT parts aligned with CS-23 Amendment 4.

- **Future civil RPAS (equivalent MALE / large RPAS)**

  EASA has yet to launch RMT.0230, NPA #2 (on Type #1 concerning Cargo IFR RPAS). Resulting adoption and Implementing Regulation expected circa 2026. However, future Civil deployment is unknown today.

  EU applicable civil regulation for RPAS will be CS-23 Amendment 4 derived.

  Future civil certified RPAS in controlled airspace will ultimately be under a future regulation resulting from EASA rulemaking action (RMT.0230, EC adoption expected 2025). It is recommended that the deployment of the Solution for Civil RPAS should be evaluated in respect of the EASA material when it is available.

  The main concern for acceptance and thus agreement is safety of operations (which can be built on the concept approach and its associated safety assessment).

  - The SESAR solution S115 RPAS Accommodation concept and its associated safety assessment should be taken in account by this RMT.0230 group.
  - The next step of the RPAS Accommodation solution S115 industrialisation/deployment phase (V4) should be coordinated with EASA's RMT.0230 scope.

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11 Standardization Framework Considerations

The Solution is implementable under existing standards.

OSED section 3.2.4 Applicable standards and regulations and associated Appendix D.1 analysed ICAO Annex 2 and with a specific assessment for RPAS during the Accommodation period related to DAA:

- Pilot responsibility is recognized to not create a collision hazard, noting that remote pilot, like any other IFR manned aircraft pilot, cannot be assumed to always be in visual meteorological conditions, and will be under separation responsibility IFR flights under ATC.

  During accommodation period, Inside Class A-C operating environment, all traffic is known by ATC through secondary radar or equivalent, cleared to access and fly through the airspace, including the RPAS electronically visible through its transponder. All IFR flights are separated by ATC: i.e. providing control service in order to safely manage all Traffic conflicts including up to ATC safety nets collision avoidance resolution.

- Initial MALE RPAS (below 5.7 T) are already excluded and no current applicable regulation exists requiring collision avoidance (ACAS) on UAS. ACAS moreover is only required on certain aircraft, and may even be absent on those certain aircraft under MEL dispatch conditions.

- Validation highlighted no ATCO expected the Remote pilot to perform visual manoeuvring knowing it was a RPAS – no expectation of visual manoeuvres is encompassed in the accommodation-operating environment.

- SAR Assessment analysed risk of encounter of the RPAS with an intruder aircraft not known by ATC within the accommodation operating environment is extremely low.

  There are low RPAS numbers (principally one) per sector in a low-medium density traffic level, En-route only (outside departures & approaches). Intruders are unlikely. Highest risk recreational light aircraft are excluded by setting the floor of the operating environment to a level where such intruders do not fly >~FL100. All other a/c in the accommodation operating environment are under ATC surveillance and are in contact and being separated by ATC.

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12 Solution Data pack

The Data pack for this Solution includes the following documents:

- SPR-INTEROP/OSED Part I D3.1.140 v 03.00.00
- OSED Part II – SAR D3.1.140 v 00.03.00
- OSED Part III – ENVAR D3.1.140 v 01.00.00
- OSED Part IV – HPAR D3.1.140 v 01.00.00
- OSED Part V – PAR D3.1.140 v 01.00.02
- VALR D3.1.030 v 03.00.00
- CBA D3.1.060 v 01.00.00

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