INDUSTRIAL RESEARCH

SESAR Solution 115 Final SPR-INTEROP/OSED for V3 - Part I

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ERICA

ENABLE RPAS INSERTION IN CONTROLLED AIRSPACE

This SPR INTEROP OSED 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

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.

SESAR Solution 115, building on actual experience, defines a concept to accommodate this RPAS demand in the current European ATM system.

This document is the SPR-INTEROP/OSED Part I, which defines the RPAS accommodation concept for initial RPAS and the associated operational procedures, with the objective of rapid deployment during short to medium term accommodation period.

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1 Executive Summary

The EU-funded SESAR PJ13 - W2 ERICA project performs technical and operational research that will permit safe operations RPAS (Remotely Piloted Aircraft Systems) in nominal, contingency and emergency conditions in controlled airspace and with no negative impacts on the legacy air traffic.
The overall project aims to develop recognised European RPAS operations in non-segregated airspace that will enable civil and STATE RPAS to operate with Air Traffic Management systems within Europe.

The overall RPAS research on their conclusion in the ATM network targets two main steps:

- **Accommodation step** (this solution 115) for a short to medium-term concept
- Integration step (addressed by solution 117) for a long-term concept

In the short to medium-term timeframe existing users of large fixed wing Medium Altitude Long Endurance Remotely Piloted Aircraft Systems (MALE RPAS) flying under Instrument Flight Rules (IFR), are in increasing demand to routinely access and transit controlled class A-C airspace in several EU states. Accommodation procedures, defined and validated in solution 115, respond to this initial RPAS user demand.

MALE RPAS[1] although already in military/state operations, are used under specific bi-lateral arrangements, under restrictions and generally segregated from civil traffic, for example flying predefined reserved corridors to their mission zones. Their need, in addition to missions and associated OAT flights, is flexible transit as non-segregated general air traffic (GAT) through controlled class A-C airspace to their mission areas. This represents the initial RPAS demand, which can be anticipated in this short to medium term timeframe as soon as 2025.

This OSED provides a solution in the ATM system to the RPAS user to transition from the current mode of segregation to improved access of IFR RPAS. The work derives its approach from preceding SESAR work in the RPAS domain and especially from actual RPAS accommodation and flight experience. The essential focus from these is directed to RPAS management during non-nominal situations[2], due to RPAS peculiarities of a separated remotely piloted aircraft (RPA)-remote pilot station (RPS) with associated flight automation when their command & control link (C2 link) is lost, and some limits in initial RPAS C-N-S

[1] HALE RPAS to a limited extent in the solution-operating environment, during their climb/descent through mid-altitude airspace.

[2] Preceding work and actual experience show that in nominal situations RPAS management is similar to GAT manned aircraft management.

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features. The solution relies on existing ATM systems and considers initial RPAS capabilities, some aspects of which might not be fully compliant with all existing manned aviation standards & rules.

The solution defines an RPAS Accommodation concept, responding to this type of demand. It seeks to ensure maximum compatibility with the existing ATM framework and procedures used to manage manned traffic, with suitable adaptation, where needed. The target is to provide access to the new RPAS airspace user, ensure equity to all airspace users, maintain safety, and not degrade human performance. This RPAS Accommodation concept delivers:

- Improvements to planning, approval and access like any other GAT IFR flight, for the RPAS transit segment
- Non-segregated RPAS transit, in the same airspace and within manned traffic (routine access provided to the initial RPAS state demand as GAT with limited restrictions and future short-term civil RPAS demand)
- Associated ATC management as GAT by civil air traffic controllers in controlled A-C class airspace:
    - during climb, En-route and descent phases of flight outside departure/arrival and aerodrome manoeuvres, in low to medium traffic density, to RPAS mission areas
    - with some limitations (inter alia: bounded traffic flight levels, RPAS flights enter/exit GAT controlled airspace (classes A to C) for transit while departing/arriving as segregated operations, one RPAS in a control sector)

Procedural improvements have been evaluated to allow routine flight planning/filing and access for this initial RPAS traffic to transit ICAO classified A, B and C controlled airspace in a non-segregated manner, while departing from or arriving to dedicated segregated airfields/zones for RPAS and OAT traffic (typically a Military), or mission zones.

The overall performance expectation related to RPAS accommodation targets the demand of initial RPAS operations, mainly STATE RPAS operations, for accessibility of IFR MALE RPAS to attain routine access and transit in Airspace classes A, B, C, which is an improvement for the RPAS user to their current situation.

Validation has been done through the V3 EXE_115_001 RTS led by DSNA (ATC and traffic scenario) with Dassault Aviation (Remote Pilot), Frequentis (Flight Planning) and Thales-AVS (RPAS) in the French Airspace /Clermont-Ferrand ATC Validation environment.

This **V3 SPR-INTEROP/OSED** defines the operational environment of RPAS accommodation, assumptions, and safety, performance, interoperability requirements, which are the initial framework of adapted RPAS accommodation procedures. These procedures may be used for wider deployment in the European airspace.

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2 Introduction[3]

2.1 Purpose of the document

This document provides the requirements specification, covering operational, safety, performance and interoperability requirements related to SESAR PJ13 Solution 115.

The SESAR Solution Development Life Cycle aims to structure and perform the work at project level and progressively increase SESAR Solution maturity, with the final objective of delivering a SESAR Solution data pack for industrialisation and deployment. The SPR-INTEROP/OSED represents one of the key parts of this SESAR Solution data pack.

Solution 115, RPAS accommodation, is a **V3 maturity level**, with the next step being operational deployment.

2.2 Scope

This SPR-INTEROP/OSED for Solution 115 (V3 phase) is the final version of the operational environment definitions, operating methods and resulting requirements characterizing the solution.

It takes into account the validation activities documented in the **VALR D3.1.030 [14]** and the Safety Assessment documented in the **SAR** [19](Part II of SPR-INTEROP/OSED).

This SESAR solution aims at accommodating IFR RPAS, in the short to medium term, during their transit phase through non-segregated controlled class A-C airspace by establishing harmonised procedures across European airspaces classified Low/ Medium complexity and derived also to a High complexity airspace during low traffic periods.

The SESAR RPAS accommodation solution targets reduced planning and approval time to enable routing flights and improved MALE RPAS access as GAT IFR flights of low numbers of IFR RPAS.

The initial RPAS demand will benefit from routine access procedures to transit and operate in airspace classes A-C, as General Air Traffic (GAT) with limited restrictions. Departure/arrival remains from/to dedicated airfields or dedicated mission areas.

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[3] *The opinions expressed herein reflect the author's view only. Under no circumstances shall the SESAR Joint Undertaking be responsible for any use that may be made of the information contained herein.*

2.3 Intended readership

S2020 Projects and Solutions listed below are also intended as readers and for coordination on this document.

PJ13 ERICA – Enable RPAS Insertion in Controlled Airspace

- Solution PJ.13-W2-111 "Collision avoidance for IFR RPAS"
- Solution PJ.13-W2-117 IFR RPAS integration in Airspace Class A to C

PJ.19 W2 CI, Content integration, performance management and business case development

- Solution PJ.19 Content integration, performance management and business case development

PJ.20 W2 AMPLE

- Solution PJ.20 Master Planning

Other Organizations

The relevant Organizations listed below are also welcome as intended audience for this document.

- ICAO
- EASA
- JARUS
- EUROCAE & RTCA
- EUROCONTROL
- EDA
- OCCAR
- NATO
- External TAC (Technical Advisory Committee) to SESAR PJ13
- IFACTCA
- IFALPA

2.4 Background

This section provides information on previous activities related to RPAS projects.

Experts in the RPAS field were called upon by the European Commission to develop the 'Roadmap for the integration of civil RPAS into the European aviation system', which was officially launched in June 2013. In response to this roadmap, the SESAR Joint Undertaking launched in 2013, nine co-funded demonstration projects within the SESAR1 framework and further work has been undertaken in SESAR 2020 Wave 1 projects.

The principal predecessor project for RPAS insertion into controlled airspace is SESAR 2020 Wave 2 **PJ.10.05 PROSA**. However, as identified in the current PJ13 Project Management Plan (PMP), this predecessor project mainly addressed RPAS Integration, while an Accommodation concept was introduced but without a definition of a set of specific requirements and relevant operating methods.

SESAR Wave 1 PJ 10.05 PROSA did identify several SESAR RPAS demonstration projects [SESAR Solution 10-05 SPR-INTEROP/OSED for V2 section 2.4 [65]], and a SESAR JU summary «Demonstrating RPAS integration in the European aviation system» [73] exists, although not all are related to MALE IFR RPAS accommodation in class A-C airspace in the short to mid-term.

SESAR-W2 PJ13 Solution 115 was launched to resolve the lack defined above and to respond to the increasing existing RPAS user demand (mainly military) to deploy operational non-segregated RPAS accommodation, hence the V3 target.

In the current situation, MALE RPAS are already in regular military/state operations. However, these operations require lengthy preparation, are under specific bi-lateral arrangements, and particularly are performed under restrictions requiring airspace reservations for segregation from civil traffic, for example using predefined reserved corridors to transit to their mission zones.

Sources of existing RPAS flights in ATC Airspace has been captured in a joint solution 115 & 117 capture phase, initiated prior to the initial SPR-INTEROP/OSED activity. In this capture phase, solution participants provided information on ongoing RPAS flight practices in current class A-C airspace. This information is documented in the **Solution 115 Capture document [64]**. In parallel, operational RPAS flight, experiments in non-segregated airspace have also been conducted over the period. Solution 115 has regularly coordinated with the external projects that conducted the trails.

In addition, several organisations are also addressing RPAS insertion into airspace, inter alia, ICAO, EASA, EUROCAE, and EUROCONTROL. Documents from these organisations have also been considered by the solution activities and are referenced in section 5.

2.5 Structure of the document

Part I of this document provides the Safety and Performance Requirements (SPR) and Interoperability Requirements (INTEROP), related to **SESAR PJ13 Solution 115**, that have been validated during validation activities at a **V3 level**. They are presented in the context of the Operational Service and Environment Definition (OSED), which describes the environment, assumptions, etc. that are applicable to the SPR and INTEROP requirements.

These requirements cover safety, performance, operational aspects as well as the interoperability aspects.

The document is completed by appendices including:

- The Benefit and cost Mechanisms, showing how the SESAR Solution elements contribute (positively or negatively) to the delivery of performance benefits and the costs.
- The TS/IRS modelling results for Solution 115.
- The different feedbacks from ANSPs, Operators, etc…

The SPR/INTEROP OSED Part I document is structured as follows:

Section 1: *Executive Summary*

- Presents the document in summary

Section 2: *Introduction*

- Provides general information on the document. It details the scope

Section 3: *Operational Service and Environment Definition* Contains the OSED essential information:

Section 3.1: *SESAR Solution 115 Summary*

- Provides a summarised description of the solution and the traceability to the relevant OIs

Section 3.2: *Detailed Operational Environment*

- Defines the operational environment in which the future concept is presented

Section 3.3: *Detailed Operational Method*

- Describes the current and the new operating methods and provides an analysis of the differences between those operating methods

Section 4: *Safety, Performance and Interoperability Requirements*

- Defines the operational requirements, performance and safety requirements

Section 5: *References and Applicable Documents*

- Identifies the documents (name, reference, source project) this document has to comply to or uses as additional inputs

Appendix A: *Cost and Benefit Mechanisms*

- Defines the benefits and Impacts (BIM)

Appendix B: *Technical and Interface Specification*

- Provides the Technical systems information that the operations in concept rely on in the existing ATM framework

Appendix C: *Feedbacks*

- Provides the partner feedback collected during the initial phase of the OSED development

2.6 Glossary of terms

Term	Definition	Source of the definition
Accommodation	Describes the condition when an RPAS can operate along with some level of adaptation or support that compensates for its inability to comply within existing operational constructs. This may be necessary during normal operations, abnormal or problematic scenarios, and when emergencies arise. Accommodation allows for early RPA flights on a temporary and transitional basis and in limited numbers before the required technology, standards, and regulations are in place. The accommodation of RPAS in the aviation has been already addressed in many Nations.	This document
Aircraft	Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface	ICAO Annex 7 [47]
Airspace Data Management service	Is to organise and provide all necessary airspace information to feed the Network Manager Operational systems – Integrated Initial Flight Plan Processing System (IFPS) and Enhanced Tactical Flow Management System (ETFMS) – and the systems of our operational stakeholders. The airspace data consists of: • ECAC airspace infrastructure (provided by the ANSPs and/or AIP published information adapted for NMOC operations); • Operational unpublished data collected from ANSPs (taxi-time, sectorisation, etc.); • Specific non AIP data required to perform the ATFCM/ASM function (such as Traffic Volumes);	EUROCONTROL

Term	Definition	Source of the definition
	• Airspace management operational data required for EAUP/EUUP publication; • Restrictions implementation required to validate Flight Plans and ETFMS profile adaptions; • Library with addresses for distributing ETFMS/IFPS messages/parameter settings to AOs and ANSPs.	
Air traffic control clearance	Authorisation for an aircraft to proceed under conditions specified by an air traffic control unit	ICAO DOC 4444 [48]
Air traffic control service	A service provided for the purpose of: a) preventing collisions: 1) between aircraft, and 2) on the manoeuvring area between aircraft and obstructions; and b) Expediting and maintaining an orderly flow of air traffic.	ICAO DOC 10019 [49]
Air traffic service	A generic term meaning variously, flight information service, alerting service, air traffic advisory service, Air Traffic Control Service (area control service, approach control service or aerodrome control service).	ICAO DOC 10019 [49]
Area Control Centre (ACC)	The ATC unit providing ATC services to En-route traffic in control areas under its jurisdiction. Part of an ACC might also supply approach services. A more general description of ACC as provided in ICAO Doc 4444 "ACC is a unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction".	SESAR PJ.19
Automatic operation	An operation during which a remotely piloted aircraft is operating without pilot intervention in the management of the flight.	ICAO DOC 10019 [49]

Term	Definition	Source of the definition
Chicago Convention	Established the International Civil Aviation Organization (ICAO), a specialized agency of the UN charged with coordinating international air travel. The Convention establishes rules of airspace, aircraft registration and safety, security, and sustainability, and details the rights of the signatories in relation to air travel. According to the Chicago Convention, every State has complete and exclusive sovereignty over the airspace above its territory.	ICAO DOC 7300/9 [50]
Command and Control (C2) link	The data link between the remotely piloted aircraft (RPA) and the RPS the remote pilot station for the purposes of managing the flight.	ICAO DOC 10019 [49]
Command and Control (C2) System	Includes data links and other system elements (e.g., instruments and transponders on satellites and/or terrestrial cable networks) that connect the remote pilot station(s) RPS to the RPA (remotely piloted aircraft).	ICAO DOC 10019[49]
Complexity Low (includes Traffic Density)	A Low Complexity En-Route Operating Environment is an En-Route airspace in which, or a part of which, area control service is provided by an ATC operational Unit with an Aggregated Traffic Complexity Score less than 2 or, if score is not available, with a number of serviced IFR flights less than 20000 per year.	EATMA Dataset 21
Complexity Medium (includes Traffic Density)	A Medium Complexity En-Route Operating Environment is an En-Route airspace in which, or a part of which, area control service is provided by an ATC operational Unit with an Aggregated Traffic Complexity Score greater or equal to 2 and less than 6 or, if score is not available, with a number of serviced IFR flights greater or equal to 20000 and less than 100000 per year.	EATMA Dataset 21
Controlled airspace	An airspace of defined dimensions within which Air Traffic Control service is provided in accordance with the airspace classification.	ICAO DOC 10019 [49]

Term	Definition	Source of the definition
En-Route OE	An ATC operational unit providing Area Control Services in a part of the airspace under control	SESAR 2020 PJ20 WP2.2 WG
Flight Plan	Specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft.	ICAO DOC 10019[49]
Flight Termination	Is an option specific to the unmanned aviation in case of flight safety is not guaranteed; further flight is not possible (due to the malfunction or due to the unavailability of a suitable landing site). The safety risk for the RPA itself, other traffic and persons and installations on ground is considerable. This manoeuvre should be done either on designated flight termination areas or at any suitable off-field site, which should easily be reachable by rescue and firefighting units to avoid unnecessary damage to the environment.	Deutscher Luft- und Raumfahrtkongress 2016 Document ID: 420042 [23]
Integration	Refers to a future when RPA may be expected to enter the airspace system routinely without requiring special provisions. Integration will require the implementation of harmonised Standards and Recommended Practices (SARPs) and procedures (PANS).	
C2 link Loss	The loss of C2 link contact with the remotely piloted aircraft such that the RP can no longer manage the aircraft's flight.	ICAO DOC 10019 [49]
Contingency Procedure	Is a flight procedure in response to an abnormal situation in which it is no longer possible to continue the flight using normal procedures but the safety of the unmanned aircraft or on the ground is not compromised.	
Emergency Procedure	An emergency is one in which the safety of the aircraft or of persons on board or on the ground is endangered for any reason.	ICAO DOC 4444 [48]
En-Route (phase)	Part of the flight from the end of the take-off and initial climb phase to the commencement of the approach and landing phase.	ICAO Annex 6 [46]

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Term	Definition	Source of the definition
Flight Crew Member	A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period	ICAO Annex 6 [46]
RPS Handover	The act of passing piloting control from one remote pilot station to another	ICAO Doc 10019 [49]
GAT	Flights or parts thereof that are operating subject to civil ATC rules and procedures	
Handover	The act of passing piloting control from one remote pilot station to another.	ICAO DOC 10019 [49]
IFPS	The Integrated Initial Flight Plan Processing System (IFPS) is a centralised service of the Network Manager operations centre (NMOC) designed to rationalise the reception, initial processing and distribution of flight plan data related to instrument flight rules (IFR) flight within the ICAO EUR Region known as the IFPS Zone (IFPZ). Flight plans and associated update messages may be submitted as individual messages. The IFPS shall check all messages received or changes thereto for: • compliance with all format and data conventions; • completeness and accuracy The IFPS shall take action to ensure that the flight plan is acceptable to air traffic services.	EUROCONTROL IFPS User's Manual
IFR	The symbol used to designate the instrument flight rules.	ICAO DOC 10019 [49]
Latency	Communication transaction time.	EASA SC RPAS.C2.01 [24]
Lost C2 Link State	The RPAS state, in which the C2 Link performance has degraded, as a result of a C2 Link interruption that is longer than the Lost C2 Link decision time, to a point where it is not sufficient to allow the remote pilot to actively manage the flight in a safe and timely manner.	ICAO DOC 10019 [49]

Term	Definition	Source of the definition
Nominal C2 Link state	The RPAS state when the C2 Link performance is sufficient to allow the remote pilot to actively manage the flight in a safe and timely manner appropriate to the airspace and operational conditions.	ICAO DOC 10019 [49]
OAT (Flights)	Flights or parts thereof that are operating subject to military ATC rules and procedures. The term Operational Air Traffic (OAT) is applied in Europe to all flights, which do not comply with the provisions stated for general air traffic (GAT) and for which rules and procedures have been specified by appropriate national authorities. OAT flights are operated by military or specific state agencies.	EUROCONTROL EATM Glossary of Terms
Operator	A person, organisation or enterprise engaged in or offering to engage in an aircraft operation.	ICAO DOC 10019 [49]
Pilot-in-command (PIC)	The pilot designated by the operator, or in the case of general aviation, the owner, as being in command and charged with the safe conduct of a flight.	ICAO DOC 10019 [49]
Pre-program	RPA data (e.g. Navigation plan) is uploaded to the RPA systems, initially at pre-flight. Several sets of data are concerned (e.g. Nominal flight plan/trajectory, C2 link loss flight plan/ trajectory, etc…).	
Reprogram	In case of pre-planned conditions (e.g. passing a given geographic point) or external conditions (e.g. severe weather avoidance) or due to ATC instructions, re-programming (i.e. changing and uploading) the RPA data in the RPA systems is performed by the RP.	

Term	Definition	Source of the definition
Recovery Procedures	Recovery means to reach and maintain a situation where the safety of persons and property as well as other air traffic is no more directly endangered by the presence of the considered RPAS subject to an abnormal situation. The recovery procedures are also likely to resolve a contingency situation of an RPAS.	Deutscher Luft- und Raumfahrtkongress 2016 Document ID: 420042 [23]
Remote pilot (RP)	The person who manipulates the flight controls of a remotely piloted aircraft during flight time.	ICAO DOC 10019 [49]
Remote pilot station (RPS)	The station at which the remote pilot manages the flight of an unmanned aircraft.	ICAO DOC 10019 [49]
Remotely piloted aircraft (RPA)	An unmanned aircraft, which is piloted from a remote pilot station.	ICAO DOC 10019 [49]
Remotely-piloted aircraft system (RPAS)	A set of configurable elements consisting of a remotely piloted aircraft, its associated remote pilot station(s), the required C2 links and any other system elements as may be required, at any point during flight operation.	ICAO DOC 10019 [49]
Rules of the Air	The rules of the air shall apply to aircraft bearing the nationality and registration marks of a Contracting State, wherever they may be, to the extent that they do not conflict with the rules published by the State having jurisdiction over the territory overflown. The Council of the International Civil Aviation Organization resolved, in adopting Annex 2 in April 1948 and Amendment 1 to the said Annex in November 1951, that the Annex constitutes Rules relating to the flight and manoeuvre of aircraft within the meaning of Article 12 of the Convention. Over the high seas, therefore, these rules apply without exception.	ICAO Annex 2 [45]

Term	Definition	Source of the definition
Segregated airspace	Airspace of specified dimensions allocated for exclusive use to a specific user(s).	ICAO DOC 10019 [49]
State Aircraft	Aircraft on a military register, or identified as such within a civil register, shall be considered to be used in military service and hence qualify as State Aircraft; Civil registered aircraft used in military, customs and police service shall qualify as State Aircraft.	Chicago Convention ICAO DOC 7300 [50]
TMA (Terminal Manoeuvring Area)	A terminal control area is a Control Area normally established at the confluence of ATS Routes near one or more major aerodromes.	ICAO Annex 2: Rules of the Air [45]
Unmanned Aircraft (UA)	Any aircraft intended to be flown without a pilot on board is an unmanned aircraft. They can be remotely and fully controlled from another place (ground, another aircraft, and space) or pre-programmed to conduct its flight **without intervention**. For RPAS operations pre-programmed flight without intervention is only automatically triggered in a specific case when the Control-Command (C2) link is lost.	ICAO UAS Toolkit website [52]
Unmanned Aircraft System (UAS)	An aircraft and its associated elements, which are operated with no pilot on board.	ICAO Cir 328 [53]

Term	Definition	Source of the definition
Vertical Separation	Vertical separation is achieved by requiring aircraft to use a prescribed altimeter pressure setting within designated airspace, and to operate at different levels expressed in terms of altitude or flight level. For manned aircraft: ICAO specify minimum vertical separation for IFR flight as 1000 ft (300 m) below FL290 and 2000 ft (600 m) above FL290, except where reduced Vertical Separation Minima (RVSM) apply. Most national authorities follow a similar rule, but may specify a different level at which the rule changes.	ICAO DOC 4444 [48]

Table 1: Glossary of terms

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2.7 List of Acronyms

Acronym	Definition
A/C	Aircraft
AFCS	Auto Flight Control System
ACC	Area Control Centre
A/G	Air/Ground
AIP	Aeronautical Information Publication
AIS	Aeronautical Information Services
ANSP	Air Navigation Service Provider
AO	Aircraft Operator
AOC	Airline Operation Centre
AOCC	Airline Operations and Control Centre
AOP	Airport Operations Plan
AoR	Air of Responsibility
APP	Approach
ARES	Airspace Reservation/Restriction
ARS	Air control center, RPA production center, Sensor fusion post
ASAP	As Soon As Possible
ASM	Airspace Management
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATMS	Air Traffic Management System
ATS	Air Traffic Service
ATSU	Air Traffic Service Unit
AU	Airspace User
BADA	Base of Aircraft Data

Acronym	Definition
BIM	Benefit Impact Mechanism
BMT	Business Mission Trajectory
BRLOS	Beyond Radio Line Of Sight
BVLOS	Beyond Visual Line of Sight
C2	Command and Control
C2LL	C2 Link Loss
C3	Command, Control and Communication
CASA	Civil Aviation Safety authority
CESNAC	“Systèmes de Navigation Aérienne Centraux”
CDM	Collaborative Decision-Making
CFMU	Central Flow Management Unit
CNS	Communication Navigation and Surveillance
COM	Communication
CONOPS	Concept of Operations
CR	Change Request
CRNA	“Centre en Route de la Navigation Aérienne”
CTA	Control Area
CTR	Control Area
CWP	Controller Working Position
DA	Decision Altitude
DAA	Detect And Avoid
DAP	Data Operation Provider
DCB	Demand Capacity Balancing
EASA	European Airspace Safety Agency
EATMA	European ATM Architecture
E-ATMS	European Air Traffic Management System
EC	European Commission
ECAC	European Civil Aviation Conference

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Acronym	Definition
ERA	Enhanced RPAS Automation
EREA	European Research Establishments in Aeronautics
ERICA	Enable RPAS Insertion in Controlled Airspace
ERSG	European RPAS Steering Group
ETA	Estimated Time of Arrival
ETD	Estimate Timed of Departure
EUROCAE	European Organisation for Civil Aviation Equipment
EUMC	European Union Military Committee
EU	European Union
EUR	Europe
FAA	Federal Aviation Administration
FF-ICE	Flight & Flow Information for a Collaborative Environment
FIS-B	Flight Information Services - Broadcast
FIR	Flight Information Region
FL	Flight Level
FOC	Flight Operation Centre
FPL or FPLN	Flight Plan
Ft (ft)	Feet
FTA	Flight Termination Area
FUA	Flexible Use of Airspace
GA	General Aviation
GAT	General Air Traffic
G/G	Ground/Ground
GND	Ground
GPS	Global Positioning System
GS	Ground Station
HALE	High Altitude Long Endurance
HL	High Level

Acronym	Definition
HLR	High Level Requirement(s)
HP	Human Performance
HPAR	Human Performance Assessment Report
HV	Horizontal Vertical
ICAO	International civil Aviation Organisation
IFACTCA	International Federation of Air Traffic Controllers
IFALPA	International Federation of Air Line Pilots' Associations
IFPS	Integrated Initial Flight Plan Processing System
IFPSZ	Integrated Initial Flight Plan Processing System Zone
IFR	Instrumental Flight Rules
ILS	Instrumental Landing System
INS	Inertial Navigation System
INTEROP	Interoperability Requirements
iOAT (FPL)	improved Operational Air Traffic (Flight Plan)
IOP	Input Output Processor
IRS	Interface Requirements Specification
JAA	Joint Aviation Authorities
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
JFAC	Joint Force Air Component Commander
LALE	Low-Altitude Long-Endurance
Lat	Latitude
LoA	Letters of Agreement
Long	Longitude
KPA	Key Performance Area
MAC	Mid-Air Collision
MALE	Medium Altitude Long Endurance
MASPS	Minimum Aviation System Performance Standards
MIL	Military

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Acronym	Definition
MSA	Minimum Sector Altitude
MSOC	Mission Operations Support Centre
MTCD	Mid-Term Conflict Detection
NAA	National Aviation Authority
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NAV	Navigation
NB	Nota-Bene
NM	Nautical Mile or Network Manager
NMF	Network Management Function
NMOC	Network Manager Operations Centre
NOP	Network Operation Plan
NOTAM	Notice To Airmen
OAT	Operational Air Traffic
OC	Operation Centre
OE	Operating Environment
OI	Operational Improvement
OPAR	Operational Performance Assessment Report
OPs	Operations
OSED	Operational Service and Environment Definition
PAR	Performance Assessment Report
PBN	Performance Based Navigation
PCA	Prior Coordination Airspace
PIC	Pilot In Command
QoS	Quality of Service
RBT	Reference Business Trajectory
RBMT	Reference Mission/Business Trajectory
RBT	Reference Business Trajectory

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Acronym	Definition
R/C	Radio Control
ReqMT	Required Mission Trajectory
R&D	Research & Development
RLOS	Radio Line of Sight
RMT	Reference Mission Trajectory
RMM	Risks Mitigation Means
RNP	Required Navigation Performance
RNP AR	RNP Authorized
RP	Remote Pilot
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft Systems
RPASP	Remotely Piloted Aircraft Systems Panel
RPS	Remote Pilot Station
R/T	Receiver/Transceiver or Radiotelephony (EASA)
RVSM	Reduced Vertical Separation Minima
RWC	Remain Well Clear
SAC	Safety Criteria
SAR	Safety Assessment Report
SARPS	Standards And Recommended Practices
SBMT	Shared Business Mission Trajectory
SBT	Shared Business Trajectory
SCTA	Short Term Conflict Alert
SMT	Shared Mission Trajectory
SDM	Service Delivery Management
SecAR	Security Assessment Report
SERA	Standardised European Rules of the Air
SES	Single European Sky
SESAR	Single European Sky ATM Research Programme

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Acronym	Definition
SID	Standard Instrument Departure
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SORA	Specific Operations Risk Assessment
SoS	System of System
SPO	Single Person Operations
SPR	Safety and Performance Requirements
SSR	Secondary Surveillance Radar
STAR	Standard Terminal Arrival
STCA	Short-Term Conflict Alert
SURV	Surveillance
SWaP	Size, Weight and Power
TAA	Terminal Area Altitude
TBC	To Be Confirmed
TBD	To Be Defined
TCAS	Traffic Alert and Collision Avoidance System
TIS-B	Traffic Information Services - Broadcast
TMA	Terminal Manoeuvring Area
ToC	Top of Climb
ToD	Top of Descent
TRA	Temporary Reserved Area
TS	Technical Specification
TSA	Temporary Segregated Area
TWR	Tower
UAS	Unmanned Aircraft system
UAV	Unmanned Aerial Vehicle
UC	Use Case
UDPP	User Driven Prioritisation Process
UHF	Ultra High Frequency

Acronym	Definition
ULTRA	Unmanned Aerial Systems in European Airspace
USAF	United States Air Forces
UTM	Unmanned (Aircraft Systems) Traffic Management
VALP	Validation Plan
VALR	Validation Report
VFR	Visual flight Rules
VHF	Very High Frequency
VLL	Very Low Level
VLOS	Visual Line Of Sight
VMC	Visual Meteorological Conditions
VNAV	Vertical Navigation
VOR/DME	VHF Omnidirectional Range/Distance measurement Equipment
V&V	Validation and Verification
WG	Working Group
WOC	Wing Operation Centre
WP	Work Package
WPT	Waypoint
WRC	World Radio communication Conference
XPDR	Transponder
ZIT	Zones Interdites (French) / Prohibited zones
ZRT	Zones Règlementées (French) / Restricted zones

Table 2: List of acronyms

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3 Operational Service and Environment Definition

3.1 SESAR Solution 115: a summary

This SESAR solution addresses existing RPAS accommodation as General Air Traffic (GAT) under Instrument Flight Rules (IFR), also recognizing that these RPAS are not fully compliant with ICAO standards.
RPAS accommodation relies on the existing mechanisms and systems already in place with minor improvements if necessary. The solution will define specific provisions on flight planning and RPAS management by establishing harmonized procedural improvements.
The timeframe is short to medium term. The target-operating environment is Low/ Medium complexity and density European airspace with low RPAS numbers. The solution covers RPAS flying transit segments in non-segregated controlled class A-C airspace whereas mission specific profiles and departure/arrival remains as currently performed outside the solution’s scope.

SESAR Solution ID	Title
PJ.13-W2-115	IFR RPAS accommodation in Airspace Class A to C
The Solution is contributing to	
Key feature	Advanced Air Traffic Services
Essential Operational Change (EOC)	Multimodal Mobility and integration of all Airspace Users
Capability	Collaborative Trajectory Planning; Coordination and Transfer; Emergency Management; Separation Provision (airspace)

Table 3: SESAR Solution 115 Summary

OI Step code	OI Step title	OI Step coverage
AUO-0619	RPAS accommodation in class A-C airspace	Fully covered by this solution

Description:

First step to accommodate IFR RPAS as General Air Traffic (GAT) in European airspace, during their transit phase through non-segregated controlled class A-C airspace.

RPAS is managed alongside manned-aircraft traffic in En-Route and partly TMA airspace structure for climb/descent (which corresponds to En-route operating environment) only with accommodation rules and procedures (planning and execution phases, applicable to Remote pilots and ATC) and allowing to manage Command and Control link loss.

It applies to the short to medium term, in airspaces of low to Medium complexity. Departure/arrival remain from/to dedicated airfields or dedicated mission areas.

No technological changes are envisaged. The solution uses existing ATM technologies.

Rationale:

In the current ATM, large RPAS in the target environment are managed segregated in reserved airspace. These RPAS cannot yet routinely access and fly in shared airspace alongside manned civil aircraft.

A form of sharing is possible through coordination and with a delay when corridor portions used (activation/deactivation margins).

The aim is to accommodate RPAS in the current ATM System through standard Flight Planning access procedures, to evaluate use of manned aircraft procedures when managing RPAS alongside manned traffic and to evaluate contingency management procedures. When required, those procedures will be adapted to RPAS.

Routine access and full sharing will be acceptable as long as the number of RPAS remains low.

Intended Benefits for this Operational Improvement is to Encourage early adoption of accommodation procedures for the initial RPAS demand that will enable:

- Reduced planning and approval time of RPAS operations;

- Routine access for transit flights across airspace class A-C with limited restrictions;

- Airspace equity to all airspace users.

Table 4: SESAR Solution 115 OI Step

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SESAR Solution ID	SESAR Solution Title	OI Steps ID	OI Steps Title	Enabler ID	Enabler Title	OI Step/Enabler Coverage
PJ.13-W2-115	IFR RPAS accommodation in Airspace Class A to C	AUO-0619	RPAS accommodation in class A-C airspace	**PRO-263**	ATC/Remote Pilot C2 Link Loss Procedure for accommodating IFR RPAS transiting in Class A-C airspace	Developed - fully covered
				REG-0535	IFR RPAS Accommodation as General Air Traffic (GAT) Standards & Regulations	Required - used

Table 5: SESAR Solution 115 Scope and related OI steps/enablers

High Level Concept of Operations Requirement ID	High Level Concept of Operations Requirement	Operational Environment	Reference to relevant Concept of Operations Sections e.g. Operational Scenario applicable to the SESAR Solution
S115-HLOR-01 [4]	Accommodation of RPAS in airspace classes A, B, C shall provide a ECAC-wide generic, operational concept for the initial short-term demand of individual RPAS types and types of operations, through the following ATM Components: • Airspace Management • Air Traffic Services Conflict Management (Separation Management) • Traffic Synchronisation - by application to RPAS of: • Adapted separation minima between RPAS them and with other Aircraft, providing required minima for safe	ER-Low Complexity; ER-Medium Complexity;	Civil and Military RPAS departing/arriving from specific airfield and transiting class A-C airspace non-segregated with other manned traffic (evolving from current use of ARES operations / smart and safe segregation) ECAC-wide applicable Specific harmonised regulations and procedures for such accommodation, whether in National airspace or Cross-border operations across ECAC states Both National airspace and Cross-border operations

High Level Concept of Operations Requirement ID	High Level Concept of Operations Requirement	Operational Environment	Reference to relevant Concept of Operations Sections e.g. Operational Scenario applicable to the SESAR Solution
	separation reduced to the minimum possible • Performance Based Navigation requirements, or Performance equivalence for the Military RPAS if required. • Adapted separation due to Performance Based Communications (possible consideration of expected latencies in C2 & C3 communications) including availability and continuity of service • Adapted Flow management and/or declared capacities in sectors expected to accommodate one or several RPAs • Adapted non nominal and/or emergency procedures, particularly in the case of loss of C2 or C3 links - while: • Reducing to the minimum the adverse impacts on flight efficiency of other aircraft/rotorcraft		Free Route and Fixed Route Airspace Mid-level MALE operations and transit from/to High Level Altitude Operations Low number of RPAS access to class A-C airspace IFR Operations in En Route and in TMA Departure and Arrival from/to dedicated airfields Use of currently existing ATC systems basic IOP Partial availability of compatible SDM services including FF-ICE
S115-HLOR-02 [4]	The ATM Components mentioned in S115-HLOR-01, to support RPAS accommodation, shall be compatible of anticipated Safe Separation procedures and enablers, in particular - The RPAS compatibility with identification means and procedures supporting separation and conflict detection - The RPAS compatibility with other manned aircraft traffic's collision avoidance procedures and systems and ATC/AD systems	ER-Low Complexity; ER-Medium Complexity;	Civil and Military RPAS non-segregated in controlled airspaces classes A, B or C (evolving from current segregated airspace using smart and safe segregation) Fixed and Free Route Airspace Mid-level MALE operations and transit from/to High Level Altitude Operations Only cooperative traffic is considered in class A-C airspaces IFR operations
S115-HLOR-03 [4]	The accommodation of RPAS, in order to improve the Situational Awareness as possible wherever the R/T link is the primary one, and reduce to the minimum the impacts on ATC systems and procedures, shall rely on:	ER-Low Complexity; ER-Medium Complexity;	Civil and Military RPAS non-segregated in controlled airspaces classes A, B or C (evolving from current segregated airspace using ARES operations/smart and safe segregation)

High Level Concept of Operations Requirement ID	High Level Concept of Operations Requirement	Operational Environment	Reference to relevant Concept of Operations Sections e.g. Operational Scenario applicable to the SESAR Solution
	• Legacy communication protocols, enablers and links, especially between the RPA and the controlling sectors, this link serving as a relay between the RPS and the ATC • Communications for in-flight re-planning • ECAC -generic contingency procedures in case of loss of C2 or C3 links		Backup alternative communications between RPS and ATC ECAC-wide applicable Specific harmonised regulations and procedures for such accommodation Both National airspace and Cross-border operations Free Route and Fixed route Airspace Mid-level MALE operations and transit from/to High Level Altitude Operations Low number of RPAS access to class A-C airspace IFR Operations in En Route and in TMA Departure and Arrival from/to dedicated airfields Use of currently existing ATC systems basic IOP Partial availability of compatible SDM services including FF-ICE
S115-HLOR-04 [4]	In the operational context of accommodation of RPAS, the non-nominal and emergency procedures shall be generic at ECAC wide area and ensure: • Limited additional impacts on legacy operations compared to the current emergency ones • Reduce to the minimum possible the local procedures at Network Operation, ATC and Airport level • Maintaining the safety of operations, especially during the possible rerouting of the RPA to any anticipated or defined area / airfield (other aircraft, overflown areas …)	ER-Low Complexity; ER-Medium Complexity;	Civil and Military RPAS departing/arriving from specific airfield and transiting non-segregated class A-C airspace with other manned traffic (evolving from current use of ARES operations / smart and safe segregation) ECAC-wide applicable Specific harmonised regulations and procedures for such accommodation, whether in National airspace or Cross-border operations across ECAC states Both National airspace and Cross-border operations

High Level Concept of Operations Requirement ID	High Level Concept of Operations Requirement	Operational Environment	Reference to relevant Concept of Operations Sections e.g. Operational Scenario applicable to the SESAR Solution
			Free Route and Fixed route Airspace Mid-level MALE operations and transit from/to High Level Altitude Operations Low number of RPAS access to class A-C airspace Departure and Arrival from/to dedicated airfields Use of currently existing ATC systems basic IOP

Table 6: High Level CONOPS requirements related to SESAR Solution PJ.13-W2-115

3.1.1 Deviations with respect to the SESAR Solution(s) definition

OI Step Code	OI Step title	Deviation
AUO-0619	RPAS accommodation in class A-C airspace	No deviation. The project and OI-step was initially defined for low/-mid complexity airspace. Validation showed that the concept can be derived also to High complexity airspace, but only during low traffic periods.

Table 7: Deviations with SESAR Solution definition and/or the list of OI step

3.2 Detailed Operational Environment

3.2.1 Operational Characteristics

Taking into account the solution scope for RPAS accommodation (cf section 2.2), the main operational characteristics considered for the solution are:

RPAS:

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).

RPAS in this solution are being accommodated as IFR flights in controlled and non-segregated airspace where the RPAS is flying as GAT 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.

Due to RPA – RPS separation and associated programmed RPA automation, certain cases lead to specific operational procedure provisions for the accommodation phase. The operational procedures considered by the project, also take into account where possible, ongoing standards (ICAO, EUROCAE).

The solution is applicable to future civil RPAS in the short-medium term, however the known initial RPAS demand for this solution is currently military/STATE RPAS (including air-force, surveillance, customs, police, search & rescue, if flying in the confined class A-C airspace domain identified for the solution). Such RPAS are characterized by NATO classification and standards (Class III of this STANAG 4671 [69], see table below), the main RPAS concerned for the accommodation phase being addressed by this project are MALE and marginally HALE during climb descent through En-Route airspace.
These MALE RPAS principally concern semi-automatic RPAS automation (cf. STANAG 4671 [69]). RPAS, under semi-automatic automation allow for waypoint programmed navigation, or direct auto-piloted commands from the RPS (e.g. heading, speed, altitude).

Amongst the several classes defined in NATO Unmanned Aircraft Classification Guide, the two main classes addressed in this solution are:

Class	Category	Normal Employment	Normal Operating Altitude	Normal Mission Radius
	MALE	Operational/ Theatre	Up to 45,000' AGL	Unlimited (BLOS)

Class	Category	Normal Employment	Normal Operating Altitude	Normal Mission Radius
Class III > 600 kg	HALE[4]	Strategic/ National	Up to 65,000' AGL	Unlimited (BLOS)

Table 8: NATO Unmanned Aircraft Classification Guide

In the EUROCONTROL RPAS CONOPS, where RPAS are grouped according to their capabilities and type of operations, amongst the seven different classes of RPAS, class VI in IFR operations is related to Solution 115 scope.

ATM and Flight environments:

Air Traffic Control managing General Air Traffic (GAT) in controlled classes A-C airspace, will manage the RPAS being accommodated as an IFR flight where the RPAS is flying as GAT non-segregated from manned aviation:

- During climb, En-route and descent phases of flight
- In low to medium traffic density, to RPAS mission areas
- One RPAS[5] in a control sector[6]

Note1: RPAS is controlled as currently as segregated operations during departure/arrival and aerodrome manoeuvers, RPAS remains segregated (because operating from military airfield).

Note 2: It is recommended to take into account whether the RPAS trajectory might affect the complexity metrics (if these are used in the DCB process, they may contribute to the sector traffic complexity metric).

[4] Marginally during climb descent through En-Route airspace.

[5] During the accommodation period, any handover considered between different RPs is not significant to the concept. There is always a single RP at a time in command.

[6] For specific cases where RPAS are operating in pairs, the RPAS Operator (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.

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Although, in general it is foreseen that ATC manages the accommodated RPAS similarly to manned IFR GAT traffic, due to the C2 link loss specificity[7] described above, adapted operating methods will be needed for certain RPAS situations which are addressed in Section 3.3.2 in individual use cases.

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.

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.

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.

[7] RPAS being a separate airborne vehicle (the Remotely Piloted Aircraft: RPA) from the remote ground based pilots (RP) in a ground based “cockpit” (the Remote Piloting Station: RPS) with cases where the RPA can be on automatic control, separated from the RP/RPS.

RPAS accommodation implies some limitations (inter alia: bounded traffic flight levels, RPAS flights enter/exit GAT controlled airspace (classes A to C) for transit:

- **Lowest Flight level:**
  - Above ~ FL100 where most recreational VFR (which are the majority of aircraft, which infringe controlled airspace) do not fly.
- **Highest Flight Level:**
  - Below ~ FL200 dense and high-speed jet traffic streams.

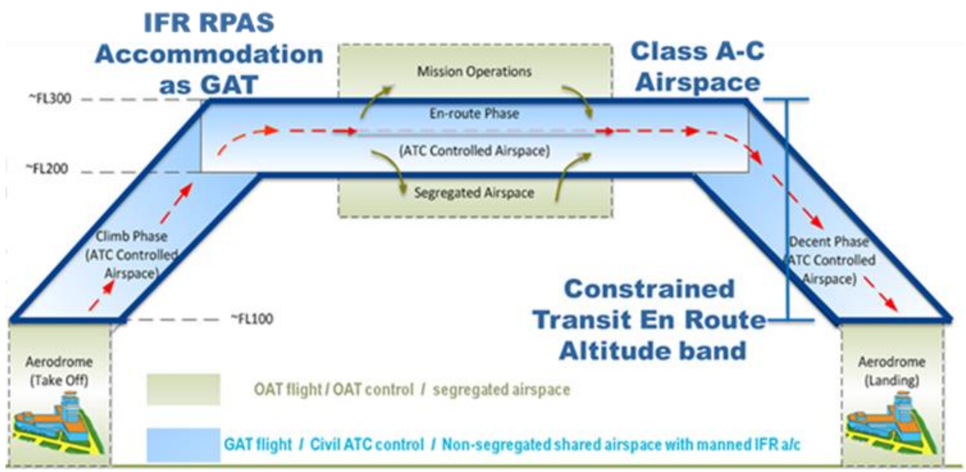

Figure 1 : Operating Environment Overview

Operating environment:

The Solution focuses on the RPAS transit phase, and target operating environment is Low/ Medium complexity European airspace En-Route[8] operating environments (OE) with low-medium traffic density and low RPAS numbers. 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

[8] During RPAS accommodation the primary operation is RPAS transit in climb, descent and en-route manoeuvres, the only operating environment was defined as the En-route OE , assumed encompassed in the ER OE, as it would be "extended TMA": not strictly a TMA sector for the type of RPAS operations in transit. (TMA Terminal manoeuvres – typically approach/departure to aerodromes - are not in the solution scope).

Firstly, when considering only transit operations that both En-Route and High Terminal airspace would be concerned (En-route transit operations are outside terminal manoeuvring but the transit can include climbing, cruise and descending portions of flight fully under a control service provided by an ACC or TMA unit). Thus, the OEs of interest should be En-Route OE and Terminal OEs (with high ceilings) where RPAS will cross for transit flights. Solution 115 should be considered applicable in European airspaces, primarily by those ANSPs/states which have initial RPAS transit demand, ER & high ceiling TMA, classified Low, Medium (and Higher Complexity during low traffic periods[9]) OEs.

Additional considerations are:

- The solution operational conditions: single RPAS per control sector, low density traffic. This provides opportunity for the concept to be used in airspaces classified Higher complexity but only under these operational conditions[10]. This also corresponds to RPAS user needs in the core European airspace.
- The accommodated MALE (Mid-Altitude) RPAS transit flight will be between FL100 and FL200/300 (below jet traffic). The RPAS would be too restricted in only the En-Route ACCs – its transit profile could be through a number of TMA control units that have high ceilings in Europe. This is illustrated in the following ATS unit distribution – OE type and complexity, summarized from PJ.20 provided data itself from EUROCONTROL ATM Cost Effectiveness reports (ACE), for the first ANSPs that would likely be concerned by initial RPAS accommodation.

	ER-L	ER-M	ER-H	ER-VH	TMA-L (>FL100)	TMA-M (>FL100)	TMA-H (>FL100)	TMA-VH (>FL100)
France			**5**		**8**	**11**	**3**	**1**
Belgium				1				1
Italy		2	2		9	9	2	
Maastricht				1				
Netherlands				1		1		
Portugal	1	1			3	2		
Spain	1	3		1	6	4		
Switzerland				2	2	1		2
UK			1	1		3	2	2

Table 9: ANSP control Centres per OE & Complexity Level

[9] The solution also must encompass TMAs with high ceilings for transit flights which, and would be applicable to ER & TMA OEs classified Higher Complexity as long the number of movements is similar or lower to the Medium Complexity OE one, e.g. during low traffic periods.

[10] A parallel can be drawn with night cargo flights in very low traffic, even though the same airspaces in daytime would be H, VH complexity.

Timeframe:

Deployment is targeted in the short to medium term.

3.2.1.1 IFR RPAS Pre Flight Characteristics:

Operational interactions per context (NOV-2)	Operating Environment
[NOV-2] IFR RPAS Pre Flight	NET-Network;
Comment	
Pre-flight exchanges are between stakeholder entities preparing the RPAS IFR GAT flight and associated filing of these flight plans. **Environment of these exchanges is the RPAS operator flight planning tools, existing Network Manager (NM), and individual ANSP Flight Plan systems.**	

Table 10: Operational Characteristics IFR RPAS Pre Flight Operations

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3.2.1.2 IFR RPAS Nominal Flight Characteristics:

Operational interactions per context (NOV-2)	Operating Environment
[NOV-2] IFR RPAS Nominal Operations	En-Route; ER-Low Complexity; ER-Medium Complexity;

Comment

- **En-Route:**

An En-route Operating Environment is a volume of airspace outside terminal manoeuvring areas, where the climb, cruise and descent phases of flight take place and within which, or part of which, area control service is provided by an ATC unit.

Complementary information:

- **The Solution focuses on the RPAS transit phase, which concerns the En-Route and Terminal Airspace operating environments (OE).**
  However when considering solely transit operations, there can be considered no significant differences between En-Route and Terminal airspace aircraft management.
  Thus, the Terminal airspace OE is considered equivalent to En-Route OE.
- **RPAS flights are assumed accommodated in Higher Complexity operating environment (OE) only if the number of movements is similar or lower than the Medium Complexity OE one.**
- **During the accommodation period, any handover considered between different RPs is not significant to the concept. There is always a single RP at a time in command.**

- **ER-Low Complexity:**

A Low Complexity En-Route Operating Environment is an En-Route airspace in which, or a part of which, area control service is provided by an ATC operational Unit with an Aggregated Traffic Complexity Score less than 2 or, if score is not available, with a number of serviced IFR flights less than 20000 per year.

- **ER-Medium Complexity:**

Operational interactions per context (NOV-2)	Operating Environment
[NOV-2] IFR RPAS Nominal Operations	En-Route; ER-Low Complexity; ER-Medium Complexity;
Comment	
A Medium Complexity En-Route Operating Environment is an En-Route airspace in which, or a part of which, area control service is provided by an ATC operational Unit with an Aggregated Traffic Complexity Score greater or equal to 2 and less than 6 or, if score is not available, with a number of serviced IFR flights greater or equal to 20000 and less than 100000 per year.	

Table 11: Operational Characteristics IFR RPAS Nominal Operations

3.2.1.3 IFR RPAS Contingency Flight Characteristics:

Operational interactions per context (NOV-2)	Operating Environment
[NOV-2] IFR RPAS Contingency Operations (C2LL)	En-Route; ER-Low Complexity; ER-Medium Complexity;

Comment

- **En-Route:**

An En-route Operating Environment is a volume of airspace outside terminal manoeuvring areas, where the climb, cruise and descent phases of flight take place and within which, or part of which, area control service is provided by an ATC unit.

Complementary information:

- **The Solution focuses on the RPAS transit phase, which concerns the En-Route and Terminal Airspace operating environments (OE).**
  However when considering solely transit operations, there can be considered no significant differences between En-Route and Terminal airspace aircraft management.
  Thus, the Terminal airspace OE is considered equivalent to En-Route OE.

- **RPAS flights are assumed accommodated in Higher Complexity operating environment (OE) only if the number of movements is similar or lower than the Medium Complexity OE one.**

- **During the accommodation period, any handover considered between different RPs is not significant to the concept. There is always a single RP at a time in command.**

- **ER-Low Complexity:**

A Low Complexity En-Route Operating Environment is an En-Route airspace in which, or a part of which, area control service is provided by an ATC operational Unit with an Aggregated Traffic Complexity Score less than 2 or, if score is not available, with a number of serviced IFR flights less than 20000 per year.

- **ER-Medium Complexity:**

A Medium Complexity in En-Route Operating Environment is an En-Route airspace in which, or a part of which, area control service is provided by an ATC operational Unit with an Aggregated Traffic

Operational interactions per context (NOV-2)	Operating Environment
Complexity Score greater or equal to 2 and less than 6 or, if score is not available, with a number of serviced IFR flights greater or equal to 20000 and less than 100000 per year.	

Table 12: Operational Characteristics IFR RPAS Contingency Operations

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3.2.1.4 IFR RPAS Emergency Flight Characteristics:

Operational interactions per context (NOV-2)	Operating Environment
[NOV-2] IFR RPAS Emergency Operations	En-Route; ER-Low Complexity; ER-Medium Complexity;

Comment

- **En Route:**

An En-route Operating Environment is a volume of airspace outside terminal manoeuvring areas, where the climb, cruise and descent phases of flight take place and within which, or part of which, area control service is provided by an ATC unit.

Complementary information:

- **The Solution focuses on the RPAS transit phase, which concerns the En-Route and Terminal Airspace operating environments (OE).**
  However when considering solely transit operations, there can be considered no significant differences between En-Route and Terminal airspace aircraft management.
  Thus, the Terminal airspace OE is considered equivalent to En-Route OE.

- **RPAS flights are assumed accommodated in Higher Complexity operating environment (OE) only if the number of movements is similar or lower than the Medium Complexity OE one.**

- **During the accommodation period, any handover considered between different RPs is not significant to the concept. There is always a single RP at a time in command.**

Emergency event is considered only when RPA is in En-Route.

Note: Emergency events could lead to infringement of uncontrolled or restricted airspace. This Operational Environment is not part of SESAR scope but Emergency management will consider it.

- **ER-Low Complexity:**

A Low Complexity En-Route Operating Environment is an En-Route airspace in which, or a part of which, area control service is provided by an ATC operational Unit with an Aggregated Traffic Complexity Score less than 2 or, if score is not available, with a number of serviced IFR flights less than 20000 per year.

Operational interactions per context (NOV-2)	Operating Environment
Complementary information: **Warning: If RPA is entering an uncontrolled airspace then there can be no assurance that airspace is low traffic.** ▪ **ER-Medium Complexity:** A Medium Complexity in En-Route Operating Environment is an En-Route airspace in which, or a part of which, area control service is provided by an ATC operational Unit with an Aggregated Traffic Complexity Score greater or equal to 2 and less than 6 or, if score is not available, with a number of serviced IFR flights greater or equal to 20000 and less than 100000 per year. Complementary information: **Warning: If RPA is entering an uncontrolled airspace then there can be no assurance that airspace is low traffic.**	

Table 13: Operational Characteristics IFR RPAS Emergency Operations

3.2.2 Roles and Responsibilities

3.2.2.1 Nodes and Responsibilities

Node (ATM Stakeholder entity)	Responsibilities
Aerodrome ATS	Performs all the aerodrome ATS operations. [RELATED ACTORS/ROLES] Runway controller, ground controller, etc.
Air Traffic Flow and Capacity Management	The ATFCM node is responsible for the demand and capacity balancing activities.
Airport Ops Support	Perform all the airport ops support activities, including analysis of airport resources, long term planning of infrastructures, coordination of airport slots, management of airport resources on the day of operation (gates, vehicles, stands, de-icing...), information sharing and CDM, etc. [RELATED ACTORS/ROLES] Airport Operator, Airport Slot Negotiator
Airspace User Ops Support	Performs all the necessary activities to support AU ops, including the strategic and tactical planning of AU operations, participation to related CDM processes and UDPP, update of AOP with AU information, and ground handling. [RELATED ACTORS/ROLES] Flight Schedule Planner, Airline Operations and Control Centre (AOCC), Wing Operations Centre (WOC), etc.
En-Route/Approach ATS	Performs all the en-route and approach ATS operations. [RELATED ACTORS/ROLES] Executive controller, planning controller, etc.
Flight Deck	Performs all the on-board AU operations including flight execution/monitoring according to agreed trajectory, compliance with ATC clearances/instructions, etc. [RELATED ACTORS/ROLES] Flight Crew

Node (ATM Stakeholder entity)	Responsibilities
Network Operations	The objectives of the ATM Network Management Function (NMF) is to enable the optimum use of airspace and ensure that Airspace Users can operate preferred trajectories while allowing maximum access to airspaces and air navigation services. The NMF integrates and manages all the tasks related to the ATM Network, i.e. the dynamic, integrated management of air traffic and airspace including Air Traffic Services (ATS), Airspace Management (ASM) and Air Traffic Flow and Capacity Management (ATFCM) - safely, economically and efficiently - through the provision of facilities and seamless services in collaboration with all parties and involving airborne and ground-based functions. For all ATM phases, the NMF is based on Collaborative Decision Making processes; the actors involved are different ones depending on the phases and the activities carried out, but collaborative actions and processes will always drive the result. The Network Management Function is truly performed at all geographical levels (regional, sub-regional, local) with a level of involvement and responsibilities depending on the activities and on the ATM phases.
RPA Operations	Performs the on-board AU operations including flight execution according to uploaded trajectory, compliance with onboard control etc. It also provides the means to monitor update trajectories and implement heading, speed etc. [RELATED ACTORS/ROLES] RPS Operations (when associated these two roles are often referenced as RPAS)
RPS Operations	Performs all the on-ground AU operations including RPA Operations trajectory, speed, altitude etc. according to agreed trajectory, compliance with ATC clearances/instructions, etc. [RELATED ACTORS/ROLES] RPA Operations (when associated these two roles are often referenced as RPAS), Remote Crew

Table 14: SESAR Solution 115 Nodes and Responsibilities

3.2.2.2 Node Instances and Roles

This section summarizes the Stakeholder entities concerned by specific activities in the RPAS accommodation concept.

3.2.2.2.1 Pre-flight Operations

Operational interactions per context (NOV-2)		**Operating Environment**
[NOV-2] IFR RPAS Pre Flight		NET-Network;
Node	Node instance	Node instance description
Network Operations	**Air Navigation Service Provider (ANSP)**	It is composed of : • A centralised European service of the Network Manager Operations Centre (NMOC). It has many roles and in this instance, the one concerned is the reception, initial processing and distribution of flight plan data related to instrument flight rules (IFR) flight within the ICAO EUR Region known as the IFPS Zone (IFPZ). Flight plans and associated update messages may be submitted as individual messages. IFPS, as a sub unit of Air Traffic Flow and Capacity Management (ATFCM), shall check all messages received or changes there and shall take action to ensure that the flight plan is acceptable to air traffic services for: 1. Compliance with all format and data conventions 2. Completeness and accuracy. In the specific context of the flight preparation, its only role, as in current operations, is to flow down flight plan coming from EU level towards National infrastructures (WOC as well as ATS units). • The flight plan is then distributed to the national Organisation in charge of providing Air Traffic Management services to Airspace Users when in the national concerned airspace.
Air Traffic Flow and Capacity Management	**Air Traffic Flow and Capacity Management**	Air Traffic Flow and Capacity Management is a centralised service of the Network Manager Operations Centre (NMOC) designed that has many roles and in this instance the one concerned is to rationalise the reception, initial processing and

Operational interactions per context (NOV-2)		Operating Environment
[NOV-2] IFR RPAS Pre Flight		NET-Network;
Node	Node instance	Node instance description
		distribution of flight plan data related to instrument flight rules (IFR) flight within the ICAO EUR Region known as the IFPS Zone (IFPZ). Flight plans and associated update messages may be submitted as individual messages. IFPS, as a sub unit of Air Traffic Flow and Capacity Management, shall check all messages received or changes thereto for: 1. Compliance with all format and data conventions 2. Completeness and accuracy. During Flight Preparation IFPS shall take action to ensure that the flight plan is acceptable to air traffic services.
En-Route/Approach ATS	Civil ATS ACC/APP Service Provider	In Solution 115 scope, Civil ATS En Route and Approach control centre is the main Node of Interest. Considering the Preparation of the Flight Plan the most important point is for the Node Instance to be the recipient of the Flight Plan.
En-Route/Approach ATS	OAT / Military ATS ACC/APP Service Provider	Considering the different European countries, OAT / Military ATS APP/ACC Service Provider status may differ. Nevertheless, whatever this status, its role is to accommodate the Operational Air Traffic Flight / Mission plan that expresses needs whenever State Aircraft are concerned during their mission flight phase either segregated or not. In the context of Solution 115, the boundaries considered are: 1. The first transfer of control from OAT control to civil control (as GAT) 2. The last transfer of control from civil control (as GAT) to OAT control 3. And considering Mission, transfer of control due to the Entry and Exit in Mission Areas. It means in the scope of the pre-flight that you only have to consider the filing of the flight plan to the civil ANSP through the existing processes considering the specificities identified for the RPAS flight plan.

Operational interactions per context (NOV-2)		**Operating Environment**
[NOV-2] IFR RPAS Pre Flight		NET-Network;
Node	Node instance	Node instance description
RPS Operations	[RPS Operations]()	In this Solution, this node represents the instantiation of the Flight Deck manned aviation for a RPAS. This Node instance characterizes all the operations concerning RPS (RPS Operations) management during pre-flight flight that are performed by the ground segment. During Pre-flight, tasks dedicated to RPS Operations are: • To create the entire RPAS flight plan (Mission Plan) which will be used to build (GAT) portions of the Flight Plan and OAT portions of the Flight Plan. • To be the recipient of the validated Flight Plan. Considering possible civil applications during Accommodation period, only difference will be non-necessity o dedicated segments to the military/OAT part. However, segregated take-off/departure and arrival/landing will still have to planned.
Airspace User Ops Support	[Wing Operation Centre (WOC)]()	Wing operations centre (WOC) performs continuous coordination between the wing and the Joint Force Air Component Commander (JFAC) (also the Airline Operations and Control Centre - AOCC), if tasking authority is delegated) or between the wing and the squadrons. Feasibility of tasking is verified throughout the mission preparation process. Tasking is adjusted for additional mission relevant information and within the wing's capabilities and capacities in coordination with the tasking authority. Mission launch schedules are generated and missions are assigned to individual squadrons or to individual aircraft. WOC monitors and ensures mission result reporting and provides continuous near real-time status information to the JFAC and associated ARS. In this specific diagram, WOC is considered through its planning role to Air Traffic Flow and Capacity Management as well as distribution of OAT Flight Plan to OAT / Military ACC/APP Service Provider.

Operational interactions per context (NOV-2)		**Operating Environment**
[NOV-2] IFR RPAS Pre Flight		NET-Network;
Node	Node instance	Node instance description
		Its role in Pre-flight operations is similar to what is assumed by Flight Operation Centres (FOC) / Airline Operations Centres (AOC).

Table 15: Node Instances and Roles Pre Flight Operations

3.2.2.2.2 For Nominal Operations

Operational interactions per context (NOV-2)		Operating Environment
[NOV-2] IFR RPAS Nominal Operations		En-Route; ER-Low Complexity; ER-Medium Complexity;
Node	Node instance	Node instance description

En-Route/Approach ATS	**Civil ATS ACC/APP Service Provider (Controlling Sector)**	During the RPAS Nominal Operations, the Civil ATS ACC/APP Service Provider (controlling sector) performs the following tasks/activities:
		• Assumes the air traffic management control responsibility including the IFR RPAS in GAT (assume control of flight).
		• Maintains the standard minima of separation between the RPAS and the other traffics (detect and resolve conflicts).
		• Instructs RPS Operations when necessary: heading, flight level, or speed instruction (ATC instructions).
		• Coordinates IFR RPAS transfer of control (coordinate transfer of control):
		  ○ With the next downstream control sector.
		  ○ With the OAT/Military ATS ACC/APP Service Provider when RPAS leaves the GAT flight regime/civil air traffic control.
		• Takes into account the C2 Link Loss (C2LL) contingency information provided by the RPS Operations in anticipation of a possible C2LL during flight (RPAS flight intentions in case of C2LL).

	Civil ATS ACC/APP Service Provider (Next Sector)	During nominal operations of RPAS, the Civil ATS ACC/APP Service Provider (Next/Adjacent Sector) assumes the RPAS transfer of control during transfer of control coordination with the Civil ATS ACC/APP Service Provider (Controlling Sector), then assumes the same tasks/activities as the Civil ATS ACC/APP Service, Provider (Controlling Sector).
Flight Deck	**N-Legacy Aircraft**	In this Solution, Flight Deck applied to N-Legacy Aircraft is exclusively used to characterize manned aviation (commercial aircraft, cargo…), flying under civil air traffic control, in GAT. 'N' represents several manned aircraft under ATC control.

Operational interactions per context (NOV-2)		Operating Environment
[NOV-2] IFR RPAS Nominal Operations		En-Route; ER-Low Complexity; ER-Medium Complexity;
Node	Node instance	Node instance description
		The N-Legacy Aircraft have regular, which are summarised as below for the description of the Use Case: • Receives and complies with the ATC instruction.
En-Route/Approach ATS	**OAT/Military ATS ACC/APP Service Provider**	During nominal operations of RPAS, the OAT/Military ATS ACC/APP Service Provider performs the following tasks/activities (RPAS leaving GAT to perform its specific mission patterns under OAT/segregation, or departing from / resp. reaching segregated departure / resp. arrival airspace) : • Coordinates the departing RPAS transfer of control to the Civil ATS ACC/APP Service Provider (Controlling Sector) through a specific civil/military coordination (coordinate transfer of control) / resp. • Assumes RPAS transfer of control initiated by the civil ATS ACC/APP Service Provider (Controlling Sector) through a specific civil/military coordination (coordinate transfer of control). • Or Assumes control responsibility for military control of flight as OAT (Operational Air Traffic) when RPAS performs its specific mission patterns as the OAT controlling unit and to perform the task associated to the OAT/Military ATS Unit controlling military sector (assume control of flight in OAT).
RPA Operations	**RPA Operations**	This Node instance characterizes all the operations concerning RPA (RPA Operations) management during nominal operations that are performed by the airborne segment. These nominal flight operations are performed by: • The Remotely-Piloted Aircraft (RPA) is an aircraft where the flying pilot is not on board the aircraft. These nominal flight operations are either programmed during flight, but manual control or navigation replanning can be dynamically performed by the RPS Operations during flight in accordance with the current flight context and/or ATC clearance/instructions.

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Operational interactions per context (NOV-2)		**Operating Environment**
[NOV-2] IFR RPAS Nominal Operations		En-Route; ER-Low Complexity; ER-Medium Complexity;
Node	Node instance	Node instance description
		During Nominal Operations, the RPA Operations performs the following tasks/activities: • Program/control and fly nominal flight plan as during flight by the RPAS Operations. • Insert C2LL contingency trajectory pre-programmed by the RPS Operations (initially at departure). • Provide health and flight status to the RPS Operations. • Provide the cooperative surveillance transponder data (to ATC and for the other aircraft (e.g. for their traffic situation awareness)). • Relay voice frequencies to/from RPS.
RPS Operations	**RPS Operations**	In this Solution, this node represents the instantiation of the Flight Deck manned aviation for a RPAS. This Node instance characterizes all the operations concerning RPS (RPS Operations) management during nominal flight that are performed by the ground segment. These nominal operations are performed by: • The Remote Pilot is the actor/person who manipulates the navigation / flight controls of the RPA during flight. • The Remote Pilot Station (RPS) is the station at which the Remote Pilot manages the flight of the RPA. During Nominal Operations, the RPS Operations performs the following tasks/activities: • Provide flight commands to the RPA Operations when necessary, i.e. upon ATC instruction (RPA navigation through flight plan change or direct primary autopilot commands). • Monitor flight path of the RPA. • Initiate (initial sector contact) and maintain contact with the Civil ATS ACC/APP Service Provider

Operational interactions per context (NOV-2)		**Operating Environment**
[NOV-2] IFR RPAS Nominal Operations		En-Route; ER-Low Complexity; ER-Medium Complexity;
Node	Node instance	Node instance description
		(controlling sector) and the OAT/Military ATS ACC/APP Service Provider. • Provide the C2LL contingency trajectory elements to the Civil ATS ACC/APP Service Provider (controlling sector), which are the Diversion point and the Airfield Airport. • Maintains continuous radio communications frequency watch, also providing a level of surrounding situation awareness to the remote pilot.

Table 16: Node Instances and Roles Nominal Operations

3.2.2.2.3 C2 link loss Contingency Operations

<table>
<tr><th colspan="2">Operational interactions per context (NOV-2)</th><th>Operating Environment</th></tr>
<tr><td colspan="2">[NOV-2] IFR RPAS Contingency Operations (C2LL)</td><td>En-Route;
ER-Low Complexity;
ER-Medium Complexity;</td></tr>
<tr><th>Node</th><th>Node instance</th><th>Node instance description</th></tr>
<tr><td>En-Route/Approach ATS</td><td>Civil ATS ACC/APP Service Provider (Controlling Sector)</td><td>During the RPAS C2 link loss contingency operations, the Civil ATS ACC/APP Service Provider (controlling sector) performs the following tasks/activities:
• Is alerted/detects that the RPAS is in a C2 link loss state
• Performs traffic management and separation adapted to the situation, which is equivalent to a manned aircraft radio-communications loss, taking into account the RPAS C2 link loss (C2LL) contingency flight behaviour that was previously communicated (at initial sector contact or updated later).
• Additionally, Coordinates (confirms and gets further details as needed) the contingency (C2LL) IFR RPAS behaviour with the RPS Operations through the backup telephone line.
Backup telephone line call is performed by Remote pilot, or by ATCO – whoever acts first: ATC has remote pilot tel. contact in the file FPLN field 18 information RMK/ indicator; RP has all ATC centres tel. numbers in their flight preparation briefing documents (Validation recommendation is that ATCO initiates the call as remote pilot tel. no will be in FPL field 18 information RMK/ indicator and ATCO CWP has telephone access a whereas RP does not know who will get the call with the ATC centre number).
• Updates the Flight Planning system with the C2LL contingency plan & destination.
• Coordinates contingency (C2LL) IFR RPAS transfer of control (coordinate C2LL contingency transfer of control):
  ○ With the next/adjacent control sector.
  ○ With the OAT/Military ATS ACC/APP Service Provider when leaving the GAT flight regime and at arrival.</td></tr>
</table>

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Operational interactions per context (NOV-2)		**Operating Environment**
[NOV-2] IFR RPAS Contingency Operations (C2LL)		En-Route; ER-Low Complexity; ER-Medium Complexity;
Node	Node instance	Node instance description
En-Route/Approach ATS	**Civil ATS ACC/APP Service Provider (Next Sector)**	During contingency operations of RPAS, the Civil ATS ACC/APP Service Provider (Next/Adjacent controlling Sector) assumes responsibility of the contingency (C2LL) IFR RPAS, and then performs the same tasks/activities as the Civil ATS ACC/APP Service Provider (Controlling Sector).
Flight Deck	**N-Legacy Aircraft**	In this Solution, Flight Deck applied to N-Legacy Aircraft is exclusively used to characterize manned aviation (commercial aircraft, cargo…), flying under civil air traffic control, in GAT. 'N' represents several manned aircraft under ATC control. The N-Legacy Aircraft have regular, which are summarised as below for the description of the Use Case: • Receives and complies with the ATC instruction.
En-Route/Approach ATS	**OAT/Military ATS ACC/APP Service Provider**	During C2LL contingency operations of RPAS, the OAT/Military ATS ACC/APP Service Provider performs the following tasks/activities (RPAS reaching segregated arrival airspace): • Assumes the contingency (C2LL) IFR RPAS transfer of control initiated by the civil ATS ACC/APP Service Provider (Controlling Sector) through a specific civil/military coordination (coordinate contingency transfer of control).
RPA Operations	**RPA Operations**	The RPA Operations characterize all the operations concerning RPAS management during the C2 link loss (C2LL) contingency that are performed by the airborne segment, i.e.: • The Remotely-Piloted Aircraft (RPA), which is an aircraft where the remote pilot is not on board the aircraft, and has lost the command-control (C2) link; The RPA is under a pre-programmed automated flight during the C2 link-loss (C2LL). No manual control by the RPS Operations is possible as long as the C2 (control & command) link is not re-established.

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<table>
<tr><th colspan="2">Operational interactions per context (NOV-2)</th><th>Operating Environment</th></tr>
<tr><td colspan="2">[NOV-2] IFR RPAS Contingency Operations (C2LL)</td><td>En-Route;
ER-Low Complexity;
ER-Medium Complexity;</td></tr>
<tr><th>Node</th><th>Node instance</th><th>Node instance description</th></tr>
<tr><td></td><td></td><td>During the contingency (C2LL) Operations, the RPA Operations perform the following tasks/activities:
• Detect the C2 link loss , then :
• Automatically activate the pre-programmed C2LL contingency trajectory after a pre-defined stability time (~10 sec.).
• And set the appropriate C2LL transponder code (to ATC and to the collaborative aircraft).</td></tr>
<tr><td>RPS Operations</td><td>RPS Operations</td><td>In this Solution, this node represents the instantiation of the Flight Deck manned aviation for a RPAS.

This Node instance characterizes all the operations concerning RPS (RPS Operations) management during C2LL contingency flight that are performed by the ground segment.

The C2LL contingency operations are performed by:
• The Remote Pilot is the actor/person who manipulates the navigation / flight controls of the RPA during flight.

• The Remote Pilot Station (RPS) is the station at which the Remote Pilot manages the flight of the RPA.

During the C2LL contingency Operations, the RPS Operations perform the following tasks/activities:
• Detect the C2 link loss condition between the RPS Operations and the RPA Operations.
• Coordinate the contingency (C2LL) IFR RPAS situation with the Civil ATS ACC/APP Service Provider (controlling sector) through the back-up telephone line. Backup telephone line call is performed by Remote pilot, or by ATCO – whoever notes and acts first: ATC has remote pilot tel. contact in the file FPLN field 18 information RMK/ indicator; RP has all ATC centres tel. numbers in their flight preparation briefing documents (Validation recommendation is that ATCO</td></tr>
</table>

Operational interactions per context (NOV-2)		**Operating Environment**
[NOV-2] IFR RPAS Contingency Operations (C2LL)		En-Route; ER-Low Complexity; ER-Medium Complexity;
Node	Node instance	Node instance description
		initiates the call as remote pilot tel. no will be in FPL field 18 information RMK/ indicator and ATCO CWP has telephone access a whereas RP does not know who will get the call with the ATC centre number): ○ Confirm the programming or re-programming of RPA's C2LL contingency route & profile (diversion point, contingency airfield, key waypoints points, flight level and any additional information). • Monitor the C2 link status and try to recover the C2 link. • When detect the C2L recovery and contacts ATS Unit by VHF (nominal R/T) to inform/to confirm the recovery link state: ○ On the last frequency used before C2LL or on the emergency frequency 121.500 MHz

Table 17: Node Instances and Roles Contingency Operations

3.2.2.2.4 For Emergency Operations

Operational interactions per context (NOV-2)		**Operating Environment**
[NOV-2] IFR RPAS Emergency Operations		En-Route; ER-Low Complexity; ER-Medium Complexity;
Node	Node instance	Node instance description
Airport Ops Support	**Civil Airport Supervision**	Placeholder for future Civil Airport Supervision receives alert of RPA to land in emergency mode on its supervised airport. It has to request Civil ATS Aerodrome Service Provider to clear runway and separate remaining traffic with respect to the emergency RPA flight. It alerts Emergency teams in order to take care of any fire or other issues as well as prepare teams to taxi landed (or crashed) RPA out of the runway.
En-Route/Approach ATS	**Civil ATS ACC/APP Service Provider**	Civil ATS ACC/APP Service Provider is the civil control entity that performs all ATS operations during the Transit of the state RPAS in the class A-C controlled airspace (until a transfer of control to OAT / segregated arrival). During Emergencies, Civil ATS ACC/APP Service Provider is in charge of separating traffic (N-Legacy Aircraft) from RPA flying Emergency flight.
Aerodrome ATS	**Civil ATS Aerodrome Service Provider**	Civil ATS Aerodrome Service Provider when alerted by Civil Airport Supervision has to empty the runway and to organise arrival area in order for RPA to land as smoothly as possible.
Flight Deck	**N-Legacy Aircraft**	In this Solution, Flight Deck applied to N-Legacy Aircraft is exclusively used to characterize manned aviation (commercial aircraft, cargo…), flying under civil air traffic control, in GAT. 'N' represents several manned aircraft under ATC control. The N-Legacy Aircraft have regular, which are summarised as below for the description of the Use Case: • Receives and complies with the ATC instruction.
En-Route/Approach ATS	**OAT/Military Service Provider**	OAT/Military ATS ACC/APP Service Provider is the military or OAT entity that performs all air traffic control Operations and responsibilities when Civil ATS ACC/APP Service Provider transfers the control of flight of the Emergency

Operational interactions per context (NOV-2)		**Operating Environment**
[NOV-2] IFR RPAS Emergency Operations		En-Route; ER-Low Complexity; ER-Medium Complexity;
Node	Node instance	Node instance description
		Situation. However, Coordination may remain necessary during the resolution of the Emergency.
RPA Operations	**RPA Operations**	RPA is the airborne segment of RPAS. It is controlled & monitored through C2 Link by RP and RPS on the ground control segment. During Emergency (use case is no other failures apart from propulsion), communication between on ground and onboard segments remain nominal. it is expected that the RPA is flying whenever possible a mode controlled and supervised by the RP through RPS. Remote Pilot also has emergency strategies planned before departure which they can apply. As Indicated in [NOV-5] Preparation and Filing of RPAS Flight Plan in the preparation of ACC/APP Centres, all procedural information are available to the ATCO.
RPS Operations	**RPS Operations**	In this Solution, this node represents the instantiation of the Flight Deck manned aviation for a RPAS. This Node instance characterizes all the operations concerning RPS (RPS Operations) management during nominal flight that are performed by the ground segment. These nominal operations are performed by: • The Remote Pilot is the actor/person who manipulates the navigation / flight controls of the RPA during flight. • The Remote Pilot Station (RPS) is the station at which the Remote Pilot manages the flight of the RPA.

Operational interactions per context (NOV-2)		**Operating Environment**
[NOV-2] IFR RPAS Emergency Operations		En-Route; ER-Low Complexity; ER-Medium Complexity;
Node	Node instance	Node instance description
		During Emergency, RP and RPS coordinate emergency with Civil ATS ACC/APP Service Provider[11]. RP and RPS permanently monitor RPA flight data.
Airspace User Ops Support	Wing Operation Centre (WOC)	If there is transfer of control to be foreseen during Emergency Operation, there is a need to coordinate with WOC in order for it to provide information to the correct OAT/Military Service Provider that will have to assume the control.

Table 18: Node Instances and Roles Emergency Operations

[11] Assumption is that there are no other failures apart from propulsion. It means that communication between on ground and onboard segments remain nominal.

3.2.3 CNS/ATS description

This section describes the fundamental CNS/ATM services (refer to EASA CS ACNS [26]) that are part of the context (CNS airborne-ground technology, and other parts of the ATM system that are in place and used by SESAR solution 115) where the set of requirements included in section 4 have been consolidated. Appendix B, which represents the solution's Technical and Interface Specification (TS/IRS), provides further details and associates S115 concept's operations with technical elements in the existing ATM architecture.

Technical constraint	description
CNS / ATS	The CNS/ATM ground environment for RPAS operations in IFR controlled airspace (classes A-C) is composed of the existing infrastructure: ▪ FPLN filing : IFPS ▪ Communication: Two-way Voice ATC radio communication systems ▪ Navigation: RNAV systems and ATS routes structures equivalent to the existing for traditional manned aircraft ▪ Surveillance : Secondary Surveillance Radar (SSR), Primary when available The RPAS CNS technologies for RPAS operations in the existing infrastructure IFR controlled airspace (classes A-C) are: **1. Communications:** ▪ Voice communications between ATC and Remote Pilot: ○ Two way radio communication (for instructions/information) Nota: R/T Voice communications between ATC and RPA are relayed via a BRLOS satellite C2 link to /from remote pilot in RPS. ▪ An additional existing technology is required for RPAS operations in IFR controlled airspace (class A-C): ○ Backup Voice Com: Direct Remote Pilot – ATC – It will rely on current Telephone lines

Technical constraint	description
	2. Navigation: ▪ ATS published routes + associated AIRAC cycle Nav data ▪ PBN performance in En-Route (RNAV 5) / in TMA (RNAV 1) ▪ Autopilot ▪ Flight Management NAV system **3. ATC Surveillance:** ▪ XPDR mode S (or min. Mode 3A/ C) Transponder Note: The specific situation during RPAS Accommodation on the pilotless nature of RPAS with regard to the Chicago convention and on DAA (Detect and Avoid) /TCAS safety Nets is summarized in section 3.2.4 and further discussed in the project's workshops in Appendix D.1.

Table 19: Solution 115 CNS/ATS Description

3.2.4 Applicable standards and regulations

This section identifies the list of standards and regulations where certain elements are relevant to RPAS Accommodation in SESAR PJ13 Solution 115.

The Solution is **implementable under existing standards**. The Solution is applicable to all types of users – initial MIL/state users as well as future Civil users. However, future Civil deployment is unknown today. It will rely on future EASA material and an EU Implementing Regulation to allow Civil RPAS to fly. 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 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.

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

In **all cases, ATS Service Provider(s) will also need to perform their Safety Assessment per EU Regulation 2017/373**. The S115 Safety assessment and change impact can be used to support this assessment.

Standard Name	Standard Description	Standard Enabler	Comment
Use Case (NOV-5)	[NOV-5] Preparation and Filing of RPAS Flight Plan		
ICAO FPL 2012 [51]	ICAO Flight Plan 2012.		During Accommodation phase, this Standard fully applies.
Use Case (NOV-5)	[NOV-5] IFR Nominal RPAS Operations		
EASA SC RPAS.1309-03 [25]	Equipment, systems, and installations.		This special condition and the related AMC are applicable to any civil RPAS following international regulations: • For which a type certification is requested.

Standard Name	Standard Description	Standard Enabler	Comment
			• For which the kinetic energy assessment in accordance with section 6 of the EASA policy E.Y013-01 results in an initial certification basis according to CS-23 Aeroplane Certification Level 3 (as per CS 23.2005 Amendment 5). • With no occupant on board. This special condition maybe not applicable to existing State RPAS not following international standards.
ICAO Annex 2 [45]	Rules of the Air.		Some specific conclusions for RPAS are derived from this standard to the Accommodation period, detailed in Appendix D.1: • A high-level principle is that the pilot can see other aircraft and thereby avoid collisions, maintain sufficient distance from other aircraft so as not to create a collision hazard, and follow the right-of- way rules. This principle must be considered in the specific scope of the accommodation environment, where the RPAS 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 with separation services from ATC. In addition, in the general scope of IFR flights in Class A-C airspace, all pilots, including the RPAS pilot have a level of traffic awareness through the "party-line" radio-communications. • Although Annex 2 also implies last resort collision avoidance through aircraft safety nets (ACAS systems) supporting the pilot, it is worth noting that ACAS is only required on

Standard Name	Standard Description	Standard Enabler	Comment
			certain aircraft (>5.7 T / 19 passengers) and may even be absent on those certain aircraft under MEL dispatch conditions. **Appendix D.1 – Conclusions 5** **With current EU regulations, current initial RPAS are already excluded regarding UAS collision avoidance (ACAS) requirements.** Appendix D.1 further discusses the RPAS environment, during the accommodation period, and appropriate provisions to ensure and maintain safety barriers to a level equivalent to IFR manned aviation and assuming worst case IMC conditions. **See and Avoid:** States may allow flight of RPAS over their territory through multilateral agreement as it is the case for State aircraft. The main concern for acceptance and thus agreement is safety of operations. **S115 ATCO feedback form evaluation EXE:** 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. It was also clearly stated during exercise by controllers that RPA has sufficiently low speed in both nominal and C2LL situation in order to manage it without any increased workload, ATCO can interact with other traffic relying on RPA maintaining its FL in particular on C2LL cleared trajectory and never relying on RP to perform a visual manoeuvre. (see detailed discussion in Appendix D.1 - DAA Focus Team output)

Standard Name	Standard Description	Standard Enabler	Comment
			Appendix D.1 – Conclusion 4 **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.** The S115 SAR: Safety Assessment Report 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 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, are in contact and being separated by ATC.
ICAO DOC 10019 [49]	Manual on Remotely Piloted Aircraft Systems (RPAS).		During Accommodation phase, this Standard applies to certain accommodation features and capabilities.
ICAO Doc 4444 [48]	Air Traffic Management.		During Accommodation phase, this Standard fully applies.
ICAO DOC 7300 [50]	Convention on International Civil Aviation.		Chicago convention statements applying to Accommodation period are: • The Chicago convention Article 3 foresees the applicability of the convention only to civil aircraft, not

Standard Name	Standard Description	Standard Enabler	Comment
			state aircraft: the latter defined as any aircraft used in military, customs or police services. • Article 8 lays out a high-level disposition for 'pilotless aircraft'', applicable to civilian ones per article 3. This is to formalise a risk management precautionary principle at individual State level. The solution scope is remotely piloted RPAS, the initial ones in operation being state and 'pilotless' and it is also applicable to future civil RPAS. Future civil RPAS are under the 'pilotless' provision. The RPAS accommodation concept of operations is for all RPAS types, initially State and future civil to operate, be managed by civil ATM as non-segregated En-route transit IFR GAT. With regard to the dispositions above, all RPAS (including future civil ones) may be operated under specific provisions and with special authorisations, ensuring that such aircraft are controlled as to obviate danger to civil aircraft. Appendix D.1 – Conclusion 1 **To provide a RPAS accommodation solution means that during the accommodation period:** **- For a civil pilotless aircraft (MALE RPAS in the case of this solution) to fly over a contracting State to the Chicago Convention, authorisation will be required from that State based on a state regulatory provision using the future Implementing Rule (IR and associated regulation), assumed resulting**

Standard Name	Standard Description	Standard Enabler	Comment
			from EASA Rulemaking Tasks RMT.0230C & RMT.0230E. **- For earlier RPAS Accommodation, State or European level authorizations and/or special agreements will have to be set by national competent authorities for future civil applications, with a supporting safety analysis case - such a specific category "Accommodated RPAS" may have to be considered under a specific agreement and special authorisations. Such can also be considered per ICAO Cir 328 AN/190.** Appendix D.1 – Conclusion 2 Moreover All RPAS, due to their 'pilotless' nature (pilotless here means without a pilot ONBOARD, however, there remains a pilot in charge), their RPS-RPA architecture, their associated automation when in C2 LL and their C-N-S features, require accommodation (if flying short and medium term in mixed traffic non segregated) and also if flying in the longer term in the same accommodation operational conditions
Future EU Implementing Regulation (202X/tbd)	outcome of RMT.0230 NPA #2, particularly .C & .E for Type #1 certified category cargo IFR RPAS		No EU civil regulation yet exists, at current time of this paper, for certified category RPAS in controlled airspace. A rulemaking action RMT.0230 NPA #2, is due to start for Type #1 - certified category cargo IFR RPAS. Timescales are EASA Opinion planned Q4/2024 and the adoption by the EC planned Q3/2025. - The Accommodation concept and its associated safety assessment should be taken in account by this RMT.0230 group. Appendix D.1 - Conclusion 3 **Future civil certified RPAS in controlled airspace will ultimately be under a future regulation resulting from EASA rulemaking**

Standard Name	Standard Description	Standard Enabler	Comment
			action (RMT.0230, EC adoption expected 2025). Their airworthiness will be derived from CS-23 Amendment 4
STANAG 4586 [66]	Standard Interfaces of UAV Control System (UCS) for NATO UAV Interoperability. WARNING: this standard is directed towards military products of NATO nations willing to apply it.		Existing Standard possibly applied partly or completely for existing State RPAS.
STANAG 4660 [67]	Interoperable Command and Control Data Link for Unmanned Systems (IC2DL) WARNING: this standard is directed towards military products of NATO nations willing to apply it.		Existing Standard, possibly applied partly or completely for existing State RPAS.
STANAG 4670 [68]	Minimum Training Requirements For UAS Operators And Pilots. WARNING: this standard is directed towards military products of NATO nations willing to apply it.		Existing Standard, possibly applied partly or completely for existing State RPAS.

Standard Name	Standard Description	Standard Enabler	Comment
STANAG 4671 [69]	Unmanned Aircraft Systems airworthiness Requirements (USAR III). WARNING: this standard is directed towards military products of NATO nations willing to apply it.		Existing Standard, possibly applied partly or completely for existing State RPAS.
Use Case (NOV-5)	[NOV-5] IFR RPAS Contingency Operations (C2LL)		
ICAO RPASP/16-WP/15 [55]	Working Paper Remotely Piloted Aircraft Systems Panel (RPASP), Progress on Lost C2 Link procedure.		The Use Case was defined to meet as feasible the En Route C2 loss behaviour defined in this Working Paper.
ICAO RPASP/19-WP/7 [56]	Working Paper Remotely Piloted Aircraft Systems Panel (RPASP), Call Sign Extension Proposed Amendments to Annex 10, Volume II.		The Use Case was defined to meet as feasible the En Route C2 loss behaviour defined in this Working Paper.
ICAO RPASP/19-IP/5 [57]	Working Paper Remotely Piloted Aircraft Systems Panel (RPASP), Guidance material and consequential changes relating to the lost C2 Link provisions.		The Use Case was defined to meet as feasible the En Route C2 loss behaviour defined in this Working Paper.

Standard Name	Standard Description	Standard Enabler	Comment
Use Case (NOV-5)	[NOV-5] IFR RPAS Emergency Operations		
Commission IR (EU) 2019/947 [72]	Rules and Procedures for the operation of unmanned aircraft of the 24th of May 2019.		This regulation specifies in its seventh article that UAS operations in the 'certified' category shall be subject to the applicable operational requirements laid down in Implementing Regulation (EU) No 923/2012 and Commission Regulations (EU) No 965/2012 (6) and (EU) No 1332/2011 (7) - see accordingly in the list of regulations for Emergency UC.
Commission Regulation (EU) No 2016/583 amends 1332/2011 [71]	Common airspace usage requirements and operating procedures for airborne collision avoidance ANNEX I.		The relevant part considering ACAS II is: Airborne collision avoidance systems (ACAS) II (Part-ACAS) Section I — ACAS II equipment AUR.ACAS.1005 Performance requirement: (1) The following turbine-powered aeroplanes shall be equipped with collision avoidance logic version 7.1 of ACAS II: (a) aeroplanes with a maximum certificated take-off mass exceeding 5 700 kg; or (b) aeroplanes authorised to carry more than 19 passengers. (2) Aircraft not referred to in point (1) but which will be equipped on a voluntary basis with ACAS II, shall have collision avoidance logic version 7.1. (3) Point (1) shall not apply to unmanned aircraft systems. Appendix D.1 - Conclusion 5 for the accommodation period: **With current EU regulations, current initial RPAS are already excluded regarding UAS collision avoidance (ACAS) requirements . Therefore there are no CNS constraints linked to this topic.**

Standard Name	Standard Description	Standard Enabler	Comment
ICAO Doc 10019 [49]	Manual on Remotely Piloted Aircraft Systems (RPAS).		During Accommodation phase, this Standard applies to certain accommodation features and capabilities.

Table 20: Solution 115 Standards and Regulations

NOTE:

As an earlier alternative to the future Implementing Regulation (IR)[12], approval based on the Specific Operations Risk Assessment (SORA) methodology was analysed. EASA feedback is that SORA is for specific operations and special purpose UAS.

It is also noted that high risk SAIL V, VI categories require an EASA approval in any case.

Conclusion is that SORA is not suitable for the type of routine IFR GAT transit operation in the solution scope.

[12] Outcome to EASA Rulemaking Task RMT.0230 particularly .C & .E (NPA #2 for Type #1 certified category Cargo IFR RPAS)

3.3 Detailed Operating Method

3.3.1 Previous Operating Method

The purpose is to describe the previous Operating Method concerning the MALE RPAS flights operated before applying the concept of non-segregated RPAS GAT flights defined by the SESAR PJ.13 S115 solution. As expressed in the solution summary, MALE RPAS already operate within national airspace in several individual EU states.

These current RPAS operations, considered the reference, or previous operating method, prior to introduction of this solution's concept, are characterised as follows:

- Operations in segregated or temporary reserved airspace, which in certain cases, are pre-established transit corridors. This relies on improved version of airspace management ASM for state/MIL users, which is more efficient than classical reservation methods, as it reserves airspace for less time, thus limiting the restriction to all GAT that could use the reserved airspace.

- Temporary reserved airspace does require processes of creation, even for segregated corridors. A European process exists, but generates longer ATM planning anticipation (prior to RPAS access), increased coordination effort and requires creation and publication of the airspace:

    1. Segregated volumes (structural to construction of « tubes ») need to be created.

    2. Volumes size driving segregation are associated to specific static performances.

    3. Publication of the new airspace required.

    4. The process is heavy in terms of aeronautical information management.

- The RPAS flight is under OAT and the RPAS is managed and separated by a specific OAT controller.

- OAT flight plans are national solutions- they can be filed even shorter than 1 hour in advance.

- All airspace reservations need to be in place (through Airspace Use Plans eAUP/eUUP). The connected airspace reservations (ARES) are booked via an agreed established procedure (ASM per **EC No 2150/2005** regulation [29]) for segregated airspace, which RPAS, can use now and in the future.

- Flight planning also has to take into account conditions during flight, due to RPAS performance and limitations. However due to longer preparation times and forecast uncertainties, this can be penalising when flight conditions degrade prior to flight: re-planning is not immediate.

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- RPAS evolves in reserved volumes of airspaces. In some zones reserved transit corridors segments are activated / deactivated when RPAS is in/outside the ARES corridor segment. This entails limited activation of individual segments used by a RPA (limited duration of reserved airspace) instead of activating an entire reserved area.

Precondition is that the ATCOs managing the regular GAT traffic, as well as the ATCOs managing the OAT/RPAS traffic:

1. Must have situation awareness (i.e. visual representation) of the airspace structure and of the environment, the ATC systems need to be programmed with that representation.

2. Perform specific task related to management (activation/deactivation) of the segregated «corridors» and of RPA / other aircraft.

3. Although segregation assumes isolation of the RPAS from manned traffic, there is no guarantee that the RPA will stay in the segregated airspace in non-nominal situations or would lead to excessively large volumes of reservation.

- Impacts and information to other Airspace Users:

  1. Other airspace users have information to be aware of the reserved airspace and activity times.

  2. Segregated airspace (ARES) is a means for awareness to other airspace users.

  3. Reserved airspace affects other airspace Users options (flexibility, equity) and indirectly affects capacity.

- Short-term Cross-Border could be established via bilateral agreement, like Letters of Agreement (LoA).
  <u>For smart segregation:</u> Adjacent states need to create contiguous transit ARES structures at state borders and within their airspace.

It may be noted that certain EU states may opt to not apply derogatory measures to RPAS operations due to the Chicago Convention and non-compliance to ICAO Annex 2 [45], and maintain this current segregation method, which is applicable to all RPAS segregated from civil air traffic under existing ICAO standards (cf. 3.2.4 Applicable standards and regulations).

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3.3.2 New SESAR Operating Method

The Purpose of this section is to describe the new SESAR Operating Method for the Accommodation of MALE IFR RPAS as GAT in the class A to C controlled airspace.

The RPAS Accommodation operating method encompasses the following key features:

- Pre-flight phase (reduced planning, reduced coordination, and reduced approval delay before flight).
- Standard separation minima (following validation and feedback from live trials performed under an EDA study).
- No segregation of RPAS operations (transit phase of RPAS flights).
- Targeted flexibility in terms of access and equity for both RPAS airspace users and legacy manned-aircraft airspace users.
- Continuity of working methods and procedures for ATCO in nominal and contingency / failure situations comparable to those for existing airspace users, preserving human performance and safety.
- Feasible both technologically and operationally
- Exclusively procedural changes, compatible with existing operational methods
- Direct and smooth transition to next long-term step (integration).

The new operating methods centres on 4 aspects, with specific attention to flight plan information and the management of abnormal in-flight situations related to contingency/ emergency procedures definition. These are described fully by use cases in the sections 3.3.2.1 – 3.3.2.4:

1. **Use of existing Flight Preparation/FPL filing** for RPAS flights including a mandatory addition to Field 18 of the pilot's contact phone number in the remark indicator of field 18, e.g**.** RMK/PILOT NAME TEL.0044 544544566.
2. **An amended procedure during Nominal Flight:**
    - R/T phraseology has been amended to ensure ATCO is aware that the aircraft is a RPAS, the suffix REMOTE is applied to the callsign (this also conforms to the ICAO RPAS panel guidance).

- RP provides ATCO with the RPAS behaviour to expect should C2LL occur. This is essential to provide the ATCO with predictable knowledge during a potential C2 link loss automated trajectory.

3. **A new C2 link loss Contingency procedure** highly similar[13] to the manned aircraft Radio-Communication loss (PLOC) procedure, route/profile, with no communication, and an aircraft in the airspace flying a predefined route/profile, with 3 RPAS particularities :

    - The RPA will SQUAWK a specific transponder code.
    - And the RPA will fly a pre-programmed automated C2LL contingency route/profile.
    - This pre-pre-programmed route/profile may continue to destination, or divert at a downstream flight plan published diversion waypoint to a diversion aerodrome (departure airfield, or Operator pre-planned diversion). The new procedure performed during nominal flight above is therefore essential to provide the ATCO with predictable knowledge of this potential behaviour.
    - No holding climb expected in C2LL En-Route (transit flight is already at high flight level).

4. **Emergency procedures:** with the objective to define the emergency scenario/behaviour of the RPAS (using example of engine loss) and procedure with ATC.

NOTES:

- This non-segregated accommodation concept is suitable for flight phases, which do not require peculiar attention of either the RPAS or the manned aircraft.
- The RPAS Accommodation concept uses standard separation minima[14] applied by the civil/GAT ATC entity controlling both the legacy manned IFR, VFR aircraft and the IFR GAT RPAS.

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[13] Refer to ICAO RPASP/16-WP/15 [55], ICAO RPASP/19-WP/7 [56], and ICAO RPASP/19-IP/5 [57].

[14] The concept validates and proposes that ANSP may apply standard separation minima ("5NM/1000 feet unless other separation are used locally (e.g., approach)". This does not preclude that an individual ANSP may initially start operations being more conservative and apply 'Increased' separation above the minimum standards to accommodated RPAS.

- This solution focusses on the GAT portion of the RPAS transit flight without airspace reservation, preferable for overall airspace capacity and alleviates transit Airspace specific design. As initial RPAS are mainly state / military, they will also perform military missions (outside this solution scope) for which existing Airspace management techniques /ARES will still apply.

- In order to achieve Short-term Cross-Border operations, all Adjacent EU states where transit routes are demanded need to allow adjacent STATE RPAS to transit with derogatory applicability of the Chicago Convention.

- The Solution recommends harmonized procedures across European airspace. During the RPAS Accommodation period :
    - This concept is only applicable to STATE RPAS in states, which apply derogation to compliance of the ICAO Chicago convention [58]. This is suitable for the solution scope as the initial demand RPAS segment corresponds to STATE RPAS.
    - In the event of any civil RPAS (non-state aircraft) existence in this period, the previous operating method will be applied to allow civil RPAS flights with segregation, conforming to the ICAO Chicago convention [58].

- Specific conditions for flight at flight planning, due to RPAS performance and limitations, are checked by the Remote Pilot (e.g., meteorological no current or forecast icing, thunderstorms, wind (tbc) around nominal and contingencies trajectories, as currently done (this is not specific to the operating method)). However, the new operating method offers the flexibility to re-plan immediately, for example in case of degraded weather conditions.

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3.3.2.1 Use Cases for [NOV-2] IFR RPAS Pre Flight Operations

Presentation:

IFR RPAS PRE FLIGHT operational interactions (information exchanges and flows) NOV-2 view specifies the specific exchanges between stakeholder entities (node instances) that are involved in the different use cases of the activities in operational exchanges (NOV-5) views describing all the necessary operations for the accommodated RPAS flight planning and filing, before departure, also identifying RPAS specificities.

Stakeholder entities (Nodes) concerned are hereafter summarized (see section 3.2.2.2.1 for more information):

- **Civil ATS ACC/APP Service Provider:** this covers the controllers in the APP and ACC centres.
- **Wing Operation Centres (WOC):** this covers the military authority in charge of managing the military centres and the link to the European and National authorities.
- **OAT / Military ATS ACC/APP Service Provider:** this covers the OAT/Military controllers in the APP and ACC centres.
- **Air Traffic Flow and Capacity Management (ATFCM):** this covers the European authority in charge of providing the RPAS performances to the centres, merging the flight plans, verifying and acknowledging their validity to the provider of Flight Plan.
- **RPS Operations[15]:** this covers the part in charge of creating the Flight Plan and configuring the system after its validation.
- **Air Navigation Service Provider (ANSP):** Civil National authority in charge of Air Traffic control. This authority is also in charge of providing the permanent information (e.g. contingencies procedures for the type of RPAS).

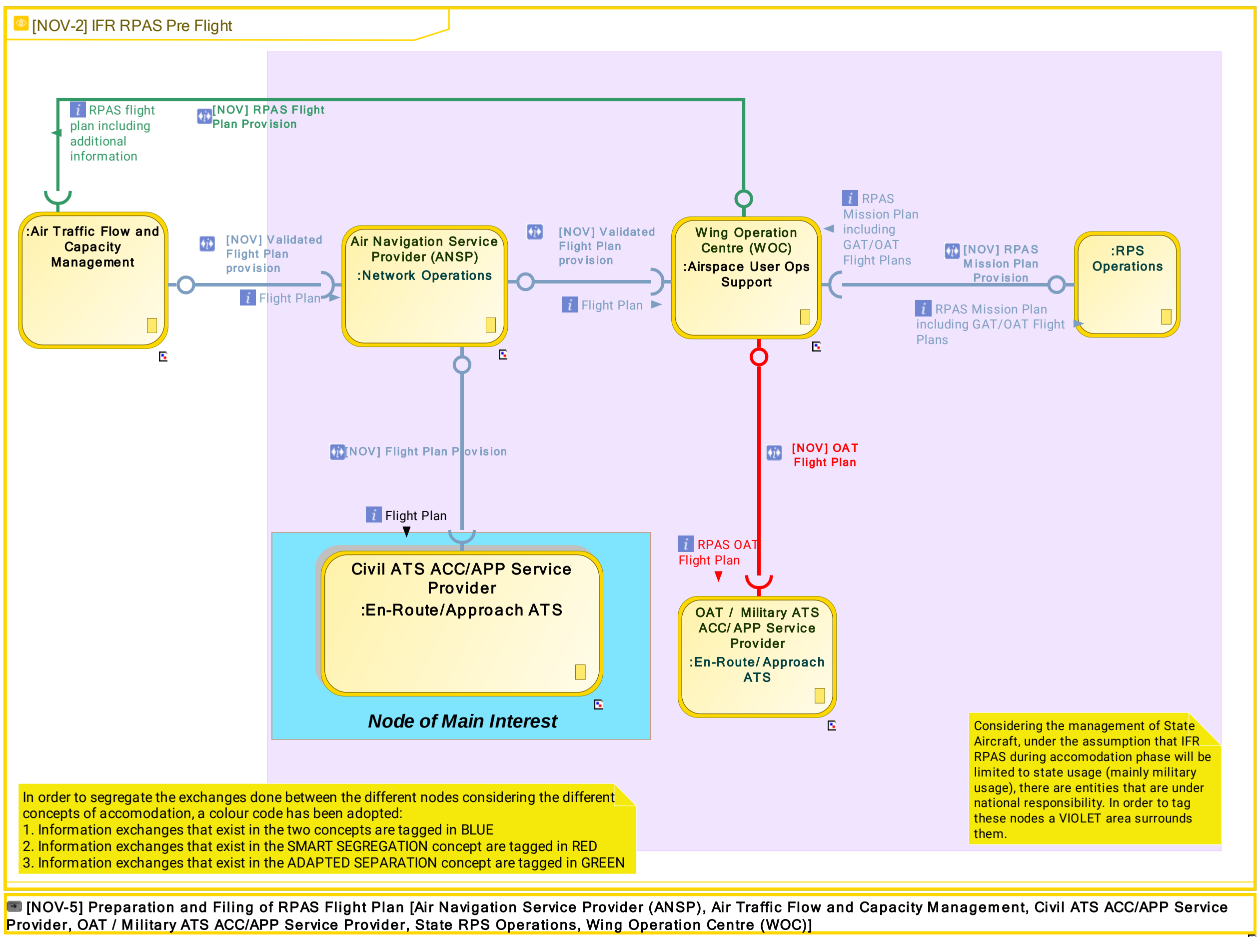
Relevant information exchanges are highlighted below:

[15] The Operational Node Structure [NOV-2] introduces information exchanges between WOC and RPS Operations Nodes due to the possible State nature of RPS Operations Node. When RPS Operations Node is purely of civil nature, these information exchanges with WOC Node are no more necessary.

- **RPAS Flight Plan including Additional Data** – Flight plan used shall conform to existing ICAO FPL 2012 [51] format consistent with all aircraft. The additional data specific to this method (backup pilot contact information) is within the existing Flight Plan syntax.

- **RPAS Mission Plan including Flight Plan** - Each nation implements in its own way the tools to manage state data and mission plan is one of them.

- **Validated Flight Plan provision** - It corresponds to what is done today through ATFCM to provide a Flight Plan taking into account the needs of all aircraft filing Flight Plans.



Click on http://webprisme.cfmu.eurocontrol.int/oneportal_working_validation/data/diagrams/780C88955FB70735 for zooming.

Figure 2 : EATMA [NOV-2] IFR RPAS Pre-Flight Operations

3.3.2.1.1 [NOV-5] Preparation and Filing of RPAS Flight Plan

Presentation:

IFR RPAS Preparation and Filing of RPAS Flight Plan operational interactions (information exchanges, flows, activities) view (NOV-5) provides the specific activities of stakeholder entities. Certain flight preparation and filing aspects exchanges are linked to the initial RPAS "State" nature and are provided for clarification purposes. Two steps have to be considered:

- **STEP 1:** Providing information to the different nodes concerned of information is NOT flight related. Information here includes the specificities linked to the **RPAS** type performance & flight envelope. The solution relied on the existence of such data for existing RPAS types (e.g. Q9). Thus, this part will not be described in EATMA.

- **STEP 2:** The actual flight plan, describing the information exchanges, their order and associated dynamic linked to the filing of the flight plan.

```
(FPL-RPAS7-IM
-Q9/L-GIUVY/C
-LFBG2000
-N0180F090 LMG DCT VERAC B19 AMB R10 DOMOD A3 MOU A27 CFA R161 MEZIN
G53 AMIKO A3 PERUS/N0180F140 G374 XAMAL/N0180F090 OAT XAMAL DCT LERMA
STAY1/0400 LERMA DCT CUERS STAY2/0400 CUERS G7 POMEG STAY3/0400 POMEG
DCT BULTO GAT Y341 SALIN Y25 FJR G393 AFRIC G39 SECHE R17 CNA
-LFBG3200
-DOF/220516 REG/RPAS6 RALT/LFPV LFMI RMK/JAN VANACEK TEL.420
775484754 STAYINFO1/WORK IN LFR31A
-E/3000 P/0 A/RED C/JAN)
```

Figure 3 : Example Layout of a RPAS Flight Plan

Concept of Operation:

STEP 1 - Preparing the environment for RPAS accommodation: This step was not covered in project activities as it is considered identical to what is currently done. The information below is provided for the sake of clarity. The generic regulation stated how every "ICAO certified" or "Nationally Certified" has to behave in GAT. However, each specific RPAS type is associated to a set of data or procedures that it will follow. Thus STEP 1 begins with ANSP providing to Network operators all information answering what the generic regulation requested but specific to this type (as an example, Centres throughout Europe are using the BADA table shared through ECTL database management system in order to collect performances data on the different new type of aircraft RPAS not being different). At that point, the network operator has to publish this information to all European Centres. As it is, the procedures linked to this type of RPAS are provided by the ANSP to the civil Centres and by the WOC to OAT/Military Service Provider. When it is a State aircraft, the centres concerned are the centres of a nation accepting this type of RPAS thanks to a bilateral agreement. When ready, Centres are acknowledging their readiness eventually providing specific limitations due for instance to part of their managed airspace not respecting the operating environment as defined for the Solution. Then the acknowledgement is forwarded by ANSP to WOC**.** The last step of STEP 1 is to tell to the RPS Operations it may now file a flight plan. This step is done once, and for all with respect to the RPAS type.

RPAS operator may have defined suitable diversion waypoint(s) through strategic-agreement with the ANSP.

STEP 2 - Filing a flight plan for the RPAS accommodation concept: Following a request for a mission encompassing GAT transit, State RPS Operations decide that there is a need to fly using ATS routes in GAT for part of their flight. It defines and prepares a Mission plan specifying mission actions, flight path and profile parts on civil controlled routes for GAT transit and OAT flight path parts for mission. This Mission Plan includes GAT / OAT Flight segments. For environments with a WOC OAT and GAT information is extracted (not addressed by this solution and not expected to be necessary for a future full civil operation). The flight plan is submitted to the Network Operator (e.g. **NM in Europe**) using current systems and interface. NM assesses the flight plan and proposes updates if necessary. The GAT flight plan parts are sent to ANSPs (e.g. **CESNAC in France**) concerned that send them to their concerned Centres (e.g. the En-Route centres: **CRNA in France**). When it is a State RPS Operations, ANSP also sends the validated flight plan to its national WOC. WOC consolidates the OAT flight plan using validated flight plan to send it to the different centres concerned (possibly not in the nation) and then recollects the Mission plan to send it back to the RPS Operations. From this stage, the flight can begin.
RPS Operations shall use this planned information to prepare and pre-programme RPAS with the nominal trajectory and the pre-planned C2 link loss contingency trajectory.

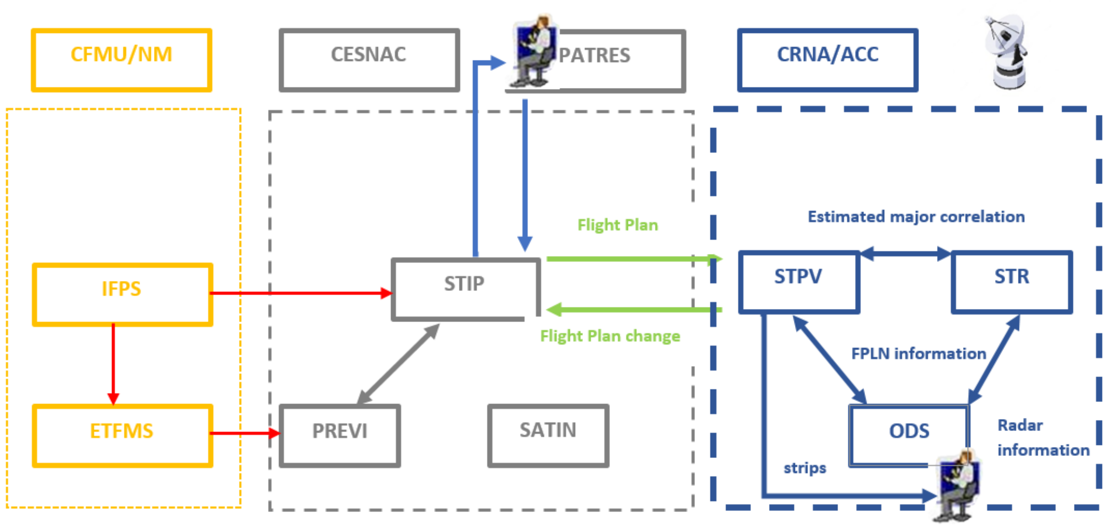


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Figure 4: Flight Plan approval process in France from NM to ATCO

There was no need expressed to distinguish the RPAS flight plan and a non-RPAS one (RPAS is an IFR aircraft), noting however :

- Aircraft type in FPL (e.g. Q9 for Reaper) provides such an indication; It was not exploited by ATCOs; If need arises, it can be exploited by systems
- ATCOs confirmed the need to identify the RPAS at initial contact (addition of "REMOTE" to Callsign)

Additional Flight Plan Content (refer to VALR D3.1.030 [14]):
Use RMK/ indicator of field 18 to convey pilot telephone number in format RMK/pilot name TEL.00xxx… (TEL. leading zeros prefix for international phone number format).

It may be noted that providing a telephone contact in this manner is not new – current IFR flights already provide a contact tel no. in FPLN field 18. It is used by TWR ATCO at departure in case of Slot amendments.

Operator shall pay attention to the following ICAO FPL items.

- Avoid DCT segments (usually rejected by NM in IFPZ).
- Do not use field 19 for the contact information. This is not part of ICAO FPL 2012 format; some systems may filter out information included in this field.
- Optionally RALT/indicator of field 18 may be used to indicate possible En-route alternate aerodromes for diversion/landing (validated at IFPS Flight Plan level but not as part of the accommodation concept).
- Do not rely on NM Route Proposal service for route proposal/correction for circular flights. RPAS operator should use other tool(s) or airspace chart to plan a valid flight.
- Optionally STAY/ indicator field 15 (Route part) may be used to indicate the time of special activity at a certain segment of the flight and associated STAYINFO/ indicator with information on stay reason.
- Minimize use of OAT/ indicator field 15, OAT route portions are not checked by NM.
- It appears possible to file FPLs with EET>24h (NM accepts such, although IFPS User Manual states limitation for max 24h).
- At the current time of validation, do not use iOAT format specifics (e.g., EUR/OAT in field 18, or 'P' letter in field 8), most of existing system and NM/IFPS will not process such flight plan in their current state.
- It is recommended that iOAT V4 phase takes into account RPAS FPL conclusion of this validation.

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.

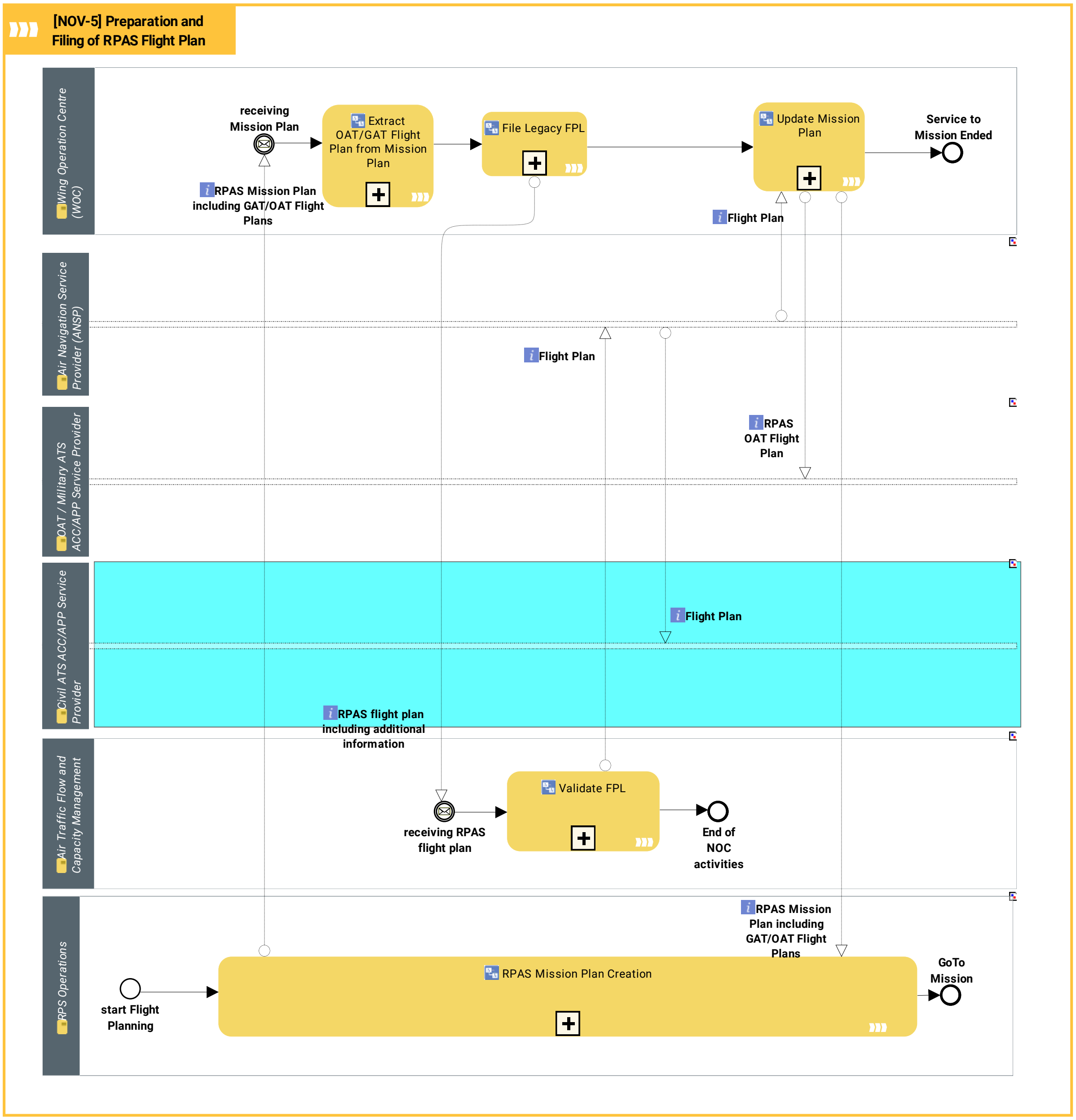


Diagram Id: 82B1A43A5FF54FEA

Figure 4 : EATMA [NOV-5] IFR RPAS Pre-Flight Operations

Activity	Description
Extract OAT/GAT Flight Plan from Mission Plan	Extraction of OAT/GAT parts from the Mission Plan in order to prepare flight plan filing.
File Legacy FPL	Creation and Submission of flight plan (OAT/GAT) to the ATM Network operator (e.g. NM in Europe) using current ICAO FPL2012 systems and interface.
RPAS Mission Plan Creation	Creation of RPAS Mission plan which includes OAT/GAT flight segment then programmation of RPAS Navigation system (nominal and C2LL trajectories) when receiving validated Mission Plan.
Update Mission Plan	On receiving Validated flight plan, WOC updates the Mission plan. Then FPL is also sent to OAT Centres and updated Mission Plan is sent to RPS Operations.
Validate FPL	Validate filed Flight Plan (rejection/acceptance process) until filed Flight Plan is accepted*. * Validate FPL is an activity introduced due to the fact that its equivalent was not found in the common library.

Table 21: Solution 115 Activities Pre Flight Operations

Issuer	Info Flow	Addressee	Info Element	Info Entity
Air Traffic Flow and Capacity Management	Assess/Update FPL o--> Air Navigation Service Provider (ANSP)	Air Navigation Service Provider (ANSP)	**Flight Plan**	**FlightPlan**
Wing Operation Centre (WOC)	Extract OAT Information/Update Mission Plan o--> Updated Mission Plan received	RPS Operations	**RPAS Mission Plan including GAT/OAT Flight Plans**	**Mission**
Wing Operation Centre (WOC)	File Legacy FPL o--> receiving RPAS flight plan	Air Traffic Flow and Capacity Management	**RPAS flight plan including additional information**	**FlightPlan**
RPS Operations	RPAS Mission Plan Creation o--> receiving Mission Plan	Wing Operation Centre (WOC)	**RPAS Mission Plan including GAT/OAT Flight Plans**	**Mission**
Wing Operation Centre (WOC)	Extract OAT Information/Update Mission Plan o--> OAT / Military ATS ACC/APP Service Provider	OAT / Military ATS ACC/APP Service Provider	RPAS OAT Flight Plan	
Air Navigation Service Provider (ANSP)	Air Navigation Service Provider (ANSP) o--> Civil ATS ACC/APP Service Provider	Civil ATS ACC/APP Service Provider	Flight Plan	**FlightPlan**
Air Navigation Service Provider (ANSP)	Air Navigation Service Provider (ANSP) o--> Extract OAT Information/Update Mission Plan	Wing Operation Centre (WOC)	Flight Plan	**FlightPlan**

Table 22: Solution 115 Information Flows and Elements - Pre Flight Operations

Info Element	Description
Flight Plan	
RPAS flight plan including additional information	RPAS flight plan contains the same information than the Flight Plan of any other aircraft that will have to fly into the controlled airspace (conformance to ICAO FPL2012 format). Due to the specific nature of the RPAS there are additional information linked to the flight. This is provided through RMK/ indicator of field 18 to convey pilot telephone number in format RMK/pilot name TEL.00xxx… (TEL. leading zeros prefix for international phone number format).
RPAS Mission Plan including GAT/OAT Flight Plans	RPAS Crew is creating a mission plan that includes all the information concerning Flight Plan when using ATS routes, specific information concerning Operational Air Traffic and Mission specific data that are Nation only information.
RPAS OAT Flight Plan	RPAS OAT part of the whole Flight Plan.

Table 23: Solution 115 Information Elements Descriptions – Pre Flight Operations

3.3.2.2 Use Cases for [NOV-2] IFR RPAS Nominal Operations

Presentation:

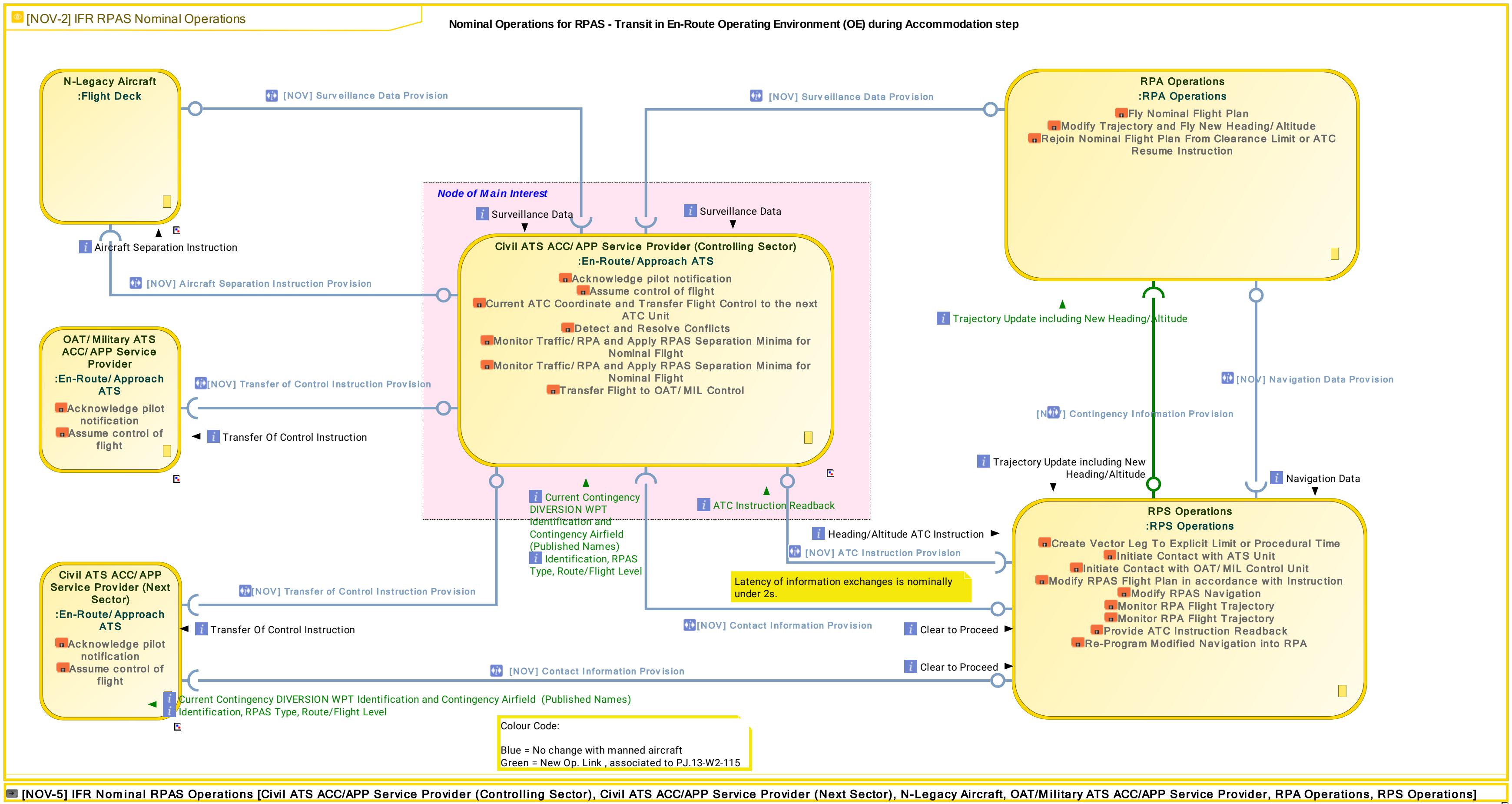
IFR RPAS Nominal operational interactions (information exchanges and flows) view (NOV-2) defines the specific exchanges between stakeholder entities (Nodes instances) concerned by the **IFR RPAS Accommodation Nominal Operations**, where ATC manages the RPAS flight during its transit phase in controlled class A-C airspace with operating methods are identical to managing manned traffic.

In addition to these operating methods for IFR traffic management, **a potential C2 link loss (C2LL) and associated RPA route/profile behaviour will be provided for predictability to the ATCO through a shared and known procedure during the nominal flight at initial contact.**

The Nodes instances used in the IFR RPAS Accommodation concept for the nominal operations:

Stakeholder entities (Node instances) concerned by the nominal operations and represented in the model are the following:

- **The RPA Operations** (RPA = Remotely Piloting Aircraft) (new);
- **The Civil ATS ACC/APP Service Provider in controlling current sector** (Node of interest);
- **The RPS Operations** (RPS = Remote Pilot Station) (new);
- **The Civil ATS ACC/APP Service Provider in next sector** to illustrate a possible 'transfer of control' of RPAS during transit flight;
- **The N-Legacy Aircraft** (the collaborative manned aviation around the RPA);
- **The OAT/Military ATS ACC/APP Service Provider**



Click on http://webprisme.cfmu.eurocontrol.int/oneportal_working_validation/data/diagrams/9204956360548657 for zooming.

Figure 5 : EATMA [NOV-2] IFR RPAS Nominal Operations

3.3.2.2.1 [NOV-5] IFR Nominal RPAS Operations

Presentation:

The IFR Nominal RPAS Operations operational interactions (information exchanges, flows, activities) view (NOV-5) highlights the different specific activities (dynamic of the exchanges) between stakeholder entities (Node Instances) concerned by the nominal operations as well as the interactions (or information exchanges) between each Node Instance.

For RPAS accommodation, it covers the amended operational procedure to anticipate a possible C2 link loss contingency.

Concept of Operation:

The operating context considered is described through the associated [NOV-2] IFR RPAS Nominal Operations.

RPS Operations shall always pre-program the C2LL contingency trajectory into RPA Operations before flight. It is recommended that this contingency trajectory maintains flight level where possible to provide predictability to the ATCO.

If necessary, due to changed conditions, the C2LL contingency trajectory elements can be modified by RPS Operations in the RPA navigation system during the flight, or in accordance with the operator's diversion strategy.

1) <u>First radio contact with ATC:</u>
RPA is cleared and fly its nominal Flight Plan.

All the onboard systems (including CNS) are operational; the RPA has its ATC assigned SSR/transponder code set for the GAT flight.

At the initial radio contact with the ATS unit (i.e. receiving controlling sector, and at transfer of control for each subsequent ATS unit), RPS Operations must communicate over the Radiotelephony voice (VHF radio assumed in European airspace).

At this initial contact, the standard initial contact information is exchanged, and two additional information elements are added for ATCO awareness in case C2 Link Loss RPA occurs:

- The standard initial contact information required from RP to ATCO in GAT (phraseology derived from manned aviation):
    - **Callsign Name + RPAS specific identification "e.g. REAPER12 REMOTE"** (including for other pilots' situation awareness)
    - [Origin/Departure] or [Position]
    - Flight Level (FL)
    - Lateral directions (Direction of turn / **Heading, or TO waypoint**)

- The C2LL contingency awareness information (specific to RPAS flight needs) to provide ATCO with mental anticipation of a future C2LL contingency and automated RPA behaviour if ever the C2LL contingency would occur[16].

  The information consist of two additional elements related to the MALE RPAS pre-programmed C2LL contingency trajectory:

  - **The waypoint name** on downstream portion of the nominal flight plan where **Diversion** would occur, which is a published named waypoint of the nominal flight plan.
    - The Diversion point characterizes the point where the RPA C2LL trajectory is pre-programmed to fly, according to a pre-defined operator strategy. According to this strategy, one of the following destinations is pre-programmed in the RPA:
      - 1: leave its shared flight path and return to its departure airfield
      - 2: leave its shared flight path and divert to an alternate specific diversion airfield
      - 3: Or the RPA may be pre-programmed to continue to fly the flight plan with no diversion to original destination

  - **The C2LL Contingency Airfield**, the specific contingency aerodrome to which the RPA will then divert to, which is also provided by its ICAO code or Name.
    - The Contingency Airfield, is the pre-programmed Operator's choice at the Diversion point either to maintain the shared nominal flight plan or leave the shared flight path (return to departure aerodrome, or divert to an alternate aerodrome).

[16] It is essential that the ATS Unit (controlling RPAS) knows how the RPA will behave during its C2LL contingency before it occurs.

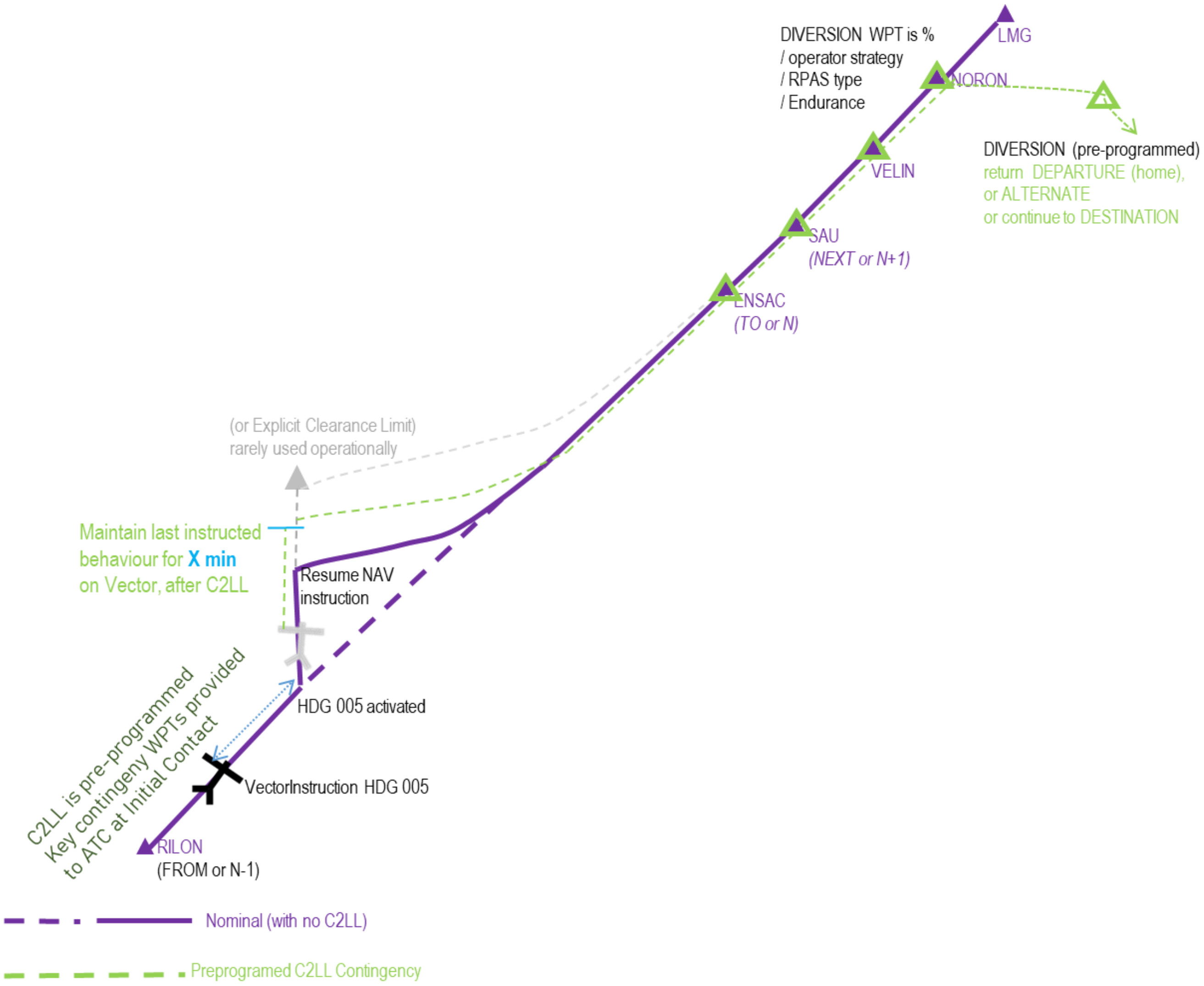


Figure 6 : Nominal and Pre-programmed C2LL Contingency trajectories

In anticipation of an automated C2LL flight, the resulting pre-programmed Diversion point and Contingency Airfield can be dynamically re-loaded, if necessary, but unlikely in most operational cases (cf. Appendix **C3.4.2**), into the RPA Operations in order to take into account changing flight conditions and at this time. In this unlikely case, the RPS Operations recommunicate these new elements to the ATS Unit by radio.

The communication between ATS Unit and RPS Operations is not different to the current communications between ATS Unit and pilots. Simply two additional trajectory elements related the C2LL procedure are systematically added (such exchanges already occur when ATCO/Pilots exchange additional trajectory information).

<u>Recommendations:</u>

- **Diversion WPT as far downstream as possible (considering national border, return, etc... constraints) on the GAT FPL.**
- **If earlier Diversion WPT(s) needed, strategic-agreement with the ANSP to select suitable Diversion WPT(s). 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**
- **And when multiple Diversion WPT(s) are strategically agreed, pre-programming of the next one must be performed before overflying existing one at minimum 2 minutes before RPA reaches the current Diversion point. In this particular case RPS operations reprograms the next Diversion point, loads the RPA and communicates it to ATCO (note: 2 minutes was selected as a parallel to the stability time when the RPAS is on vector instruction).**
- **Considering likelihood of permanent C2LL is very low (i.e. high likelihood that C2 link will be regained), the most suitable option is for RPAS to revert to and maintain its original FPLN (as long as operator considers no other major failure or risk on RPAS).**

2) <u>ATS Unit assumes control of flight (RPAS):</u>

ATS Unit acknowledges and reads back the initial contact announcement with RPAS, and clears RPAS to proceed. During this process, the ATS Unit notes the elements of the C2LL contingency awareness information.

RPAS flight is now under GAT control of the receiving ATS Unit.

3) <u>ATS Unit nominal management of flight (RPAS):</u>

During the GAT flight transit phase (of RPAS), ATS Units and RPS Operations will perform standard and recurrent traffic management tasks:

<u>ATS Unit:</u>

- Monitors traffic in the sector of control.
- Manages all traffic: i.e. RPAS flight and other aircraft (manned), with application of standard separation minima.

<u>RPS Operations:</u>

- Manages RPA nominal flight trajectory (with respect to flight performance and ATC clearances/instructions).
- Monitors RPA health status.

4) <u>ATS Unit traffic conflict management:</u>

<u>ATS Unit:</u>

- Detects traffic, potentially ending in loss of separation, in conflict with the RPAS trajectory and resolves the conflict (assumed on the RPAS for the Use Case) by an appropriated method:
  - Lateral resolution: Vectoring method by a heading type instruction (Vector/Heading instruction)

    - Or Vertical resolution : Flight Level change / Flight Level limit method (Altitude instruction)
- Instructs the RPS Operations over radio with the appropriate resolution (see above) to solve the conflict[17].

RPS Operations:

- Provides a read-back to the ATC instruction.
- Then modifies the new trajectory in accordance with the ATC instruction (Heading or Altitude).
- As for manned aviation:
  - If vectoring/Heading with no limit defined:
    - RPA will fly the instructed heading until a new ATC instruction.
  - If vectoring/Heading with a limit:
    - RPA will fly the instructed heading until reaching the limit then will resume the nominal flight plan – this case is noted for completeness, but rarely used in En-Route operations.
  - If level change :
    - RPA will fly the instructed altitude until new ATC instruction.

5) ATS Unit transfer of control during flight:

When the RPA crosses into a new sector/FIR,

ATS Unit (controlling sector):

- Instruct RPS Operations to contact the next sector [contact/ frequency change ('contact XX on XXX.xxx MHz')].
- Transfers the RPAS control to the next (downstream) sector and indicates that it is a RPAS (remotely piloted).

The transfer is terminated when the ATCO of the downstream sector has assumed control of the RPAS.

RPS Operations:

- Contacts the new ATS Unit through a first radio contact (see first step of this NOV).

6) RPAS transfer of control to OAT (end of use case):

The use case ends when the RPAS flight switches from GAT to OAT and is under OAT control.

[17] ATC operation practices confirmed that ATS Unit instructs taking into account environment and restricted airspace in the vectored zone, and possible automatic C2LL reversion of RPA.

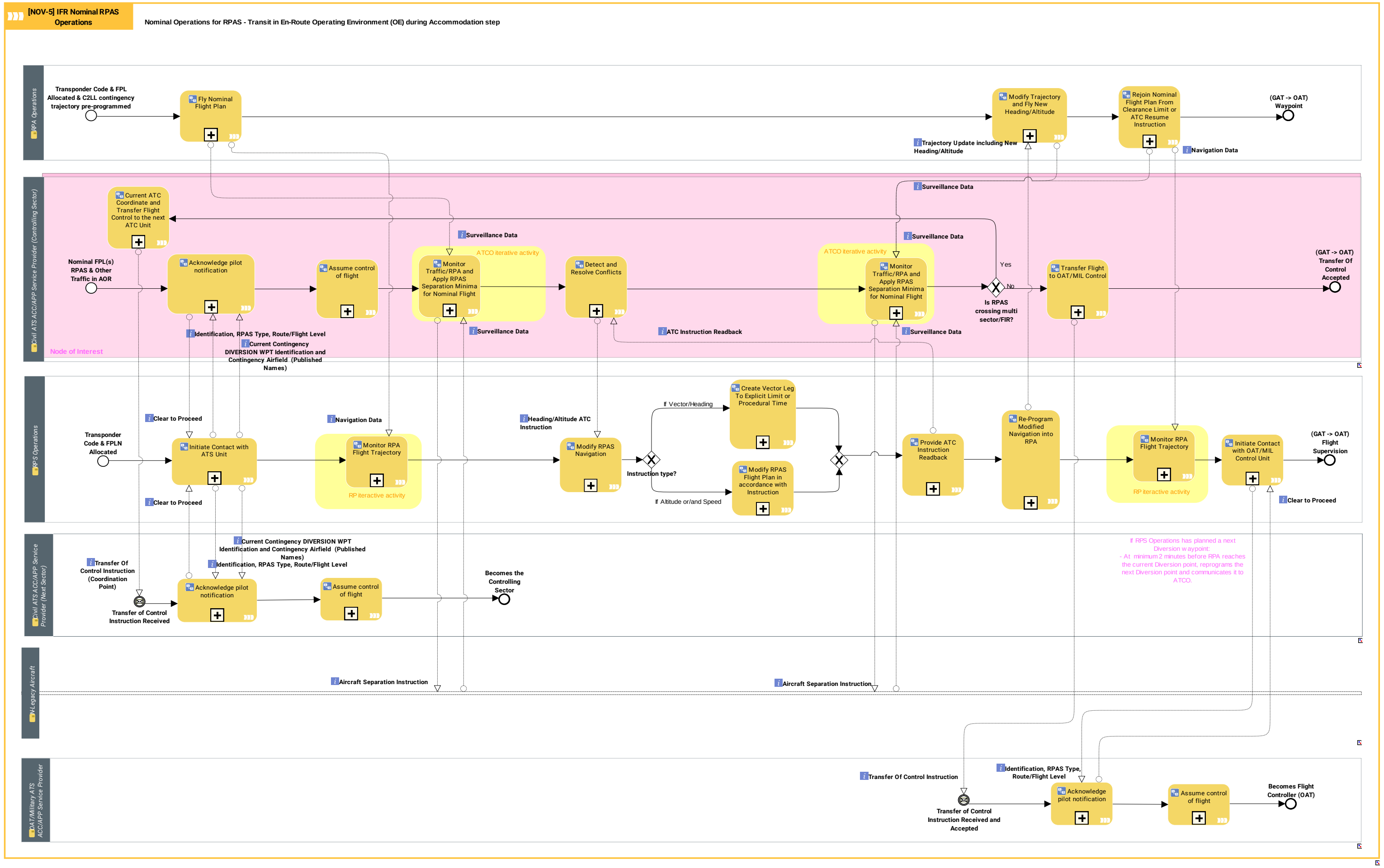


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Figure 7 : EATMA [NOV-5] IFR RPAS Nominal Operations

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Activity	Description
Acknowledge pilot notification	The controller acknowledges the pilot notification.
Assume control of flight	The aircraft passes the coordination point. The Accepting ATSU assumes control of the flight and may now issue ATC clearances and instructions to the flight.
Create Vector Leg To Explicit Limit or Procedural Time	When RPS Operations receives the ATC instruction Vector/Heading type, RPS Operations modifies the new trajectory in accordance with the ATC instruction (Heading). As for manned aviation: • If vectoring/Heading with no limit defined: RPAS will execute the instructed heading until a new ATC instruction • If vectoring/Heading with a limit: RPAS will execute the instructed heading until reaching the limit then will resume the nominal flight plan
Current ATC Coordinate and Transfer Flight Control to the next ATC Unit	If RPA crosses a multi-sector/FIR, then ATS Unit (controlling sector) will coordinate / transfer the control of RPAS to the new ATS Unit in charge of the next sector.
Detect and Resolve Conflicts	Detecting conflicts between RPAS and the manned aviation is an important part of the ATS Unit job and arguably the most complex one; RPAS does not present the same performances than the manned aircraft (speed, and systems). Once a conflict is properly identified the resolution is relatively straightforward - the controller chooses an appropriate method (e.g. level change, vectoring, speed control, etc.), implements the plan and monitors aircraft compliance.
Fly Nominal Flight Plan	RPA flies the nominal Flight Plan (FPL) with route and profile for its active flight planned until the destination aerodrome/airport.
Initiate Contact with ATS Unit	RPS Operations must initiate a first contact with the ATS Unit when RPA enters a new ATC sector. This contact is done by the nominal ATC R/T Voice link. At this initial contact, the standard initial contact information is exchanged, and two additional information elements are added for ATCO awareness in case C2 Link Loss RPA occurs.

Activity	Description
Initiate Contact with OAT/MIL Control Unit	When flight switches from GAT to OAT, RPS Operations must initiate a first contact with the OAT/Military Control Unit.
Modify RPAS Flight Plan in accordance with Instruction	When RPS Operations receives the ATC instruction (Altitude /FL) RPS Operations modifies the new trajectory in accordance with the ATC instruction. RPA will fly the instructed altitude until new ATC instruction.
Modify RPAS Navigation	RPS Operations decides which navigation parameters need to be modified due to the ATC instruction.
Modify Trajectory and Fly New Heading/Altitude	Execution of instruction by RPS Operations. (Note: this may lead to change of the C2LL contingency preparation, though unlikely, by the RPS operations).
Monitor RPA Flight Trajectory	RPS Operations monitoring of RPA flight trajectory parameters.
Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight	ATS Unit standard activity providing the separation service.
Provide ATC Instruction Readback	Remote Pilot readback to the ATS Unit (ATCO) of ATC clearances /instructions.
Re-Program Modified Navigation into RPA	RPS Operations reprograms the RPA trajectory (through C2 link) related to the ATC instruction.
Rejoin Nominal Flight Plan From Clearance Limit or ATC Resume Instruction	RPAS resumes nominal flight plan from clearance limit or ATC instruction to resume initial route.
Transfer Flight to OAT/MIL Control	At the OAT coordination point, Civil ATS Unit transfers the RPAS control to the OAT/Military Control Unit.

Table 24: Solution 115 Activities Nominal Operations

Issuer	Info Flow	Addressee	Info Element	Info Entity
Civil ATS ACC/APP Service Provider (Controlling Sector)	**Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight o--> N-Legacy Aircraft**	N-Legacy Aircraft	**Aircraft Separation Instruction**	Separation provision
N-Legacy Aircraft	**N-Legacy Aircraft o--> Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Surveillance Data**	SystemTrack
Civil ATS ACC/APP Service Provider (Controlling Sector)	**Transfer Flight to OAT/MIL Control o--> Transfer of Control Instruction Received and Accepted**	OAT/Military ATS ACC/APP Service Provider	**Transfer Of Control Instruction**	TransferOfControlPoint
Civil ATS ACC/APP Service Provider (Controlling Sector)	**Detect and Resolve Conflicts o--> Modify RPAS Navigation**	RPS Operations	**Heading/Altitude ATC Instruction**	Flight level
Civil ATS ACC/APP Service Provider (Controlling Sector)	**Detect and Resolve Conflicts o--> Modify RPAS Navigation**	RPS Operations	**Heading/Altitude ATC Instruction**	CruisingSpeed
Civil ATS ACC/APP Service Provider (Controlling Sector)	**Detect and Resolve Conflicts o--> Modify RPAS Navigation**	RPS Operations	**Heading/Altitude ATC Instruction**	Heading
RPS Operations	**Initiate Contact with OAT/MIL Control Unit o--> Acknowledge pilot notification**	OAT/Military ATS ACC/APP Service Provider	**Identification, RPAS Type, Route/Flight Level**	ATS route
RPS Operations	**Initiate Contact with OAT/MIL Control Unit o--> Acknowledge pilot notification**	OAT/Military ATS ACC/APP Service Provider	**Identification, RPAS Type, Route/Flight Level**	Aircraft identification

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Issuer	Info Flow	Addressee	Info Element	Info Entity
RPS Operations	**Initiate Contact with OAT/MIL Control Unit o--> Acknowledge pilot notification**	OAT/Military ATS ACC/APP Service Provider	**Identification, RPAS Type, Route/Flight Level**	Area navigation route
RPS Operations	**Initiate Contact with OAT/MIL Control Unit o--> Acknowledge pilot notification**	OAT/Military ATS ACC/APP Service Provider	**Identification, RPAS Type, Route/Flight Level**	Flight level
RPS Operations	**Initiate Contact with OAT/MIL Control Unit o--> Acknowledge pilot notification**	OAT/Military ATS ACC/APP Service Provider	**Identification, RPAS Type, Route/Flight Level**	AircraftType
RPA Operations	**Rejoin Nominal Flight Plan From Clearance Limit or ATC Resume Instruction o--> Monitor RPA Flight Trajectory**	RPS Operations	**Navigation Data**	AreaNavigationRoute
RPA Operations	**Fly Nominal Flight Plan o--> Monitor RPA Flight Trajectory**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Navigation Data**	AreaNavigationRoute
OAT/Military ATS ACC/APP Service Provider	**Acknowledge pilot notification o--> Initiate Contact with OAT/MIL Control Unit**	RPS Operations	**Clear to Proceed**	ATCClearance
RPS Operations	**Re-program modified navigation into RPA o--> Modify Trajectory and Fly New Heading/Altitude**	RPA Operations	**Trajectory Update including New Heading/Altitude**	FlightDataMessage
Civil ATS ACC/APP Service Provider (Controlling Sector)	**Acknowledge pilot notification o--> Initiate Contact with ATS Unit**	RPS Operations	**Clear to Proceed**	ATCClearance

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Issuer	Info Flow	Addressee	Info Element	Info Entity
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Identification, RPAS Type, Route/Flight Level**	ATS route
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Identification, RPAS Type, Route/Flight Level**	Aircraft identification
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Identification, RPAS Type, Route/Flight Level**	Area navigation route
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Identification, RPAS Type, Route/Flight Level**	Flight level
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Identification, RPAS Type, Route/Flight Level**	AircraftType
Civil ATS ACC/APP Service Provider (Controlling Sector)	**Current ATC Coordinate and Transfer Flight Control to the next ATC Unit o--> Transfer of Control Instruction Received**	Civil ATS ACC/APP Service Provider (Next Sector)	**Coordination Point**	TransferOfControlPoint
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Current Contingency DIVERSION WPT Identification and Contingency Airfield (Published Names)**	Waypoint
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Current Contingency DIVERSION WPT Identification and Contingency Airfield (Published Names)**	CoordinatedAirport

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Issuer	Info Flow	Addressee	Info Element	Info Entity
RPA Operations	**Modify Trajectory and Fly New Heading/Altitude o--> Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Surveillance Data**	SystemTrack
Civil ATS ACC/APP Service Provider (Next Sector)	**Acknowledge pilot notification o--> Initiate Contact with ATS Unit**	RPS Operations	**Clear to Proceed**	ATCClearance
RPA Operations	**Fly Nominal Flight Plan o--> Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Surveillance Data**	SystemTrack
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Next Sector)	**Current Contingency DIVERSION WPT Identification and Contingency Airfield (Published Names)**	Waypoint
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Next Sector)	**Current Contingency DIVERSION WPT Identification and Contingency Airfield (Published Names)**	CoordinatedAirport
RPA Operations	**Rejoin Nominal Flight Plan From Clearance Limit or ATC Resume Instruction o--> Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Surveillance Data**	SystemTrack

Issuer	Info Flow	Addressee	Info Element	Info Entity
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Next Sector)	**Identification, RPAS Type, Route/Flight Level**	ATS route
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Next Sector)	**Identification, RPAS Type, Route/Flight Level**	Aircraft identification
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Next Sector)	**Identification, RPAS Type, Route/Flight Level**	Area navigation route
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Next Sector)	**Identification, RPAS Type, Route/Flight Level**	Flight level
RPS Operations	**Initiate Contact with ATS Unit o--> Acknowledge pilot notification**	Civil ATS ACC/APP Service Provider (Next Sector)	**Identification, RPAS Type, Route/Flight Level**	AircraftType
RPS Operations	**Provide ATC Instruction Readback o--> Detect and Resolve Conflicts**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**ATC Instruction Readback**	CruisingSpeed
RPS Operations	**Provide ATC Instruction Readback o--> Detect and Resolve Conflicts**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**ATC Instruction Readback**	Flight level
RPS Operations	**Provide ATC Instruction Readback o--> Detect and Resolve Conflicts**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**ATC Instruction Readback**	Waypoint
RPS Operations	**Provide ATC Instruction Readback o--> Detect and Resolve Conflicts**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**ATC Instruction Readback**	Heading

Table 25: Solution 115 Information Flows and Elements - Nominal Operations

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Info Element	Description
Aircraft Separation Instruction	This information contains the ATC instruction needed to assume a safe separation with RPAS in accordance with the traffic situation and the RPAS situation (nominal, contingency, or emergency).
ATC Instruction Readback	The read-back provided by RP to the ATC instruction for ATCO to have confirmation that the instruction is understood and implemented.
Clear to Proceed	ATC Unit provides clearance to the pilot/RP to proceed as planned.
Current Contingency DIVERSION WPT Identification and Contingency Airfield (Published Names)	Specific C2LL contingency elements (diversion wpt, contingency airfield) provided by RPS Operations to ATCO to know the RPAS intentions in case of C2LL contingency.
Heading/Altitude ATC Instruction	This instruction provided by ATCO to RP, requires modification of RPA state/ trajectory.
Identification, RPAS Type, Route/Flight Level	Initial contact information provided by RP to ATCO.
Navigation Data	The data related to the RPA flight trajectory, which allows RP to monitor RPA trajectory at RPS.
Surveillance Data	Data about aircraft and vehicles: position, speed, acceleration information…
Trajectory Update including New Heading/Altitude	The trajectory change commands sent by RPS to RPA in accordance to ATCO instruction received and entered by RP.
Transfer Of Control Instruction	Any information provided during the transfer of control between two Control Units 'current and next' (civil/civil or civil/military-OAT).

Table 26: Solution 115 Information Elements Descriptions - Nominal Operations

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3.3.2.3 Use Cases for [NOV-2] IFR RPAS Contingency Operations (C2LL)

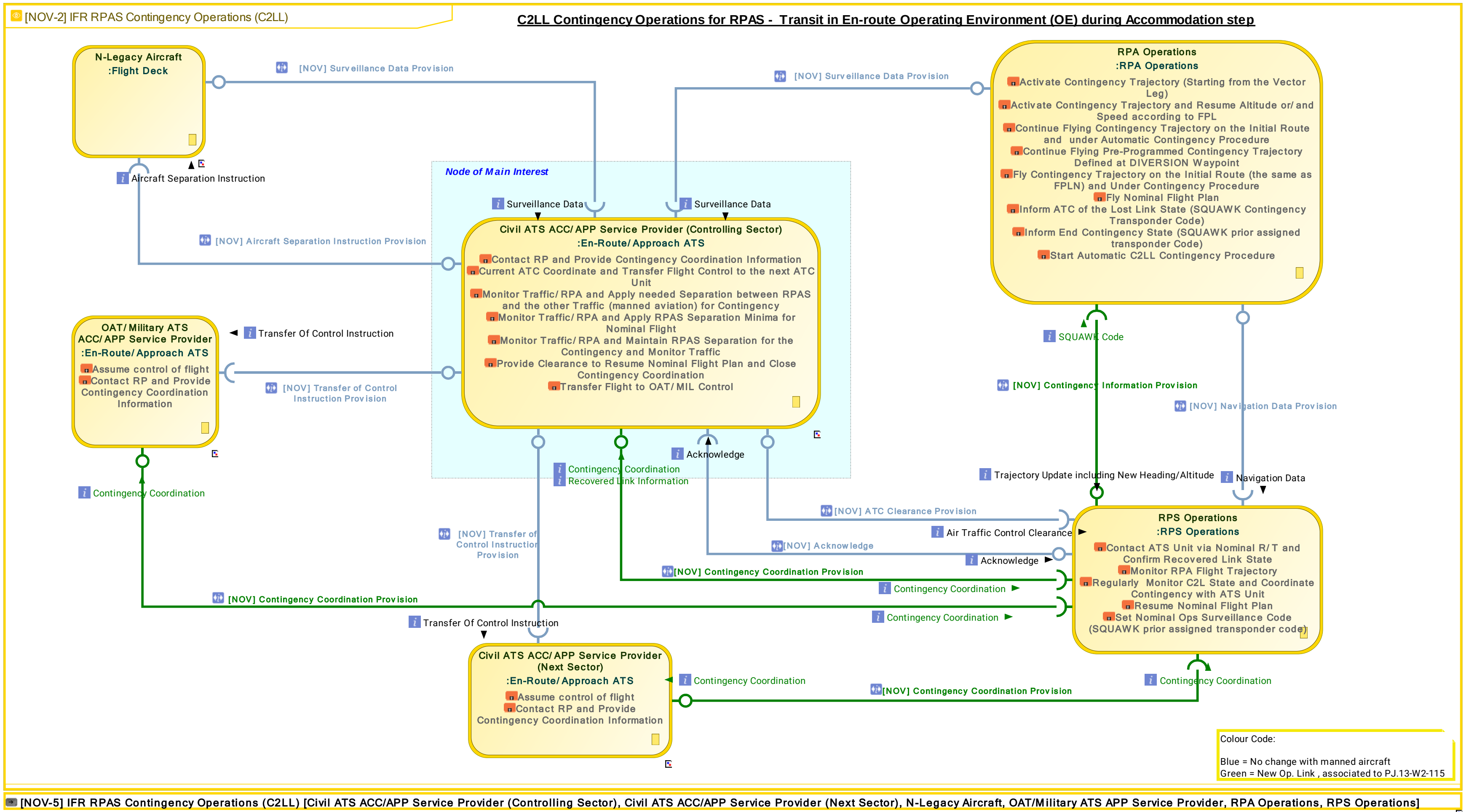
Presentation:

These operational interactions (information exchanges and flows) of IFR RPAS C2 link loss Contingency Operations view (NOV-2) defines the specific exchanges between stakeholder entities (Nodes instances) concerned by the C2 Link Loss (C2LL) Contingency Operations (in flight) concerning IFR RPAS as General Air Traffic (GAT) for RPAS Accommodation phase.

The Nodes instances used in the IFR RPAS Accommodation concept for the contingency operations:

Stakeholder entities Node instances concerned by the contingency operations (C2LL) and represented in the model are the following:

- The RPA Operations (RPA = Remotely Piloting Aircraft) (new);
- The Civil ATS ACC/APP Service Provider in controlling current sector (Node of interest);
- The RPS Operations (RPS = Remote Pilot Station) (new);
- The Civil ATS ACC/APP Service Provider in next/adjacent sector to illustrate a possible 'transfer of control' of RPAS during transit flight;
- The N-Legacy Aircraft (the collaborative manned aviation around the RPA);
- The OAT/Military ATS ACC/APP Service Provider



Click on http://webprisme.cfmu.eurocontrol.int/oneportal_working_validation/data/diagrams/1C5449CA5FF3722E for zooming

Figure 8 : EATMA [NOV-2] IFR RPAS Contingency Operations

3.3.2.3.1 [NOV-5] IFR RPAS Contingency Operations (C2LL)

Presentation:

This operational interactions (information exchanges, flows, activities) view (NOV-5) describes the specific activities (dynamic of the exchanges) between stakeholder entities to manage Contingency Operations for C2 Link Loss (C2LL) (in flight) concerning IFR RPAS as General Air Traffic (GAT) for the RPAS Accommodation phase.

Concept of Operation:

The operating context and operational characteristics considered are described in 3.2.1.

Sequencing of activities related to the contingency operations (C2LL) is detailed below.

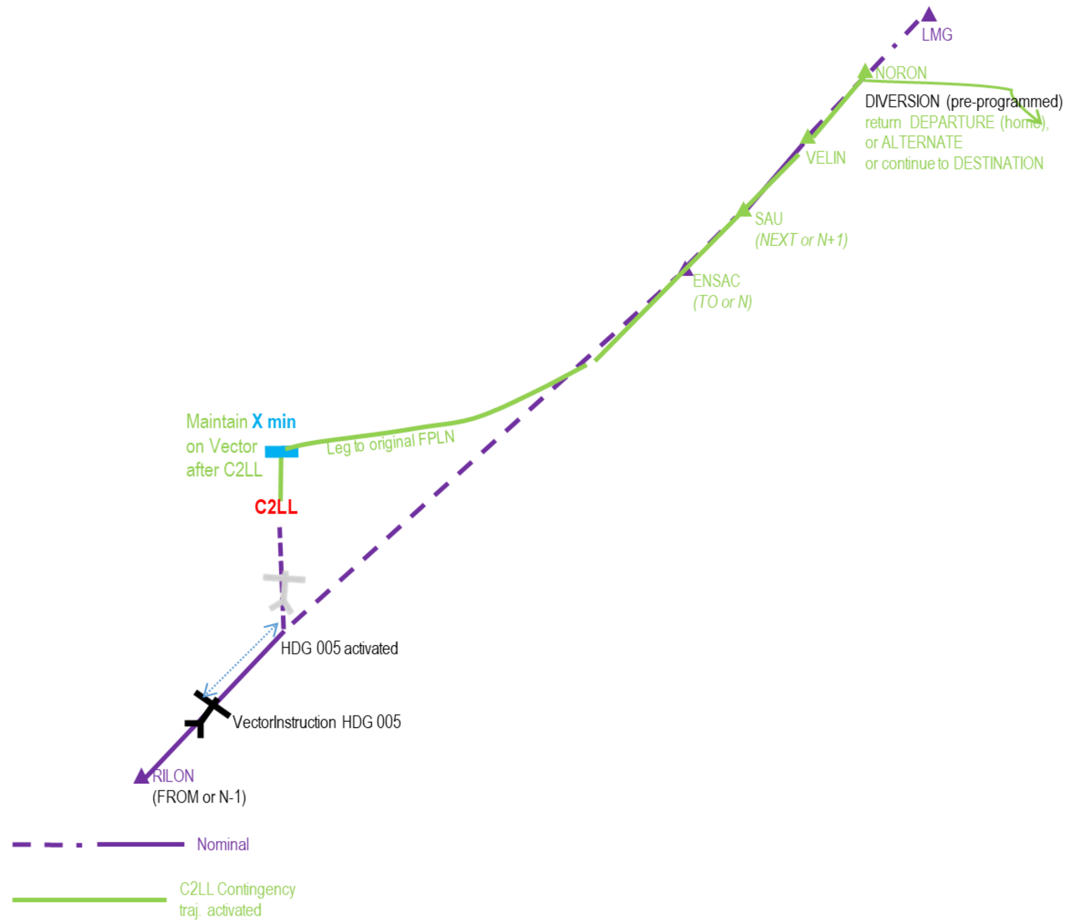


Figure 7: C2LL Contingency trajectory automatically activated (C2LL occurring after heading instruction)

<u>Step 1:</u> The C2 link is lost. RPA/RPS Operations detects the C2 link loss.

After a RPA stability time (~10 sec.), RPA Operations automatically engages its **pre-programmed** C2 link loss contingency trajectory.

<u>Note 1:</u> C2 link loss (C2LL) stability time is set by Operator and is not visible by ATCO.

<u>Note 2:</u> In the Accommodation phase, on existing RPAS, ATC Voice (VHF) is lost when the C2 link is lost because RPA Operations relays both Commands/Control data and voice on this link to/from RPS Operations.

As part of the C2 link loss procedure, RPA Operations automatically sets its transponder code to a specifically defined C2 link loss code.

<u>Note 3:</u> ICAO RPAS panel has set 7400 as the RPAS C2 link loss code when RPAS operations will be fully endorsed by states. However, during the accommodation phase the Operator must pre-program the C2LL transponder code suitable to the ATC systems existing capability (7400 if implemented by ANSP or 7600).

ATS Unit controlling the RPAS is informed of the C2 link loss condition (Radar track label on the control screen highlighting the particular state of the RPA).

ATS Unit knows the RPA flight intentions in C2 link loss contingency, as these have been provided by the RPS Operations before the C2 link loss (refer to section 3.3.2.2.1).

<u>Step 2:</u> Contingency coordination.

Use of a telephone line conceptually enables the first actor (ATCO or RP) which noted the C2 link loss to initiate the telephone call to the other. Such telephone coordination after the C2LL is also expected by ATCO for longer term-concepts.

Following validation:

- It is recommended that ATCO, who has telephone access through their control console, initiated the telephone call to the RP. The RP telephone number is in the Flight Plan.
- For information, ATCOs highlighted that telephone coordination after the C2LL is also expected for long-term integration concepts.

<u>Note 4:</u> This task is expected to be supported by the Planning controller (rather than the Executive Controller performing traffic scanning and control tasks).

This contingency coordination, after observation of the C2 link loss contingency state, allows exchanging any helpful/useful and more detailed information or reminders, additional follow-on actions between ATCO and RP.

Step 3: Contingency management.
RPS Operations: During the C2 link loss with the RPA, RPS Operations will regularly monitor the C2 link state with the RPA.
RPS Operations will try to identify the origin of the failure (RPA vs. RPS) and if possible to correct it (possible only if the origin is the RPS).

ATS Unit: will monitor traffic (manned aviation) vs. RPAS position and overall C2LL trajectory and will apply an operationally suitable adapted separation between traffic and the RPAS trajectory in accordance with the traffic situation (for a C2LL/link loss contingency the separation values could be higher than for a nominal situation with RPAS). Such a situation is equivalent to manned aircraft flying a procedurally defined behaviour/ trajectory in a radio-communication loss contingency.

Step 4: RPA operations automatically flies its C2LL pre-programmed contingency flight trajectory.
During the accommodation phase, in case the RPA was not on its flight plan, due to an ATCO instruction prior to the C2LL, taking into account existing RPAS and Depending on the Operator strategy, RPAS maintains current values for pre-set time, then rejoins the pre-programmed FPLN.

Note 5: ICAO RPAS panel guidance for the long-term is:

- ATCO Vector/Heading/offset instruction in En-Route: maintain for 2 minutes, then rejoin original flight plan.
- If ATCO Altitude instruction, maintain for 20 minutes, then resume altitude or/and speed values according to original flight plan.

Step 5: C2 link status.

1. **If C2L is never re-established:**

Then RPA remains in the C2 link loss contingency situation and continues flying the C2 link loss contingency trajectory.

The contingency operations description of the GAT flight portion ends when the RPAS control is transferred to the OAT/Military Controller (RPA has reached the GAT to OAT pre-defined waypoint).

2. **If C2L is re-established:**

Then RPS Operations detect the C2L recovery and contacts ATS Unit by VHF (nominal R/T) to inform/to confirm the recovery link state:

- On the last frequency used before C2LL or on the emergency frequency 121.500 MHz (ATC units will coordinate to provide RPS Operations with the frequency of the sector it flies in).

When RPS Operations has R/T contact established, ATS Unit provides RPS Operations with a clearance requesting to resume nominal flight plan, confirms re-use of the nominal (prior assigned) SQUAWK code. Contingency coordination is closed.

RPS Operations acknowledges the clearance, and then instructs RPA Operations to set nominal operation surveillance code (SQUAWK prior assigned transponder code).

Following RPS Operations instruction, RPA Operations end contingency state and informs ATS Unit of the end contingency procedure:

- ATS Unit receives this through the SSR (Secondary Surveillance Radar) code/ Transponder code set by RPA Operations to prior assigned transponder code.

Then, RPA reverts towards the nominal flight plan with route and profile of its active flight plan including the rejoin behaviour cleared by the ATS Unit.

ATS Unit continues nominal flight tasks.

ATS Unit transfer of Control during contingency:

If RPA crosses a multi-sector/FIR, then ATS Unit (controlling sector) will coordinate the control transfer of RPAS during contingency to the next ATS Unit in charge of the next sector.
The coordination and transfer of control of a flight between successive ATC units is done by the standard transfer of control dialogue and as for a manned aircraft in a particular contingency state, includes information on the contingency state.

Once the transfer of control received and accepted, the ATS Unit in charge of the next sector initiates the contingency coordination, over the coordination telephone line, with the RPS Operations in the same conditions than the ATS Unit of the previous sector.

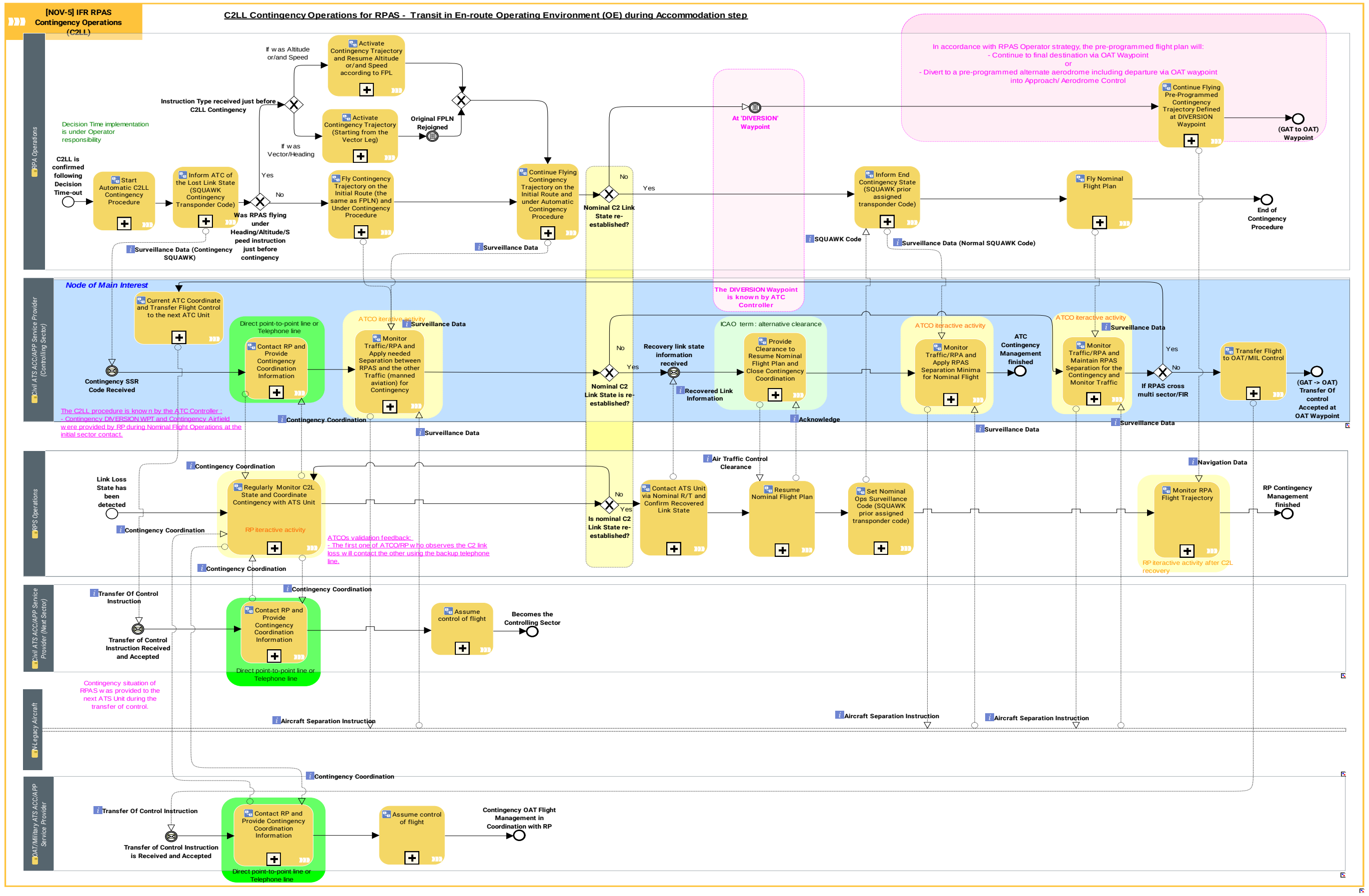


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Figure 9 : EATMA [NOV-5] IFR RPAS Contingency Operations (C2LL)

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Activity	Description
Activate Contingency Trajectory (Starting from the Vector Leg)	RPA is flying in C2LL contingency and had received a Vector/Heading instruction before C2LL event. RPA automatically maintains current values for pre-set time, then rejoins the pre-programmed FPLN. Note : ICAO RPAS panel guidance for the long-term is: • ATCO Vector/Heading/offset instruction in En-Route: maintain for 2 minutes, then rejoin original flight plan
Activate Contingency Trajectory and Resume Altitude or/and Speed according to FPL	RPA is flying in C2LL contingency and had received an Altitude instruction before C2LL event. RPA automatically maintains current values for pre-set time, then rejoins the pre-programmed FPLN. Note: ICAO RPAS panel guidance for the long-term is: • If ATCO Altitude instruction, maintain for 20 minutes, then resume altitude or/and speed values according to original flight plan.
Assume control of flight	The aircraft passes the coordination point. The Accepting ATSU assumes control of the flight and may now issue ATC clearances and instructions to the flight.
Contact ATS Unit via Nominal R/T and Confirm Recovered Link State	RPS Operations detects the C2 link recovery and contacts ATS Unit by VHF (nominal R/T) to inform/to confirm the link state recovered.
Contact RP and Provide Contingency Coordination Information	Once ATS Unit is informed of the C2LL/link loss situation (specific transponder code), ATS Unit initiates contingency coordination with RPS Operations through the backup telephone line.
Continue Flying Contingency Trajectory on the Initial Route and under Automatic Contingency Procedure	RPA, under automatic flight, rejoins the pre-programmed FPLN and continues to automatically fly its C2LL contingency trajectory on the initial route.
Continue Flying Pre-Programmed Contingency Trajectory Defined at DIVERSION Waypoint	RPA, under automatic flight at the DIVERSION pre-programmed waypoint continues to automatically fly its C2LL contingency trajectory to the diversion aerodrome. Diversion aerodrome has already been pre-programmed to one of the following, in accordance with RPAS Operator strategy: • alternate aerodrome • original departure aerodrome

Co-funded by the European Union

Activity	Description
	• final destination
Current ATC Coordinate and Transfer Flight Control to the next ATC Unit	RPA is reaching another sector/FIR: the current ATS Unit (controlling sector) will coordinate the transfer of control of RPAS in C2LL contingency to the next ATS Unit. Once the transfer of control received and accepted, the ATS Unit in charge of the next sector initiates the contingency coordination with the RPS Operations.
Fly Contingency Trajectory on the Initial Route (the same as FPLN) and Under Contingency Procedure	RPA, which was on its nominal Flight Plan trajectory when C2LL occurs, continues to automatically fly its contingency trajectory, which is the same as the nominal Flight Plan until the DIVERSION pre-programmed waypoint.
Fly Nominal Flight Plan	RPA flies the nominal Flight Plan (FPL) with route and profile for its active flight planned until the destination aerodrome/airport.
Inform ATC of the Lost Link State (SQUAWK Contingency Transponder Code)	RPA automatically sets its SQUAWK/transponder code to its preset specific code for C2LL. The code is broadcasted through its surveillance data and received by the ATS Unit. It remains active while the C2 Link is not re-established.
Inform End Contingency State (SQUAWK prior assigned transponder Code)	RPS Operations (after C2 link recovery and ATC clearance) sets back its SQUAWK/transponder code to the previous nominal code.
Monitor RPA Flight Trajectory	RPS Operations monitoring of RPA flight trajectory parameters.
Monitor Traffic/RPA and Apply needed Separation between RPAS and the other Traffic (manned aviation) for Contingency	During the RPA in C2LL contingency, ATS Unit performs a recurrent task: • ATS Unit monitors traffic (manned aviation) vs. RPA trajectory and applies an adapted separation with RPAS trajectory in accordance with the traffic situation.
Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight	ATS Unit standard activity providing the separation service.
Monitor Traffic/RPA and Maintain RPAS Separation for the Contingency and Monitor Traffic	During RPA in C2LL, ATC Unit monitors traffic and maintains separation between the RPA and other manned aircraft.
Provide Clearance to Resume Nominal Flight Plan	ATS Unit provides RPS Operations with a clearance (via VHF operational communication) to resume nominal flight plan and set

Activity	Description
and Close Contingency Coordination	nominal SQUAWK/transponder code; then closes the contingency coordination (closes the backup audio-line).
Regularly Monitor C2L State and Coordinate Contingency with ATS Unit	During C2LL contingency, RPS Operations recurrently monitor the C2 link state.
Resume Nominal Flight Plan	RPS Operations resumes nominal Flight Plan, after ATC clearance is received.
Set Nominal Ops Surveillance Code (SQUAWK prior assigned transponder code)	RPS Operations sets the nominal SQUAWK/ transponder code (prior code assigned) in RPA Operations after ATC clearance is received.
Start Automatic C2LL Contingency Procedure	When RPA detects C2LL event, it automatically actives its pre-programmed C2LL contingency trajectory.
Transfer Flight to OAT/MIL Control	At the OAT coordination point, ATS Unit transfers the RPAS management to the OAT/Military Control Unit.

Table 27: Solution 115 Activities Contingency Operations

Issuer	Info Flow	Addressee	Info Element	Info Entity
RPS Operations	**Resume Nominal Flight Plan o--> Provide Clearance to Resume Nominal Flight Plan and Close Contingency Coordination**	Civil ATS ACC/APP Service Provider	**Acknowledge**	AIRM_OutOfScope
Civil ATS ACC/APP Service Provider	**Current ATC Coordination and Transfer Flight Control to the next ATC Unit o--> Transfer of Control Instruction Received and Accepted**	Civil ATS ACC/APP Service Provider (Next Sector)	**Transfer Of Control Instruction**	TransferOfControlPoint
RPS Operations	**Set Nominal Ops Surveillance Code (SQUAWK prior assigned transponder code) o--> Inform End Contingency State (SQUAWK prior assigned transponder Code)**	RPA Operations	**SQUAWK Code**	SSRCode
RP and RPS	**Contact RP and Provide Contingency Coordination Information o--> Regularly Monitor C2L State and Coordinate Contingency with ATS Unit**	RP and RPS	**Contingency Coordination and Contact Frequency**	CoordinationAndTransfer
N-Legacy Aircraft	**N-Legacy Aircraft o--> Monitor Traffic/RPA and Maintain RPAS Separation for the Contingency and Monitor Traffic**	Civil ATS ACC/APP Service Provider	**Surveillance Data**	SystemTrack

Issuer	Info Flow	Addressee	Info Element	Info Entity
N-Legacy Aircraft	**N-Legacy Aircraft o--> Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight**	Civil ATS ACC/APP Service Provider	**Surveillance Data**	SystemTrack
N-Legacy Aircraft	**N-Legacy Aircraft o--> Monitor Traffic/RPA and Apply needed Separation between RPAS and the other Traffic (manned aviation) for Contingency**	Civil ATS ACC/APP Service Provider	**Surveillance Data**	SystemTrack
RPA Operations	**Continue Flying Contingency Trajectory on the Initial Route and under Automatic Contingency Procedure o--> Monitor Traffic/RPA and Apply needed Separation between RPAS and the other Traffic (manned aviation) for Contingency**	Civil ATS ACC/APP Service Provider	**Surveillance Data**	SystemTrack
Civil ATS ACC/APP Service Provider (Next Sector)	**Contact RP and Provide Contingency Coordination Information o--> Regularly Monitor C2L State and Coordinate Contingency with ATS Unit**	RP and RPS	**Contingency Coordination and Contact Frequency**	CoordinationAndTransfer

Issuer	Info Flow	Addressee	Info Element	Info Entity
RPA Operations	**Continue Flying Pre-Programmed Contingency Trajectory Defined at DIVERSION Waypoint o--> Monitor RPA Flight Trajectory**	RPS Operations	**Navigation Data**	AreaNavigationRoute
RP and RPS	**Regularly Monitor C2L State and Coordinate Contingency with ATS Unit o--> Contact RP and Provide Contingency Coordination Information**	OAT/Military ATS APP Service Provider	**Contingency Coordination**	CoordinationAndTransfer
OAT/Military ATS APP Service Provider	**Contact RP and Provide Contingency Coordination Information o--> Regularly Monitor C2L State and Coordinate Contingency with ATS Unit**	RP and RPS	**Contingency Coordination and Contact Frequency**	CoordinationAndTransfer
RP and RPS	**Regularly Monitor C2L State and Coordinate Contingency with ATS Unit o--> Contact RP and Provide Contingency Coordination Information**	RP and RPS	**Contingency Coordination**	CoordinationAndTransfer
RP and RPS	**Regularly Monitor C2L State and Coordinate Contingency with ATS Unit o--> Contact RP and Provide Contingency Coordination Information**	Civil ATS ACC/APP Service Provider (Next Sector)	**Contingency Coordination**	CoordinationAndTransfer

Issuer	Info Flow	Addressee	Info Element	Info Entity
Civil ATS ACC/APP Service Provider	**Transfer Flight to OAT/MIL Control o--> Transfer of Control Instruction Received and Accepted**	Civil ATS ACC/APP Service Provider (Next Sector)	**Transfer Of Control Instruction**	TransferOfControlPoint
Civil ATS ACC/APP Service Provider	**Monitor Traffic/RPA and Apply needed Separation between RPAS and the other Traffic (manned aviation) for Contingency o--> N-Legacy Aircraft**	N-Legacy Aircraft	**Aircraft Separation Instruction**	Separation provision
RPA Operations	**Fly Nominal Flight Plan o--> Monitor Traffic/RPA and Maintain RPAS Separation for the Contingency and Monitor Traffic**	Civil ATS ACC/APP Service Provider	**Surveillance Data**	SystemTrack
RPS Operations	**Contact ATS Unit via Nominal R/T and Confirm Recovered Link State o--> Recovery link state information received**	Civil ATS ACC/APP Service Provider (Controlling Sector)	**Recovered Link Information**	FlightCapability
RPA Operations	**Fly Contingency Trajectory on the Initial Route (the same as FPLN) and Under Contingency Procedure o--> Monitor Traffic/RPA and Apply needed Separation between RPAS and the other Traffic (manned aviation) for Contingency**	Civil ATS ACC/APP Service Provider	**Surveillance Data**	SystemTrack

Issuer	Info Flow	Addressee	Info Element	Info Entity
RPA Operations	**Inform End Contingency State (SQUAWK prior assigned transponder Code) o--> Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight**	Civil ATS ACC/APP Service Provider	**Surveillance Data (Normal SQUAWK Code)**	SSRCode
Civil ATS ACC/APP Service Provider	**Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight o--> N-Legacy Aircraft**	N-Legacy Aircraft	**Aircraft Separation Instruction**	Separation provision
Civil ATS ACC/APP Service Provider	**Monitor Traffic/RPA and Maintain RPAS Separation for the Contingency and Monitor Traffic o--> N-Legacy Aircraft**	N-Legacy Aircraft	**Aircraft Separation Instruction**	Separation provision
RPA Operations	**Inform ATC of the Lost Link State (SQUAWK Contingency Transponder Code) o--> Contingency SSR Code Received**	En,-Route/	**Surveillance Data (Contingency SQUAWK Code)**	SSRCode
Civil ATS ACC/APP Service Provider	**Provide Clearance to Resume Nominal Flight Plan and Close Contingency Coordination o--> Resume Nominal Flight Plan**	RPS Operations	**Air Traffic Control Clearance**	ATCClearance

Table 28: Solution 115 Information Flows and Elements - Contingency Operations

Info Element	Description
Acknowledge	Confirmation of receipt and acceptance of any type of information facilitated by an air traffic control unit.
Air Traffic Control Clearance	Authorization for an aircraft to proceed under conditions specified by an air traffic control unit.
Aircraft Separation Instruction	This information contains the ATC instruction needed to assume a safe separation with RPAS in accordance with the traffic situation and the RPAS situation (nominal, contingency, or emergency).
Contingency Coordination	Share information between RP and ATCO related to the C2 link loss (C2LL) contingency.
Navigation Data	The data related to the RPA flight trajectory, which allows RP to monitor RPA trajectory at RPS.
Recovered Link Information	RP information to ATCO on the C2 link recovery.
SQUAWK Code	A Transponder code assigned by air traffic controllers to identify the aircraft/RPA uniquely in a flight information region (FIR). This allows easy identification of aircraft/RPA on radar.
Surveillance Data	Data about aircraft and vehicles: position, speed, acceleration information…
Surveillance Data (Contingency SQUAWK Code)	A specific Transponder code setting by aircraft/RPA to inform of the contingency/emergency type encountered during flight. Signifies the contingency type of aircraft/RPA abnormal situation through secondary radar.
Surveillance Data (Normal SQUAWK Code)	A Transponder code setting by aircraft/RPA return to a normal identification code on secondary radar.
Transfer Of Control Instruction	Any information provided during the transfer of control between two Control Units 'current and next' (civil/civil or civil/military-OAT).

Table 29: Solution 115 Information Elements Descriptions – Contingency Operations

3.3.2.4 Use Cases for [NOV-2] IFR Emergency RPAS Operations

Presentation:

This operational interactions (information exchanges and flows) view [NOV-2] of **IFR RPAS Emergency Operations** defines the specific information exchanges between stakeholder entities (Node instances) in an emergency Accommodated RPAS situation.
The operating context considered has been defined in section 3.2.1.

Emergency situation is considered with an **engine failure on RPA, RPS Operations** still maintaining control of command but limited battery energy and time for other actions, requiring landing/termination within this limited time.

The Nodes instances used in the IFR RPAS Accommodation concept for the emergency operations:

Stakeholder entities (Node instances) concerned by the emergency situation are the following:

1. **Civil ATS ACC/APP Service Provider** (En-Route/Approach ATS) is the Node of interest ;
2. **OAT/Military ATS APP Service Provider** (En-Route/Approach ATS) ;
3. **Wing Operation Centre (WOC)** (Airspace User Ops Support)
4. **RPS Operations**;
5. **RPA Operations**;
6. **N-Legacy Aircraft** (Flight Deck) to represent all the collaborative manned aircraft (commercial/cargo) flying at the velocity of the RPAS within the same controlled airspace;
7. **Civil Airport Supervision** (Airport Ops Support)
8. **Civil ATS Aerodrome Service Provider** (Aerodrome ATS)

During the emergency situation, **Civil ATS ACC/APP Service Provider** is immediately aware of the emergency status of the RPAS through the specific surveillance link code, identically as a manned aircraft. Surveillance is maintained with the RPA and the rest of the traffic (Surveillance Data):

- [NOV] Surveillance Data Provision.

Civil ATS ACC/APP Service Provider is responsible for ensuring the separation needed between **RPA Operations** and the surrounding traffic in order to maintain the safety conditions when **RPA Operations** is in Emergency mode. In addition, **RPS Operations** (Remote Pilot) will inform Civil ATS ACC/APP Service Provider of the emergency, identically as a manned aircraft, over the voice radio.

Separation will be adapted with associated margins depending on the emergency situation encountered and the traffic situation, similarly to an equivalent emergency situation with manned aircraft (Aircraft Separation Instruction):

- [NOV] Aircraft Separation Instruction Provision.

RPS Operations and **Civil ATS ACC/APP Service Provider** will remain in contact over the voice radio in order to consolidate the emergency status or any needed coordination:

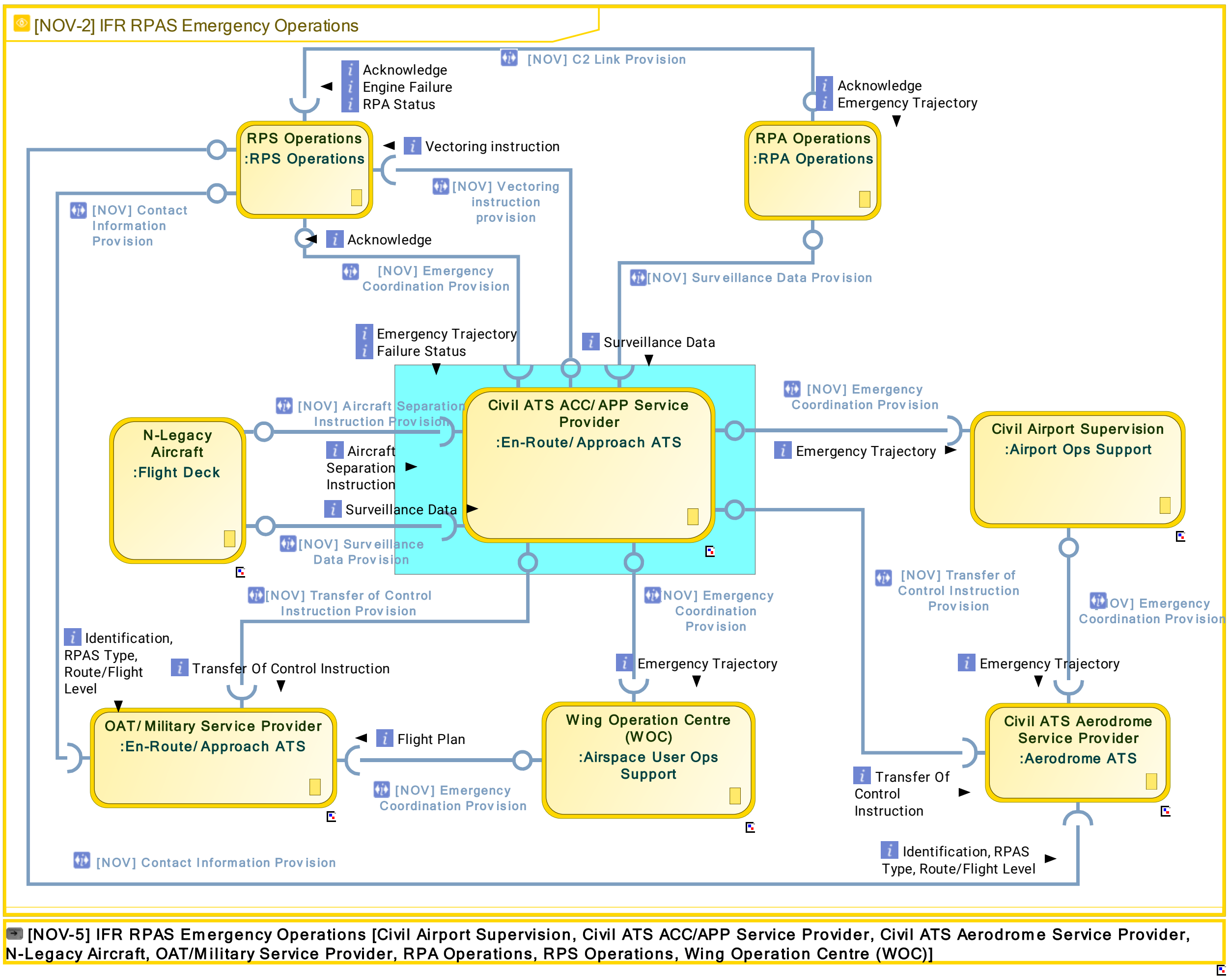
- [NOV] Contingency Coordination Provision.

To reach the final landing/termination point, the RPA management is:

1. For initial state/military RPAS, transferred to the OAT/Military ATS APP Service Provider if landing/termination area considered is a military one :
    - [NOV] Transfer of Coordination

2. to anticipate a future longer term case, at a further accommodation step, with additional landing options on a civil airfield, or future civil accommodated RPAS[18], provided by the Civil ATS Aerodrome Service Provide:
    - [NOV] Transfer of Coordination

[18] For a future, longer-term, accommodation step and for possible future civil applications, civil airfield access in emergency is noted as an extension under the low-medium complexity assumption. However, the Use Case does not imply mandatory usage of civil airfield; it only suggests an extension for their use.



Click on http://webprisme.cfmu.eurocontrol.int/oneportal_working_validation/data/diagrams/1C5451E65FF376E7 for zooming.

Figure 10 : EATMA [NOV-2] IFR RPAS Emergency Operations

3.3.2.4.1 Use Cases for [NOV-5] IFR Emergency RPAS Operations

Presentation:

IFR RPAS IFR RPAS Emergency Operations operational interactions (information exchanges, flows, activities) view defines the specific activities(dynamic of the exchanges) and associated conditions between stakeholder entities (nodes instances), when the IFR RPAS is in Emergency.

Emergency status differs from the C2LL status, as the RPAS, under RP control, must terminate flight / land as soon as possible. The rationale behind the emergency description is the fact that every situation leading to immediate landing/termination of flight should be managed following the same procedure as a manned aircraft emergency with associated margins depending on the emergency situation encountered. Even if multiple failures are not considered in the solution, choices taken are as conservative as possible. This leads to the conclusion that the procedure principle should be to land/terminate the flight as fast as possible using whichever planned emergency airfield is available and suitable. State RPAS being the initial demand are expected to be limited to military airfields. However, considering possible future civil application, at a further accommodation step, there is a suggested extended need in the future to access to civil emergency airfield(s) under the low complexity assumption. However, the Use Case does not imply mandatory usage of civil airfield; it only recognizes their usage.

Note1: At this step, we did not introduce the engine relight, which is similar to manned aircraft.

Concept of Operation:

Emergency event may group many different events. Their common point is the immediate action taken to land/terminate the flight. It leads to consider the most stringent of all these events. In this specific Use Case we will consider loss of engine propulsion as most of the other events will provide more margins for the RPAS to complete its emergency flight but underlying logic remains the same.

Following schematics illustrates the flight path main features.

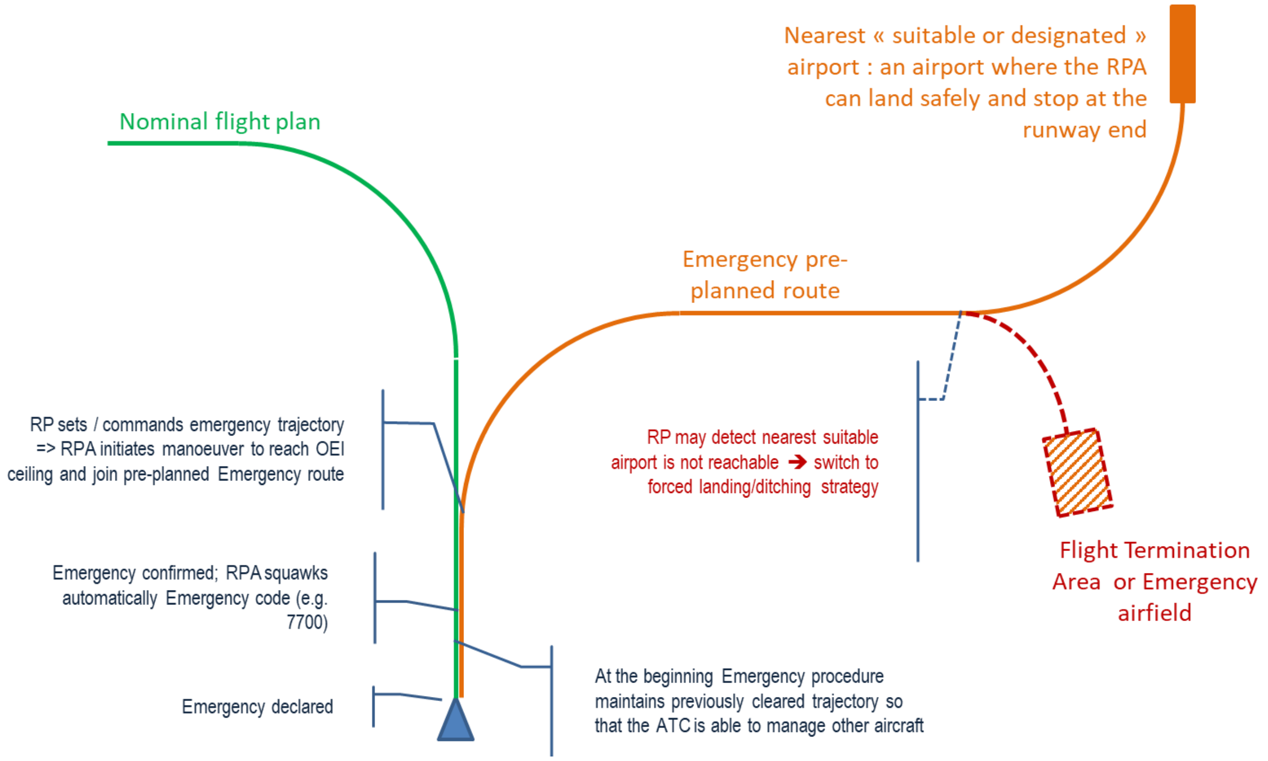


Figure 11 : EATMA – Flight path main features

<u>Step 1:</u> Emergency event to Emergency flight

During its flight as GAT, **RPA Operations** has an engine failure event. **RPS Operations** analyse the situation, then conclude that **RPA Operations** engines/propulsion is lost (however, batteries are used to allow management of flight control commands & surfaces during a maximum time linked to RPAS design).

RPS Operations sets **RPA Operations** to inform ATC of the emergency situation through squawk emergency code 7700, and through Radio communications. **Civil ATS ACC/APP Service Provider** detects the Emergency. **RPS Operations** coordinates with **Civil ATS ACC/APP Service Provider** through radio communications, providing the Emergency trajectory to land/terminate the flight including the emergency landing airfield & possibly an alternative Termination area.

RPS Operations maintains last ATC cleared path such that **RPA Operations** flies following its last ATC cleared path. A specific behaviour to note (identically to a manned aircraft in a propulsion loss situation) is that the **RPA Operations** will start descending, considering **RPA Operations** performances.

The way to choose what termination to use is already compliant (in existing operations) to the RPAS Manual (**see associated ICAO 10019 standard section 9.7.1 [49] - Emergency landing/ditching locations**: RPAS flight planning should include provisions for emergency landing of the RPA in locations that minimize the safety risks to people or property on the ground). In order to allow coordination actions to take place with Termination area responsible, time is needed. Safety being paramount, that may disqualify the closest airfield available and either terminate in the second closest possible airfield or due to not enough energy remaining to the closest pre-planned Forced Landing area.

Note 2: Forced Landing sites are published through the AIRAC Cycle in SUP AIP documents.

Note 3: suggested extension to include in the list of termination areas civil airfield allows less constrained flight plan due to the distance to fly to reach them and decrease of lost altitude during descent allowing to more easily remain in controlled area. Civil airfields that may be used must respect the Accommodation operating environment complexity constraints either inside the CTR or in the Approaching area.

Step 2: Emergency flight until handover to Landing/Termination area responsible

- **RPS Operations** now control **RPA Operations** Emergency flight following the Emergency trajectory as provided to **Civil ATS ACC/APP Service Provider** and loaded into **RPA Operations**. **RPS Operations** coordinate the flight with **Civil ATS ACC/APP Service Provider** until transfer of control is to be executed. **Civil ATS ACC/APP Service Provider** separates **N-Legacy Aircraft** traffic from **RPA Operations** Trajectory as for any Aircraft flying such an emergency trajectory.

  o if Termination Area is **Civil ATS ACC/APP Service Provider,** ground-ground coordination will be necessary with concerned **Civil Airport/Aerodrome actors** (to provide expected landing time and to prepare Airfield for Emergency landing)

  o if Termination Area is Military area **ATS ACC/APP Service Provider,** ground-ground coordination will be necessary with **Wing Operation Centre** that assume the same task as previously for the Military environment.

  Whatever the process (outside the scope of the solution and depending of the European Country), **OAT/Military Service Provider** has the correct information at transfer of control, for it to manage the Emergency flight.

- Possibly, **Civil ATS ACC/APP Service Provider** may provide **RPS Operations** with some vectoring instructions. **RPS Operations**, considering the present situation, agree or not the request (acknowledgment sent) and if agreed marginally update the Emergency Trajectory to take the request into account not changing Landing/Termination area accessibility. **RPA Operations** then control **RPA Operations** to implement the instruction(s);

- An extremely remote occurrence, due to an unexpected RPA performance condition (outside the worst-case planned cases), is that **RPA Operations** leave the controlled airspace. Following assumption below, **Civil ATS ACC/APP Service Provider** transfer management of the situation to Military Authority through **Wing Operation Centre** during Accommodation. **RPS Operations** maintain flight control of **RPA Operations** and concurrently broadcast on the emergency voice channel the **RPA Operations** situation in order for all the traffic (VFR, IFR, equipped, not equipped, ...) to receive the emergency broadcast situation in order for them to give priority to **RPA Operations**.

Step 3: Handover to Landing/Termination Area responsible

RPA Operations reaching Termination Area:

1. If managing the Emergency flight, **Civil ATS ACC/APP Service Provider** transfers management of RPAS to concerned Termination area (The corresponding units have been provided relevant information on the Emergency flight thanks to the process described above);
2. Whatever the situation, **RPS Operations** initiate contact either with **Civil ATS Aerodrome Service Provider** or **OAT/Military Service Provider** depending on the Civil or Military nature of the Termination area;
3. Emergency management in the area is not developed beyond this handover as outside the scope of the project. However, it is described that the Use Case finishes when **RPA Operations** have stopped.

Note 4: It is very important to understand that we discuss of Termination Area, as it is necessary to know how the transfer of control is done either using Military Airfields or Possibly Civil Airfields. However, The termination procedure in itself remains outside the solution scope. Moreover, Civil airfield is quoted only for the sake of usage opportunities in one or the other EU Nations. If such an opportunity does not exist then only Military Airfield usage will remain for RPAS.

Additional points:

If State RPA emergency trajectory enters uncontrolled area (extremely remote case due to an unexpected RPA performance condition outside the worst-case planned cases), Management (e.g. Alerting) of RPAS goes to OAT/Military ACC/APP Service Provider.

It may be noted that Emergency will no longer be under civil/GAT control anymore if the RPA leaves controlled area [19] (i.e. crosses Classes F-G) –its situation is beyond the scope of the solution and its operating context.

Flight preparation outputs are expected to take into account margins and performances such that this situation would not occur. If planned trajectory in emergency has not considered any margins (not expected), or if the RPA has unexpected “lower performance” (extremely remote case) in emergency, then it may cross uncontrolled-areas during descent (see schematic below).

Management of the situation then escapes Civil Authority. Reliance on management of this situation will be on Military Authority. This part of the flight is outside the scope of the project.

[19] There may potentially be non-cooperative aircraft flying in the area even if OAT / Military ATS unit is taking care of the RPA during descent in uncontrolled area.

For possible future accommodated Civil RPAS , emergency alerting during Accommodation phase should be identical to manned aircraft in the same emergency situation.

C2LL failure and Emergency situation:

Considering failures with Remote Pilot in the loop, everything is managed as it is already done with respect to manned aviation.

At a first level, the following combinations have been identified if a C2 LL failure occurs after an emergency event.

At a first level, the following combinations have been identified.

Current Event	trajectory	Following	Next event	trajectory
C2LL	Pre-programmed C2LL to destination airfield (HOME, or ALTERNATE, DESTINATION)		Engine loss (**Emergency**)	Continues C2LL pre-programmed traj. However, lack of propulsion and glide performance can lead to a lower altitude profile from the nominal C2LL traj.
Emergency	RP controls/selects traj. (which takes into account emergency performance)		**C2LL**	Automatically engages C2LL pre-programmed traj. (alt. profile as above)

Figure 12 : EATMA – C2LL and Emergency Trajectories

Consolidation of inputs:

1. Glider-like nature of RPA:

Discussion topic: Existing and coming State RPAS are gliders that reach a long rang range flying high. It means that their capability to reach landing/termination areas in emergency remains high. However reaching a termination area remaining in controlled airspace with only cooperative traffic constrains the possible flight planning with margins to take into account floor of the flight volume to be maintained. It suggests that for the sake of safety GAT flight would enforce margins allowing proof of reaching landing/termination area never crossing uncontrolled areas.

Consolidation: Due to introduction of possible civil RPAS applications during accommodation phase, more than glider airframe solution may be introduced. Moreover, consensus was established on the fact emergency broadcast was sufficient even when crossing uncontrolled area. Thus nothing specific is necessary during accommodation period with respect to constraint imposed onto flight plan.

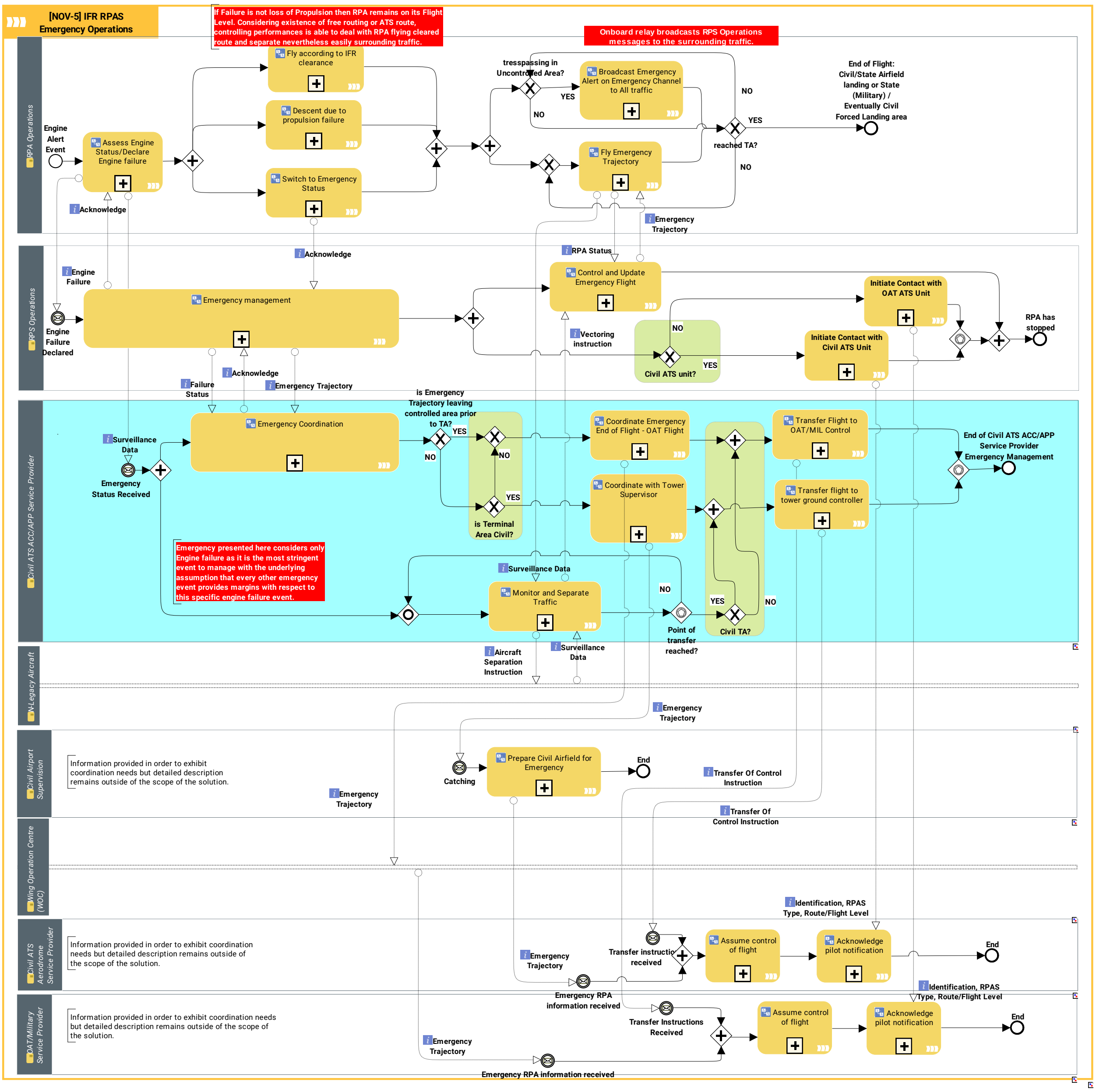


Figure 13 : EATMA [NOV-5] IFR RPAS Emergency Operations

Activity	Description
Broadcast Emergency Alert on Emergency Channel to All traffic	Emergency R/T message broadcast by RPS Operations through RPA Operations on emergency frequencies to ATC and all traffic to be aware of the emergency situation and RPAS state/ location/ prediction.
Fly according to IFR clearance	*Flight is maintained according to current clearance.* [EATMA definition not suitable – too specific to PinS departure for rotorcraft].
Acknowledge pilot notification	The controller acknowledges the pilot notification.
Assess Engine Status/Declare Engine failure	RPA Operations send Engine status to RPS Operations allowing detection/assessment of the emergency status.
Assume control of flight	The aircraft passes the coordination point. The Accepting ATSU assumes control of the flight and may now issue ATC clearances and instructions to the flight.
Control and Update Emergency Flight	RPS Operations controls trajectory associated with the current state/performance of RPAS, adhering to Emergency Plan.
Coordinate Emergency End of Flight - OAT Flight	Civil ATS ACC/APP Service Provider coordinates End of Flight including transfer of responsibility with the corresponding OAT/Military Service Provider. This activity is triggered either in case of Military/State terminal area (Airfield / Ditching area) or in case of entering uncontrolled area all along the flight.
Coordinate with Tower Supervisor	The Tower Supervisor and Approach Supervisor coordinate on the need and timing for a planned change of final approach spacing minimum. The Approach Supervisor coordinates with the Initial Approach Controller the identification of the last aircraft, for each arrival runway, for which the current final approach separation spacing minimum shall be applied.
Descent due to propulsion failure	Following Propulsion Failure, RPA Operations performance generates a descending trajectory, which is linked to RPA Operations gliding performances.
Emergency Coordination	Civil ATS ACC/APP Service Provider coordinates with RPS Operations about the Emergency: nature of the failure, Emergency trajectory.
Emergency management	RP and RPS Operations monitor/detect emergency state and coordinate with Civil ATS ACC/APP Service Provider.

Fly Emergency Trajectory	Agreed Emergency Trajectory is flown RPS Operations control.
Initiate Contact with ATS Unit	RPS Operations must initiate a first contact with the ATS Unit when RPA enters a new ATC sector. This contact is done by the nominal ATC R/T Voice link. At this initial contact, the standard initial contact information is exchanged, and two additional information elements are added for ATCO awareness in case C2 Link Loss RPA would occur later.
Monitor and Separate Traffic	This corresponds to the tasks of controllers to provide separation corresponding to the individual phases of flight.
Prepare Civil Airfield for Emergency	Civil Airport Supervisor coordinates with Civil ATS Aerodrome Service Provider.
Switch to Emergency Status	RPS Operations change and broadcast its Emergency status set by RP through RPS Operations controls. RP applies pre-planned emergency strategies, as needed, to load the closest Termination airfield/area respecting safety aspects and corresponding to the Termination airfield/Area as set in pre-planned coordination/AIPs between RPS Operations and Civil ATS ACC/APP Service Provider. Rationale is here to allow RPA Operations to reach the termination airfield/area.
Transfer Flight to OAT/MIL Control	At the OAT coordination point, ATS Unit transfers the RPAS management to the OAT/Military Control Unit.
Transfer flight to tower ground controller	The transfer of control at least implies a communication from the controller towards the Flight Crew to provide it with next frequency.

Table 30: Solution 115 Activities Emergency Operations

Issuer	Info Flow	Addressee	Info Element	Info Entity
RPS Operations	**Initiate Contact with OAT ATS Unit o--> Acknowledge pilot notification**	OAT/Military Service Provider	**Identification, RPAS Type, Route/Flight Level**	ATS route
RPS Operations	**Initiate Contact with OAT ATS Unit o--> Acknowledge pilot notification**	OAT/Military Service Provider	**Identification, RPAS Type, Route/Flight Level**	Aircraft identification
RPS Operations	**Initiate Contact with OAT ATS Unit o--> Acknowledge pilot notification**	OAT/Military Service Provider	**Identification, RPAS Type, Route/Flight Level**	Area navigation route
RPS Operations	**Initiate Contact with OAT ATS Unit o--> Acknowledge pilot notification**	OAT/Military Service Provider	**Identification, RPAS Type, Route/Flight Level**	Flight level
RPS Operations	**Initiate Contact with OAT ATS Unit o--> Acknowledge pilot notification**	OAT/Military Service Provider	**Identification, RPAS Type, Route/Flight Level**	AircraftType
Civil ATS ACC/APP Service Provider	**Transfer Flight to OAT/MIL Control o--> Transfer Instructions Received**	OAT/Military Service Provider	**Transfer Of Control Instruction**	TransferOfControlPoint
Civil ATS ACC/APP Service Provider	**Transfer flight to tower ground controller o--> Transfer instructions received**	Civil ATS Aerodrome Service Provider	**Transfer Of Control Instruction**	TransferOfControlPoint
Civil ATS ACC/APP Service Provider	**Emergency Coordination o--> Emergency management**	RPS Operations	**Acknowledge**	AIRM_OutOfScope
RPS Operations	**Emergency management o--> Emergency Coordination**	Civil ATS ACC/APP Service Provider	**Failure Status**	EmergencyMessage
RPS Operations	**Emergency management o--> Assess Engine Status/Declare Engine Failure**	RPA Operations	**Acknowledge**	AIRM_OutOfScope

Issuer	Info Flow	Addressee	Info Element	Info Entity
RPS Operations	**Emergency management o--> Emergency Coordination**	Civil ATS ACC/APP Service Provider	**Emergency Trajectory**	CoordinatedAirport
RPS Operations	**Emergency management o--> Emergency Coordination**	Civil ATS ACC/APP Service Provider	**Emergency Trajectory**	Waypoint
Civil ATS ACC/APP Service Provider	**Monitor and Separate Traffic o--> Control and Update Emergency Flight**	RPS Operations	**Vectoring instruction**	OpenLoopInstruction
RPS Operations	**Initiate Contact with Civil ATS Unit o--> Acknowledge pilot notification**	Civil ATS Aerodrome Service Provider	**Identification, RPAS Type, Route/Flight Level**	ATS route
RPS Operations	**Initiate Contact with Civil ATS Unit o--> Acknowledge pilot notification**	Civil ATS Aerodrome Service Provider	**Identification, RPAS Type, Route/Flight Level**	Aircraft identification
RPS Operations	**Initiate Contact with Civil ATS Unit o--> Acknowledge pilot notification**	Civil ATS Aerodrome Service Provider	**Identification, RPAS Type, Route/Flight Level**	Area navigation route
RPS Operations	**Initiate Contact with Civil ATS Unit o--> Acknowledge pilot notification**	Civil ATS Aerodrome Service Provider	**Identification, RPAS Type, Route/Flight Level**	Flight level
RPS Operations	**Initiate Contact with Civil ATS Unit o--> Acknowledge pilot notification**	Civil ATS Aerodrome Service Provider	**Identification, RPAS Type, Route/Flight Level**	AircraftType
Civil ATS ACC/APP Service Provider	**Monitor and Separate Traffic o--> N-Legacy Aircraft**	N-Legacy Aircraft	**Aircraft Separation Instruction**	Separation provision
N-Legacy Aircraft	**N-Legacy Aircraft o--> Monitor and Separate Traffic**	Civil ATS ACC/APP Service Provider	**Surveillance Data**	SystemTrack
RPA Operations	**Assess Engine Status/Declare Engine Failure o--> Engine Failure Declared**	RPS Operations	**Engine Failure**	EngineFailure

Issuer	Info Flow	Addressee	Info Element	Info Entity
RPA Operations	**Assess Engine Status/Declare Engine Failure o--> Emergency Status Received**	Civil ATS ACC/APP Service Provider	**Surveillance Data**	SystemTrack
RPA Operations	**Fly Emergency Trajectory o--> Monitor and Separate Traffic**	Civil ATS ACC/APP Service Provider	**Surveillance Data**	SystemTrack
Civil Airport Supervision	**Prepare Civil Airfield for Emergency o--> Emergency RPA information received**	Civil ATS Aerodrome Service Provider	**Emergency Trajectory**	CoordinatedAirport
Civil Airport Supervision	**Prepare Civil Airfield for Emergency o--> Emergency RPA information received**	Civil ATS Aerodrome Service Provider	**Emergency Trajectory**	Waypoint
Wing Operation Centre (WOC)	**Wing Operation Centre (WOC) o--> Emergency RPA information received**	OAT/Military Service Provider	**Emergency Trajectory**	CoordinatedAirport
Wing Operation Centre (WOC)	**Wing Operation Centre (WOC) o--> Emergency RPA information received**	OAT/Military Service Provider	**Emergency Trajectory**	Waypoint
Civil ATS ACC/APP Service Provider	**Coordinate Emergency End of Flight - OAT Flight o--> Wing Operation Centre (WOC)**	Wing Operation Centre (WOC)	**Emergency Trajectory**	CoordinatedAirport
Civil ATS ACC/APP Service Provider	**Coordinate Emergency End of Flight - OAT Flight o--> Wing Operation Centre (WOC)**	Wing Operation Centre (WOC)	**Emergency Trajectory**	Waypoint
Civil ATS ACC/APP Service Provider	**Coordinate with Tower Supervisor o--> Catching**	Civil Airport Supervision	**Emergency Trajectory**	CoordinatedAirport

Issuer	Info Flow	Addressee	Info Element	Info Entity
Civil ATS ACC/APP Service Provider	**Coordinate with Tower Supervisor o--> Catching**	Civil Airport Supervision	**Emergency Trajectory**	Waypoint
RPA Operations	**Switch to Emergency Status o--> Emergency management**	RPS Operations	**Acknowledge**	AIRM_OutOfScope
RPS Operations	**Control and Update Emergency Flight o--> Fly Emergency Trajectory**	RPA Operations	**Emergency Trajectory**	CoordinatedAirport
RPS Operations	**Control and Update Emergency Flight o--> Fly Emergency Trajectory**	RPA Operations	**Emergency Trajectory**	Waypoint
RPA Operations	**Fly Emergency Trajectory o--> Control and Update Emergency Flight**	RPS Operations	**RPA Status**	FlightStatus

Table 31: Solution 115 Information Flows and Elements - Emergency Operations

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Info Element	Description
Acknowledge	Confirmation of receipt and acceptance of any type of information facilitated by an air traffic control unit.
Aircraft Separation Instruction	This information contains the ATC instruction needed to assume a safe separation with RPAS in accordance with the traffic situation and the RPAS situation (nominal, contingency, or emergency).
Emergency Trajectory	RPAS trajectory flown when in an emergency situation (e.g. engine failure).
Engine Failure	
Failure Status	Failure Status is noted by RP in RPS and provided to Civil ATS ACC/APP Service Provider.
Flight Plan	
Identification, RPAS Type, Route/Flight Level	Initial contact information provided by RP to ATCO.
RPA Status	RPS Operations monitors RPA Operations status, which is transferred through C2 Link.
Surveillance Data	Data about aircraft and vehicles: position, speed, acceleration information…
Transfer Of Control Instruction	Any information provided during the transfer of control between two Control Units 'current and next' (civil/civil or civil/military-OAT).
Vectoring instruction	The term vectoring without additional indication refer to open-loop vectors. Exceptionally ATCO could provide the flight crew with vectoring instructions (heading, speed and altitude changes). If the aircraft is on the missed approach procedure and above minimum vectoring altitude, it is possible that the controller issues a radar vector so that the missed approach procedure is abandoned at this point.

Table 32: Solution 115 Information Elements Descriptions - Emergency Operations

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3.3.3 Differences between new and previous Operating Methods

Key differences between new and previous operating methods:

Current Operating Method	New Operating Method
RPAS flight OAT, managed by OAT specialised ATCO and segregated from GAT traffic	RPAS flight managed non-segregated within GAT traffic, identically to an IFR GAT flight, by civil ATCO
Manned aviation communications loss contingency relies on pilot onboard still controlling aircraft, but with no further communications	RPAS C2 link loss, which also encompasses RP-ATC radio-communications loss leads to automated RPA contingency flight. Further communications possible over backup telephone with Remote Pilot (for RPA flight behaviour, next frequencies, etc…)
Manned aviation communications loss contingency route procedure is to maintain last instruction for a procedurally defined time, then to resume flight plan to destination (procedurally defined route, with no options)	RPAS C2 link loss contingency route procedure is to maintain last instruction for a procedurally defined time (as for Manned aviation communications loss), then to resume original flight plan followed by 3 predefined RPAS operator C2LL destination strategies (due to initial RPAS operational constraints): ▪ 1: divert from original flight plan at an original downstream waypoint, and return to departure airfield ▪ 2: divert from original flight plan at an original downstream waypoint, to an alternate pre-defined diversion airfield ▪ 3: continue to fly the original flight plan to original destination Remote pilot will provide ATCO with the main elements of the pre-programmed C2LL behaviour at initial contact
RPAS requires reserved airspace	Not necessary to reserve airspace, neither to provide information on reservations or RPAS activity to other airspace users

Table 33: Main differences between new and previous Operating Method

Detailed analysis of differences between new and previous operating methods:

SEGREGATION (previous)	
	• Applicability to all RPAS, (through segregation)
	• Segregated airspace (ARES) is a means for awareness to other airspace users ○ *NOTE – this is not relevant to class A-C* ○ *However reserved airspace impacts capacity*
	• Imposes much longer ATM planning anticipation (prior to RPAS access), increased coordination effort and requires creation and publication of the airspace • Segregated volumes (structural to construction of « tubes ») need to be created • Volumes size driving segregation driven specific static performances • Publication of the new airspace required
	• Heavy in terms of aeronautical information messages
	• Less efficient , higher human impact and lower confidence to ATC ○ Specific workload related to management (activation/deactivation) of the segregated «corridors» and of RPA / other aircraft ○ No guaranty that the RPA will stay in the segregated airspace in non-nominal situations
	• Short-term Cross-Border requires in the best case an EU wide harmonised approach, processes and an airspace structures, but could also be established via bilateral agreement, like Letters of Agreement (LoA). For smart segregation : Adjacent states need to create contiguous transit ARES structures at state borders and within their airspace
RPAS ACCOMMODATION WITH STANDARD SEPARATION MINIMA (new)	
	• Identical to ATCO current working methods regularly used for separation assurance and conflict solving and preserves safety
	• Flexibility, ease of use by ATCO
	• Continuity of technique for ATCO in contingency / failure situations
	• Feasible both technologically and operationally ○ Does not demand changes in the ATC systems ○ Compatible with ATC operational methods
	• No Airspace reserved – preferable for capacity
	• Alleviates Airspace management process (no creation / design / publication of specific reservations)
	• Standard separation minima. This does not preclude that an individual ANSPs may initially start operations with increased separation above the minimum standard.

	• Short-term derogatory applicability to STATE RPAS due to Chicago Convention and non-compliance to ICAO Annex 2 [45]: ○ Consistent with S115 accommodation scope where existing demand is MIL; ○ Next transition step to the integration phase (beyond S115) encompasses future civil RPAS which will be complaint to regulations in the integration environment. At the integration timeframe, the ICAO standards will have evolved.
	• Direct and smooth transition to next step (full integration: standard separation minima, no segregation and beyond airspace constraints of accommodation).
	• Short-term Cross-Border requires an EU wide harmonised approach and processes. For Adapted separation: all Adjacent EU states where transit routes are demanded need to allow STATE RPAS transit with derogatory applicability of the Chicago Convention.

Table 34: Detailed differences between new and previous Operating Method

Analysis per activity:

The following table only represents new ("introduce") and changed ("update") activities of the previous operating method.

OI Step code – title		
AUO-0619 - RPAS accommodation in class A-C airspace		
Activity	Impact	Change
Activate Contingency Trajectory (Starting from the Vector Leg)	Introduce	New activity introduced for RPA Operations in the realisation of the C2LL contingency procedure during Vector/Heading instruction.
Activate Contingency Trajectory and Resume Altitude or/and Speed according to FPL	Introduce	New activity introduced for RPA Operations in the realisation of the C2LL contingency procedure during Altitude or/and Speed instruction.
Assess Engine Status/Declare Engine failure	Update	In manned aviation it is up to the pilot to declare failure considering its analysis of the aircraft status. Due to latency issues too much time may be lost declaring emergency mode thus RPA Operations have to declare emergency mode autonomously. Moreover, even if the case is not considered in the Solution, this way to proceed makes the system robust to double failure.

OI Step code – title		
AUO-0619 - RPAS accommodation in class A-C airspace		
Activity	Impact	Change
Broadcast Emergency Alert on Emergency R/T Channel to All traffic	Update	It becomes mandatory for RPS Operations to broadcast emergency information through RPA relay onto emergency frequencies. Some phraseology should be introduced in order to allow other users their proximity with RPA Operations.
Contact ATS Unit via Nominal R/T and Confirm Recovered Link State	Update	Update status to add confirmation of C2L recovery state by the nominal ATC link.
Contact RP and Provide Contingency Coordination Information	Introduce	New activity introduced for ATS Unit in the C2LL contingency procedure to keep contact between RP and ATCO when the nominal R/T link is broken.
Continue Flying Contingency Trajectory on the Initial Route and under Automatic Contingency Procedure	Introduce	New activity introduced for RPA Operations in the realisation of the C2LL contingency procedure (to resume initial route after flying instruction).
Continue Flying Pre-Programmed Contingency Trajectory Defined at DIVERSION Waypoint	Introduce	New activity introduced for RPA Operations in the realisation of the C2LL contingency.
Control and Update Emergency Flight	Introduce	Solution 115 proposes a harmonised way of controlling RPA during Emergency flight. For the time being no activity have been designed into EATMA in order to implement this harmonisation.
Coordinate Emergency End of Flight - OAT Flight	Update	Coordination action is required with WOC due to the fact specific exit points conditions exist such as uncontrolled area infringement that are no condition to let control with respect to either civil or military manned aircraft.
Create Vector Leg To Explicit Limit or Procedural Time	Introduce	New activity introduced for RPA Operations in the re-programming of the C2LL contingency procedure in according with new instruction.
Emergency management	Introduce	There is a need at the RPS Operations level to provide ATCO a possible emergency flight plan specifying termination area. This operation is done differently inside an aircraft where the pilot will not follow any automated route designed by its aircraft.

OI Step code – title		
AUO-0619 - RPAS accommodation in class A-C airspace		
Activity	Impact	Change
Extract OAT/GAT Flight Plan from Mission Plan	Update	Considering the solution adopted during accommodation period there will be a need to update some interfaces allowing creation of the correct format for the flight plan. It is also needed to introduce into the field 18 at least the RPs phone number.
Fly Contingency Trajectory on the Initial Route (the same as FPLN) and Under Contingency Procedure	Introduce	New activity introduced for RPA Operations in the realisation of the C2LL contingency procedure if no instruction received before contingency event.
Fly Emergency Trajectory	Update	Emergency flight plan is loaded from RP/RPS by RPA Operations. It remains under the control of RPS Operations.
Inform ATC of the Lost Link State (SQUAWK Contingency Transponder Code)	Update	Activity update to add a new SSR code to announce RPAS C2LL contingency status (certainly different to SSR code for COM loss in manned aviation).
Initiate Contact with ATS Unit	Update	Activity update because contingency data must be provided during the first radio contact with ATS Unit in anticipation of the C2LL event.
Modify RPAS Flight Plan in accordance with Instruction	Introduce	New activity introduced for RPS Operations in the C2LL contingency preparation during nominal flight in case of ATC new trajectory instruction.
Modify RPAS Navigation	Introduce	New activity introduced for RPS Operations to modify RPA trajectory as well contingency flight trajectory in anticipation of the C2LL event.
Monitor Traffic/RPA and Apply needed Separation between RPAS and the other Traffic (manned aviation) for Contingency	Update	Activity update for ATS Unit to provide contingency separation values to the other traffic (values still TBD certainly with regard to the current traffic).
Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight	Update	Activity update for ATS Unit to provide RPAS minima separation against the other traffic.
Provide ATC Instruction Readback	Update	Activity update status to add contingency data during read-back to ATC Heading/Altitude/Speed instruction.

OI Step code – title		
AUO-0619 - RPAS accommodation in class A-C airspace		
Activity	Impact	Change
Provide Clearance to Resume Nominal Flight Plan and Close Contingency Coordination	Update	Activity update to request ATS Unit to close the contingency coordination with RPS Operations initiated by the audio backup-line.
Re-Program Modified Navigation into RPA	Introduce	New activity introduced for RPS Operations in the preparation of the C2LL contingency procedure to take a new trajectory instruction during nominal flight.
Regularly Monitor C2L State and Coordinate Contingency with ATS Unit	Introduce	New activity introduced for RPS Operations during C2LL contingency.
RPAS Mission Plan Creation	Update	Mission plan necessary to State / Military aircraft is to be completed also for State RPAS flying GAT or not. This activity may be deleted from the list of impacted activities due to the fact it is probably out of the scope of the Solution.
Start Automatic C2LL Contingency Procedure	Introduce	New activity introduced for RPA Operations to start automatic C2LL contingency procedure when the link with the RPS Operations is broken.
Switch to Emergency Status	Introduce	There are no standard way to negotiate Emergency flight plan when considering RPAS. This activity is introduced in order to pave the way towards this standardisation.
Update Mission Plan	Update	Update needed depends upon status of iOAT implementation in the corresponding state. This activity should be standardised at the European level.

Table 35: Analysis per Activity of Differences between new and previous Operating Methods

4 Safety, Performance and Interoperability Requirements (SPR-INTEROP)

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0010**
Title	ATC - RPAS Control Responsibility
Requirement	ATC shall be able to support the accommodation of non-segregated transit GAT RPAS among all other GAT.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 004.** Operational: In control class A-C environment: - RPAS departs from/arrives to specific OAT aerodrome. - OAT/coordination transfer of control procedures are performed for Entry into / Exit from controlled class A-C airspace. Management of RPAS by applying same conflict management methods/procedure as manned aircraft.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] ATC Instruction Provision [NOV] Contact Information Provision [NOV] Transfer of Control Instruction Provision [NOV] Aircraft Separation Instruction Provision
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

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[REQ]

Identifier	REQ-PJ13.115-SPRINTEROP-0020
Title	ATC - RPAS Nominal Separation Method
Requirement	ATC shall be able to support accommodation of RPAS in class A-C airspace through standard separation minima between traffic.
Status	<validated>
Rationale	Operational: ATC will manage all traffic identically. RPAS will no longer be separated through segregated TRA/TSA.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] ATC Instruction Provision [NOV] Contact Information Provision [NOV] Aircraft Separation Instruction Provision
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

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[REQ]

Identifier	~~REQ-PJ13.115-SPRINTEROP-0030~~
Title	~~Deleted.~~
Requirement	~~ATC shall be able to manage RPAS by applying same conflict management methods/procedure as manned aircraft.~~
Status	~~<deleted>~~
Rationale	~~Deleted before Initial OSED delivery after partner review:~~ ~~s115_OSED_v04_review-CONSOLIDATED.xlsx~~
Category	

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0040**
Title	RPAS - Vertical Flight Domain Limitation
Requirement	RPS Operations shall be able to plan flight within flight levels where a minimum traffic risk is usually present.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 026.** NOTE: The span of flight levels considered will usually be above low levels to minimise recreational VFR traffic risk (> FL100), and below high levels to minimise flying within high speed cruising jet aircraft (~ FL200). Nevertheless, these vertical limits could be adapted depending on the specific characteristics of each operational environment. Operational: Lowest Flight level: - Above FL100 where most leisure VFR (which are the majority of infringers) do not fly. This is to reduce the likelihood of infringer VFR encounter. Highest Flight Level: - ~ FL200 (below dense and high-speed jet traffic streams). These vertical domain limitations can be adapted to individual States risk levels.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] RPAS Flight Plan Provision [NOV] OAT Flight Plan [NOV] RPAS Mission Plan Provision [NOV] Validated Flight Plan provision
<ALLOCATED_TO>	<Activity>	RPAS Mission Plan Creation
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] Preparation and Filing of RPAS Flight Plan

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[REQ]

Identifier	REQ-PJ13.115-SPRINTEROP-0050
Title	ATC - Management of limited RPAS Numbers per Sector Limitation
Requirement	Only one RPAS shall be authorized to fly at the same time under responsibility of one sector.
Status	<validated>
Rationale	**Safety (SAR): SRD 016.** This is to reduce the likelihood of another RPAS last MAC collision barrier encounter. Note: For specific cases where RPAS are operating in pairs, the RPAS Operator (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. Moreover, as C2LL behaviour will be provided at initial contact, the ATCO can also check that the C2LL behaviour of the two RPAS are not in conflict, which is assumed to generate negligible additional planning workload.
Category	<Operational>, <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] ATC Instruction Provision [NOV] Contact Information Provision
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0060**
Title	RPAS Operator - Flight Planning data
Requirement	RPAS Operator shall be able to use Flight Planning procedures with minimal additional information.
Status	<validated>
Rationale	Existing tools and means (ICAO FPLN2012). Published AIPs. AIRAC cycle data (ATS routes and waypoints). RPAS specific information in existing flight plan fields: ▪ RPAS type if available (e.g. Q9) or for RPAS whose type is not included in the Aircraft Types ICAO database, a special codification ('ZZZZ') will be used in the flight plan. ▪ **IFR** flight plans of **Military** type ('IM' in field 8). ▪ **RMK/** indicator of field 18 for **pilot telephone** (format RMK/pilot name TEL.00xxx…). ▪ Optionally **RALT/**indicator of field 18 to indicate **En-route alternate aerodromes** for diversion/landing. ▪ **STAY/** indicator of field 15 to indicate the time of special activity at a certain segment of the flight and associated **STAYINFO/** indicator with information on stay reason. ▪ Minimize use of **OAT/** indicator in field 15, OAT route portions are not checked by NM. ▪ **EET>24h** is accepted by NM (IFPS User Manual states limitation for max 24h). Use supporting tools to plan the flight route over existing Airways and Waypoints: ▪ **Avoid DCT** segments (due to rejection by NM in IFPZ). ▪ Do not rely on **NM Route Proposal** service for planning **circular flights**.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] RPAS Mission Plan Provision [NOV] RPAS Flight Plan Provision
<ALLOCATED_TO>	<Activity>	RPAS Mission Plan Creation Extract GAT Flight Plan from Mission Plan File Legacy FPL Extract OAT Information/Update Mission Plan Assess/Update FPL
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] Preparation and Filing of RPAS Flight Plan

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[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0070**
Title	ATC - RPAS Identification
Requirement	ATCO shall be able to easily recognise the RPAS traffic.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 003A.** ATCO will recognises RPAS through the specific phraseology identification “REMOTE” associated with the callsign at the first radio contact. Optionally, to identify RPAS, ATC existing tools to highlight traffic could be used.
Category	<Interoperability> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-02
<ALLOCATED_TO>	<Activity>	Initiate Contact with ATS Unit
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0080**
Title	RPAS - Communicate
Requirement	RPAS shall be able to perform two-way direct radio communication during flight with controlling ATC Unit.
Status	<validated>
Rationale	CNS requirements by EU or equivalent performance (e.g: Radio communication: two-way Voice link (8.33/25 kHz channel spacing)).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-03
<ALLOCATED_TO>	<Information Exchange>	[NOV] Contact Information Provision [NOV] ATC Instruction Provision
<ALLOCATED_TO>	<Activity>	Fly Nominal Flight Plan
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0090**
Title	RPAS - Navigate
Requirement	RPAS shall be able to navigate during flight in a structured airspace with performances and capabilities associated with the airspace including the C2LL trajectory: • Positioning aids (GNSS, inertial) • AIRAC cyclic navigation data (ATS routes, waypoints) • RNAV required in the class A-C airspace environment (RNAV5 En-Route / RNAV1 Terminal).
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 025.** **The aim is to ensure the capability of the system in nominal conditions and while applying C2LL procedures.** CNS requirements by EU or equivalent performance.
Category	<Interoperability> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-03
<ALLOCATED_TO>	<Information Exchange>	[NOV] Navigation Data Provision [NOV] Contingency Information Provision
<ALLOCATED_TO>	<Activity>	Fly Nominal Flight Plan
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0100**
Title	RPAS - Surveillance
Requirement	RPAS shall be able to perform cooperative ATC surveillance during flight: • Transponder Mode A/C (or MODE S if available) to provide its radar position to ATC
Status	<validated>
Rationale	CNS requirements by EU or equivalent performance. This also allows RPAS visibility through its transponder to other TCAS equipped manned aircraft (non-coordinated manoeuvres). As RPA is not equipped with TCAS, two RPAS cannot be present in a given airspace. The two RPAs would not be able to perform a safety net TCAS manoeuvring in case ATC separation fails.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-03
<ALLOCATED_TO>	<Activity>	Fly Nominal Flight Plan
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0110**
Title	RPAS- Predictable C2 Link Loss Contingency Procedure
Requirement	RP shall provide C2 link loss pre-programmed contingency information for ATCO pre-awareness.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 002.** ATCO will rely on additional contingency information from RP, which must be provided prior to contingency, for ATCO to predict contingency behaviour in case C2LL occurs. The information consist of two additional elements, which are dynamic in certain cases for MALE RPAS flight: ▪ The waypoint name on downstream portion of the flight plan where Diversion would occur, which is a published named waypoint of the flight plan. ○ The Diversion point characterizes the point where if the RPA is still in C2LL state, it is pre-programmed to fly one of the following: 1: leave its shared flight path and return to its departure airfield 2: leave its shared flight path and divert to an alternate specific diversion airfield 3: Continue to fly the flight plan ▪ The Contingency Airfield, the specific contingency aerodrome to which the RPA will then divert to, which is also provided by its ICAO code or Name. The Contingency Airfield, is the Operator's choice at the Diversion point to maintain the shared flight plan or leave the shared flight path (return to departure aerodrome, or divert to an alternate aerodrome).
Category	<Operational>, <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Information Exchange>	[NOV] Navigation Data Provision [NOV] Contingency Information Provision
<ALLOCATED_TO>	<Activity>	Initiate Contact with ATS Unit
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0120**
Title	RPAS - Backup communication means
Requirement	A direct telephone line shall be available between ATC and RP/RPS as backup solution in C2 link loss situation.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 014.** Existing experience, RPS is located on ground.
Category	<Operational>, <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Information Exchange>	[NOV] Contingency Coordination Provision [NOV] Contact Information Provision
<ALLOCATED_TO>	<Activity>	Contact RP and Provide Contingency Coordination Information
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115) Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR RPAS Contingency Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0130**
Title	RPAS - Standard contingency procedures and methods
Requirement	RP shall be able to execute the standard IFR contingency procedures and operating methods identically to manned aviation: • Voice Comm loss with No C2 link loss; • GNSS/positioning loss; • Transponder failure/loss
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 023.** Operational : No change in existing procedures for Accommodation when possible. Nota: Specific case for transponder failure: it is possible that ATC identifies failure and informs RP.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Information Exchange>	[NOV] Navigation Data Provision
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR RPAS Contingency Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0140**
Title	RPA - Broadcast C2LL status
Requirement	RPA shall be able to automatically provide specific C2 link loss transponder code and to maintain it active during C2 link loss.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 012.** Decision time before triggering specific C2LL transponder code avoids intermittent alerts. ATC capability to be alerted on C2LL state. ATCOs Validation feedback is that C2LL contingency procedure is similar to manned aircraft radio loss procedure. Therefore, **it would be relevant to use existing code 7600 for C2LL during accommodation**, at least until all Euro wide systems evolve to process 7400 as a specific RPAS behaviour and highlight the C2LL state on the CWP in an explicit manner.
Category	<Interoperability> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Activity>	Inform ATC of the Lost Link State (SQUAWK Contingency Transponder Code) Inform End Contingency State (SQUAWK prior assigned transponder Code)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR RPAS Contingency Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0150**
Title	ATC - Recognize C2LL information elements
Requirement	ATC shall be able to support the specific RPAS C2LL contingency procedure: • Recognize C2LL information provided in the procedure to know possible C2LL trajectory of RPAS.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 017.** This is to keep other traffic clear of the RPAS contingency trajectory.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Information Exchange>	[NOV] Contingency Coordination Provision
<ALLOCATED_TO>	<Activity>	Initiate Contact with ATS Unit
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR RPAS Contingency Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0160**
Title	RPAS - Emergency management
Requirement	RPAS shall be able to identify its emergency status and to execute the emergency procedure associated with the severe failure situation with RP in the loop.
Status	<In progress>
Rationale	**Safety (SAR): cf. SRD 018.** Emergency procedures are associated with severe failures, engine loss, multiple combined failures encountered during flight. They usually need a rapid flight path and landing change.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Information Exchange>	[NOV] C2 Link Provision [NOV] Emergency Coordination Provision
<ALLOCATED_TO>	<Activity>	Assess Engine Status/Declare Engine failure Descent due to propulsion failure Extract Emergency Flight Plan Assess Failure Extract and Compare Emergency Flight Plan
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR RPAS Emergency Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0170**
Title	RPAS - Emergency Trajectory
Requirement	RPAS shall be able to remain on the RP controlled/selected trajectory, which takes into account emergency performance.
Status	<In progress>
Rationale	**Safety (SAR): cf. SRD 021.**
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Information Exchange>	[NOV] C2 Link Provision
<ALLOCATED_TO>	<Activity>	Fly Emergency Flight Plan Control RPA Emergency Flight
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR RPAS Emergency Operations

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[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0180**
Title	RPA - Broadcast emergency status
Requirement	RPAS shall be able to set specific emergency transponder code and to maintain it active during emergency.
Status	<In progress>
Rationale	**Safety (SAR): cf. SRD 019.** Status will remain set and broadcast if the emergency flight path enters an uncontrolled area.
Category	<Interoperability>, <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Activity>	Broadcast Emergency to VFR traffic
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR RPAS Emergency Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0190**
Title	ATC - RPAS emergency management
Requirement	ATC shall be able to manage RPAS emergency situation. This includes the appropriate coordination with RP or other actors in order to manage the emergency situation.
Status	<In progress>
Rationale	Safety (SAR): cf. SRD 020. RPAS Emergency Information Coordination. Immediately inform the concerned authorities of the emergency, the RPA flight path and communicate potential risk of entering an uncontrolled area.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Information Exchange>	[NOV] Emergency Coordination Provision [NOV] Aircraft Separation Instruction Provision [NOV] Transfer of Control Instruction Provision
<ALLOCATED_TO>	<Activity>	Initiate Emergency Coordination Emergency Flight Plan Assessment Coordinate Emergency End of Flight - OAT Flight Transfer Flight to OAT/MIL Control
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR RPAS Emergency Operations

[REQ]

Identifier	REQ-PJ13.115-SPRINTEROP-0200
Title	Deleted.
Requirement	ATC shall be able to coordinate transfer of control responsibility for nominal, contingency, and emergency RPAS flights to other authorities including MIL/OAT.
Status	<deleted>
Rationale	Deleted before Initial OSED delivery after partner review: s115_OSED_v04_review-CONSOLIDATED.xlsx
Category	

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115

[REQ]

Identifier	REQ-PJ13.115-SPRINTEROP-0210
Title	Deleted.
Requirement	ATC shall be able to immediately inform the concerned authorities of the emergency RPA flight path and risk of entering an uncontrolled area.
Status	<deleted>
Rationale	Depending on Emergency type/risk, this will result in scramble to accompany the RPA during its Emergency flight path. Deleted before Initial OSED delivery after partner review: s115_OSED_v04_review-CONSOLIDATED.xlsx
Category	

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115

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[REQ]

Identifier	REQ-PJ13.115-SPRINTEROP-0220
Title	ATC - RPAS collision risk management
Requirement	Mid-Air Collision En-Route (ER-MAC) risk values shall be maintained by ATC on the base of separation methods.
Status	<validated>
Rationale	
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Contact Information Provision [NOV] ATC Instruction Provision [NOV] Aircraft Separation Instruction Provision [NOV] Emergency Coordination Provision
<ALLOCATED_TO>	<Activity>	Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight Monitor Traffic/RPA and Apply needed Separation between RPAS and the other Traffic (manned aviation) for Contingency Detect and Resolve Conflicts
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations [NOV-5] IFR RPAS Contingency Operations [NOV-5] IFR RPAS Emergency Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0230**
Title	ATC - Training and methods for nominal RPAS
Requirement	ATCO shall be trained and shall be able to apply standard IFR procedures/operating methods to RPAS for nominal IFR situations thus to reiterate requests to RP for expected information.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 005.**
Category	<Operational>, <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Contact Information Provision [NOV] ATC Instruction Provision [NOV] Aircraft Separation Instruction Provision [NOV] Transfer of Control Instruction Provision
<ALLOCATED_TO>	<Activity>	Transfer Flight to OAT/MIL Control Initiate Contact with ATS Unit Current ATC Coordinate and Transfer Flight Control to the next ATC Unit Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight Detect and Resolve Conflicts
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0240**
Title	RPAS - Training and methods for Nominal RPAS
Requirement	RP shall be trained, and shall be able to apply new operating methods including the communication to ATCO of the two additional elements related to C2LL contingency procedure, and specific RPAS preparation procedures for RPAS nominal situations
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 001.**
Category	<Operational>, <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Contact Information Provision [NOV] Contingency Information Provision
<ALLOCATED_TO>	<Activity>	Provide Readback including Rejoin Waypoint and Exit Waypoint Initiate Contact with ATS Unit Monitor RPA Flight Trajectory Initiate Contact with OAT/MIL Control Unit
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0250**
Title	ATC -Training and methods for non-nominal RPAS
Requirement	ATCO shall be trained and shall be able to apply adapted procedures/operating methods for RPAS non-nominal situations.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 015.**
Category	<Operational>, <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Activity>	Current ATC Coordinate and Transfer Flight Control to the next ATC Unit Monitor Traffic/RPA and Apply needed Separation between RPAS and the other Traffic (manned aviation) for Contingency Provide Clearance to Resume Nominal Flight Plan and Close Contingency Coordination Monitor Traffic/RPA and Maintain RPAS Separation for the Contingency and Monitor Traffic Transfer Flight to OAT/MIL Control Initiate Emergency Coordination Emergency Flight Plan Assessment Coordinate Emergency End of Flight - OAT Flight Coordinate Emergency End of Flight - Civil Terminal Area Prepare Civil Airfield for Emergency
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR RPAS Contingency Operations [NOV-5] IFR RPAS Emergency Operations

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[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0260**
Title	ATC/RPAS - Contingency coordination for C2LL
Requirement	The first one of ATCO/RP who observes the C2 link loss shall be able to contact the other using the backup telephone line. RP (resp. ATCO) will request ATCO (resp. RP) to confirm by telephone that the message is well understood, and the ATCO will recontact RP if the actual RPAS behaviour contradicts the expected behaviour.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 013.** Operational: - Backup communication are needed during C2 link loss, so C2 link also relays ATC communications. - Existing RPAS experience uses telephone communication. Following validation: ▪ ATCOs validation feedback confirmed that the first who noted the C2LL (RP or ATC) initiated the telephone call to the other. The solution scenario was applied and worked. This telephone coordination after the C2LL is also expected by ATCO for longer term-concepts. ○ However, it is recommended that ATCO, who has telephone access through their control console, initiated the telephone call to the RP. The RP telephone number is in the Flight Plan. ○ For information, ATCOs highlighted that telephone coordination after the C2LL is also expected for long-term integration concepts.
Category	<Operational>, <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Information Exchange>	[NOV] Contingency Coordination Provision
<ALLOCATED_TO>	<Activity>	Contact RP and Provide Contingency Coordination Information Regularly Monitor C2L State and Coordinate Contingency with ATS Unit
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115) ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR RPAS Contingency Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0270**
Title	RPAS -Training and Methods for non-nominal RPAS
Requirement	RP shall be trained and shall be able to apply new procedures including specific RPAS preparation procedures and operating methods for RPAS non-nominal situations. RP will, if necessary, re-program diversion preparation in case of changes in nominal flight (i.e. prior to C2LL).
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 024.**
Category	<Operational>, <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Information Exchange>	[NOV] Contingency Coordination Provision [NOV] Contingency Information Provision
<ALLOCATED_TO>	<Activity>	Regularly Monitor C2L State and Coordinate Contingency with ATS Unit Contact ATS Unit via Nominal R/T and Confirm Recovered Link State Set Nominal Ops Surveillance Code (SQUAWK prior assigned transponder code) Initiate Contact with OAT/MIL Control Unit Initiate Contact with ATS Unit
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR RPAS Contingency Operations [NOV-5] IFR RPAS Emergency Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0280**
Title	ATC - Usual surveillance and conflict management methods
Requirement	ATCO shall be able to use usual surveillance and conflict management methods.
Status	<In progress>
Rationale	**Safety (SAR): cf. SRD 007.**
Category	<Operational>, <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-02
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0290**
Title	ATC - Conflicts Detection Tools for RPAS
Requirement	ATC shall be able to use the usual tools as used for manned aircraft to detect possible conflicts: • Medium-Term Conflict Detection (MTCD) probe; • Short-Term Conflict Alert (STCA) safety net
Status	<In progress>
Rationale	**Safety (SAR): cf. SRD 011.** Assumption: Existing RPAS performance data is available, in the ATC systems and compatible with the ATC Conflict Detection tools. 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.
Category	<Interoperability> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-02
<ALLOCATED_TO>	<Information Exchange>	[NOV] Aircraft Separation Instruction Provision [NOV] ATC Instruction Provision [NOV] Contact Information Provision
<ALLOCATED_TO>	<Activity>	Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight Monitor Traffic/RPA and Apply needed Separation between RPAS and the other Traffic (manned aviation) for Contingency Monitor Traffic/RPA and Maintain RPAS Separation for the Contingency and Monitor Traffic Detect and Resolve Conflicts
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0300**
Title	ATC systems - Usual tools vs. RPAS surveillance
Requirement	ATC shall be able to perform surveillance of RPA with the current secondary surveillance tools and technologies, which are compatible with airborne Mode A/C transponders (i.e. primarily/ secondary surveillance radar (SSR)).
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 006.**
Category	<Interoperability> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-02
<ALLOCATED_TO>	<Activity>	Monitor Traffic/RPA and Apply RPAS Separation Minima for Nominal Flight Monitor Traffic/RPA and Maintain RPAS Separation for the Contingency and Monitor Traffic
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0310**
Title	RPAS - C2LL systems automation
Requirement	RP shall always pre-program RPA with a C2LL trajectory that shall be automatically triggered and flown when the RPAS goes into a C2LL state.
Status	<validated>
Rationale	**Safety (SAR): SRD 009.** Note: The RP shall re-program this C2LL trajectory whenever it is required.
Category	<Operational>, <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-04
<ALLOCATED_TO>	<Activity>	Start Automatic C2LL Contingency Procedure Activate Contingency Trajectory and Resume Altitude or/and Speed according to FPL Activate Contingency Trajectory (Starting from the Vector Leg) Fly Contingency Trajectory on the Initial Route (the same as FPLN) and Under Contingency Procedure Continue Flying Contingency Trajectory on the Initial Route and under Automatic Contingency Procedure Fly Pre-Programmed Contingency Trajectory Defined at EXIT Waypoint
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR RPAS Contingency Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0320**
Title	RPAS - in-flight trajectory reprogramming capability
Requirement	RP shall be able to modify the RPAS navigation according to the new instructions.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 008.**
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Navigation Data Provision [NOV] Contingency Information Provision
<ALLOCATED_TO>	<Activity>	Modify RPAS Pre-Programmed Navigation Create Vector Leg to and Limit (explicit or procedural) and the Rejoin in Contingency Flight Plan Modify Contingency Flight Plan in accordance with Instruction
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

~~Identifier~~	~~REQ-PJ13.115-SPRINTEROP-0330~~
~~Title~~	~~RPAS - Situation awareness~~
~~Requirement~~	~~RP situational awareness shall be linked to the controls RPs need in an IFR operational environment.~~ ~~RPs will have traffic awareness in their RPS through radio communications on shared frequency through, which RPs are able to identify threatens like ware risk and request additional margins to ATCO if necessary.~~
~~Status~~	~~<deleted>~~
Rationale	Encompassed in SAR assumptions.
Category	

[REQ Trace]

<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0340**
Title	RPAS - Specific callsign
Requirement	The RP shall add "REMOTE" as RPAS specific identification in addition to the callsign.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 003B.**
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Contact Information Provision
<ALLOCATED_TO>	<Activity>	Initiate Contact with ATS Unit
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0350**
Title	RPAS - pilots team organisation
Requirement	A team of pilots shall be always available to manage the RPA, and at all times during flight, there will be one pilot designated Pilot in Command in the RP position.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 022.**
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Contact Information Provision [NOV] Contingency Information Provision [NOV] Navigation Data Provision
<ALLOCATED_TO>	<Activity>	Monitor RPA Flight Trajectory
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	~~REQ-PJ13.115-SPRINTEROP-0360~~
Title	~~RPAS - Navigation systems robustness~~
Requirement	~~RPA navigation system shall ensure that RP cannot introduce inconsistent information.~~
Status	~~<deleted>~~
Rationale	Encompassed in SAR assumptions.
Category	

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	~~REQ-PJ13.115-SPRINTEROP-0370~~
Title	~~ATC - RPAS ordinary flight management~~
Requirement	~~From an ATC environment point of view, the flight of the RPAS shall be considered an ordinary flight in the sectors or groups of sectors concerned.~~ ~~Therefore, the current training of the ATCOs will prepare RPAS to manage technical failures related to the ATSU like radio failures, CWP failures...~~
Status	~~<deleted>~~
Rationale	Encompassed in SAR assumptions.
Category	

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	~~REQ-PJ13.115-SPRINTEROP-0380~~
Title	~~RPAS - Traffic density limitation~~
Requirement	~~RPAS accommodation phase operational environment is low-medium traffic density.~~
Status	~~<deleted>~~
Rationale	Encompassed in SAR assumptions.
Category	

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	~~REQ-PJ13.115-SPRINTEROP-0390~~
Title	~~RPAS - Standard qualification and methods~~
Requirement	~~RP shall be IFR qualified and apply standard IFR procedures/operating methods.~~
Status	~~<deleted>~~
Rationale	Encompassed in SAR assumptions.
Category	

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0400**
Title	ATC - Inter Centre Transfer of Control Procedures
Requirement	Procedures regarding the transfer of control of RPAS between ATS units in nominal conditions shall be used per the LoA or operations manual in effect.
Status	<validated>
Rationale	Safety: **Safety (SAR): cf. SRD 010.**
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Transfer of Control Instruction Provision
<ALLOCATED_TO>	<Activity>	Transfer Flight to OAT/MIL Control Current ATC Coordinate and Transfer Flight Control to the next ATC Unit
<ALLOCATED_TO>	<Role>	ATC Executive Controller (PJ.13-W2-115) ATC Planning Controller (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

[REQ]

Identifier	**REQ-PJ13.115-SPRINTEROP-0410**
Title	RPAS - Speed Flight Limitation
Requirement	RPAS shall fly low speeds (below 200 knots) in order to allow ATCO sufficient time to update the RPA clearance or re-organize the traffic around RPAS after C2LL occurrence.
Status	<validated>
Rationale	**Safety (SAR): cf. SRD 027.**
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.13-W2-115
<SATISFIES>	<High Level Operational Requirement>	S115-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Navigation Data Provision [NOV] ATC Instruction Provision [NOV] Contact Information Provision
<ALLOCATED_TO>	<Activity>	Fly Nominal Flight Plan
<ALLOCATED_TO>	<Role>	Remote Flight Crew (PJ.13-W2-115)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route ER-Low Complexity ER-Medium Complexity
<ALLOCATED_TO>	<ActivityView>	[NOV-5] IFR Nominal RPAS Operations

5 References and Applicable Documents

5.1 Applicable Documents

Content Integration

[1] EATMA guidance material and report 01.00.01 16, Dec 2019

[2] EATMA Community pages

[3] SESAR ATM Lexicon

Content Development

[4] High Level Operational Requirements (HLOR) for Wave 2 Solutions (D2.0.002 Ed 1.02)

[5] European ATM Master Plan 2020

System and Service Development

N/A.

Performance Management

[6] Validation Targets W2 01.00, 30 Jun 2020

[7] Maturity Criteria Ed. 01.06.00, 29 April 2021

[8] Performance Framework Ed. 01.00.01, 20 Dec 2019

[9] Method to assess cost of European ATM improvements and technologies, EUROCONTROL (2014)

[10] ATM CBA Quality Checklist D26_08 Ed. 02.00.01, 15 June 2016

Validation

[11] SESAR Solution 115: Validation Plan (VALP) for V3 – Part I (D3.1.010) Ed. 00.00.05, 19 July 2021

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[13] SESAR Solution 115: Validation Plan (VALP) for V3 – Parts IV (D3.1.010) Ed. 00.00.02, 19 July 2021

[14] Solution 115: Validation Report (VALR) for V3 (D3.1.030) Ed. 3.00.00, 19 December 2022

[15] Requirements and Validation Guidelines Ed. 00.02.02, 01 May 2021

System Engineering

[16] SESAR 2020 Requirements and Validation Guidelines

Safety

[17] Safety - Guidance Reference Material v04.01, 8 June 2020

[18] Safety – Guidance to Apply the SESAR2020 Safety Reference Manual D4.0.050 Ed00.03.01, 14 Dec 2018

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Human Performance

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Environment Assessment

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[24]EASA SC RPAS.C2.01 - Special Condition RPAS Command and Control (C2) Datalink, 2 May 2016

[25] EASA SC RPAS1309-03 Special Condition Equipment, Systems, and Installations CRI F-01, 1 June 2018

[26] EASA CS-ACNS issue 2 Airborne Communications, Navigation and Surveillance

[27] EASA Accommodation of military IFR MALE type RPAS under GAT Airspace classes A-C Final Version

[28] EASA concept for regulation of UAS 'certified' category operations of Unmanned Aircraft Systems (UAS), the certification of UAS to be operated in the 'specific' category and for the Urban Air Mobility operations Issue 2.1, Nov 2019

[29]EC No 2150/2005 Commission Regulation Laying down common rules for the flexible use of airspace, 23 December 2005

[30]EDA MALE RPAS ATI Concept of Operation (White Paper)

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[32] EDA MALE RPAS Accommodation Study – D1 Task 1 Report : General Approach and Safety Assessment Method Definition Ref: SIRENS/20180309/T1/001 Issue 04, 24 July 2018

[33] EDA MALE RPAS Accommodation Study – D2 Task 2 : Simulation Readiness Report Issue 5.0,– 3 Aug 2018

[34] EDA MALE RPAS Accommodation Study – D3 Task 4 : Simulation Campaign & Safety Case Assessment Ref: SIRENS/20180906/T4/003 Issue 05, 19 Oct 2018

[35] EDA MALE RPAS Accommodation Study – D4 : Final Report Ref: SIRENS/2018/FR Issue 08, 1 March 2019

[36] Ente Nazionale Assistenza Al Volo (ENAV) - Italian case for RPAS accommodation Webex, 20 March 2020

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[39] EUROCAE Operational Services and Environment Definitions (OSED) for Remotely Piloted Aircraft System (RPAS) Automation and Emergency Recovery (A&ER) Functions ED-253, March 2019

[40] European RPAS Steering Group (ERSG) - Roadmap for the integration of civil Remotely-Piloted Aircraft Systems into the European Aviation System – Final Report, Annex 1 (Regulation), Annex 2 (Strategic Research), Annex 3 (Societal), June 2013

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[41] EUROCONTROL IFPS User's Manual

[42] EUROCONTROL EATM Glossary of Terms

[43] Eurocontrol Air Traffic Management Guidelines for GLOBAL HAWK in European Airspace, December 2010

[44] Eurocontrol Specifications for the use of Military Remotely Piloted Aircraft as operational Air Traffic outside segregated airspace, Feb 2012

[45] ICAO Annex 2 to the Convention on International Civil Aviation: Rules of the Air, 9th Edition July 1990

[46] ICAO Annex 6-2 to the Convention on International Civil Aviation - Operation of Aircraft Part II: International General Aviation - Aeroplanes, 6th Edition July 1998

[47] ICAO Annex 7 to the Convention on International Civil Aviation: Aircraft Nationality and Registration Marks, 5th Edition July 2003

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[49] ICAO DOC 10019-AN/507 Manual on Remotely Piloted Aircraft Systems (RPAS), first edition 2015

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[62] NASA Report To Congress - Technical Results of NASA's High Altitude Long Endurance Unmanned Aerial Vehicles (UAVs) in the National Airspace System (NAS) Project, March 2006

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Appendix A Cost and Benefit Mechanisms

A.1 Stakeholders identification and Expectations

Stakeholder	Involvement	Why it matters to stakeholder
ANSP /ATCO	ATC Operational expertise ATCO participation Provides a service to airspace users (in context of S115, this includes a limited number of RPAS (only one) and existing manned aviation)	▪ ANSP are responsible for the safety of air traffic. The accommodation of RPAS shall not affect the safety KPA. ▪ RPAS operations shall not increase ATCO workload. ▪ Operational experts validate and obtain feedback on the procedure they designed. ▪ Standards and regulations can be adapted based on these assessments. ▪ Without additional technologies to assist integration of RPAS in the near term, ATCO's needs consistent procedures to facilitate the routine accommodation of a limited number of RPAS (limited to one) in low to medium density and complexity airspace. This will allow ANSPs to continue to provide a safe, efficient and equitable service to all airspace users. ▪ Ability for manufacturers to provide or design future equipment/functions compliant to user needs for overtaking solution 115 recommendations, and to support standards and regulations.
RPAS Operators	External RPAS operator operational expertise Strong coordination with French RPAS operators (French air and space forces, Dassault Aviation and Safran).	▪ The concept tested may allow the RPAS operator to access the whole airspace class A to C without coordination constraints, which are time consuming and sometime not adapted to operational needs. ▪ The procedure is suitable to existing RPAS/RP capabilities and working methods. ▪ Increase the area of current operations. ▪ Gain more flexibility.

Stakeholder	Involvement	Why it matters to stakeholder
		▪ Equitable access to airspace. ▪ Ability for manufacturers to provide or design equipment/functions compliant to user needs, and to support standards and regulations.
Manned aircraft operators	No involvement	Indirectly, the fact that a segregated transit corridor is no more put in place for RPAS transit in airspace class A to C may facilitate seamless trajectories of other traffic.

Table 36: Stakeholders' expectations

A.2 Benefits mechanisms

Solution Info / The following solution information is derived from the OSED section 3.1

1. Description:

This SESAR solution addresses existing RPAS accommodation as General Air Traffic (GAT) under Instrument Flight Rules (IFR), also recognizing that these RPAS are not fully compliant with ICAO standards.

2. Aim:

Enable initial RPAS demand to routinely access and transit ICAO classified A, B and C controlled airspace in a non-segregated manner

- Reduced planning and approval time of RPAS operations;
- Routine access for transit flights across airspace class A-C with limited restrictions;
- Airspace equity to all airspace users

3. Timeframe:

Short to medium term.

4. Environment:

Low/Medium and high (under conditions) complexity and density European airspace with low RPAS numbers. RPAS flying transit segments in non-segregated controlled class A-C airspace (En Route operating environment) whereas mission specific profiles and departure/arrival remains as currently performed outside the solution's scope.

Focus, Assumptions: RPAS accommodation relies on procedural improvements, with the existing mechanisms and systems already in place (no technological changes - the solution uses existing ATM technologies) with minor improvements if necessary. The solution will define specific provisions on flight planning and RPAS management by establishing harmonized procedural improvements.

NOTE:

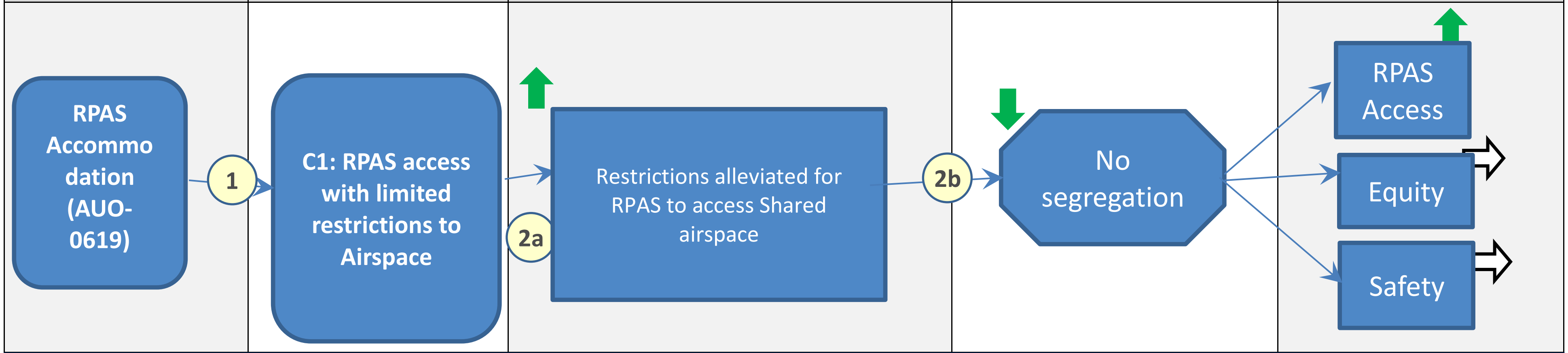
Complexity / Capacity: not impacted (maintained) during accommodation phase. The no-effect on capacity impact is due to assumption below, as well as the other B/I mechanisms described in the following tables were Capacity impact may be a side effect of the other KPA factors (e.g. HP)

Assumptions for the accommodation phase (low/mid density airspace and low numbers of RPAS => 1 RPAS per controlling sector max.).

⬇	beneficial decrease e.g. reduction in controller workload (positive impact)
⬆	beneficial increase e.g. increase in no. of movements (indicator) / increase in safety (positive impact)
⬆	detrimental increase e.g. increase in controller workload (negative impact)
⬇	detrimental decrease e.g. reduction in no. of movements (indicator) / reduction in safety (negative impact)
⇨	Change, a positive or negative impact is expected, but with current knowledge, the direction is still not clear.

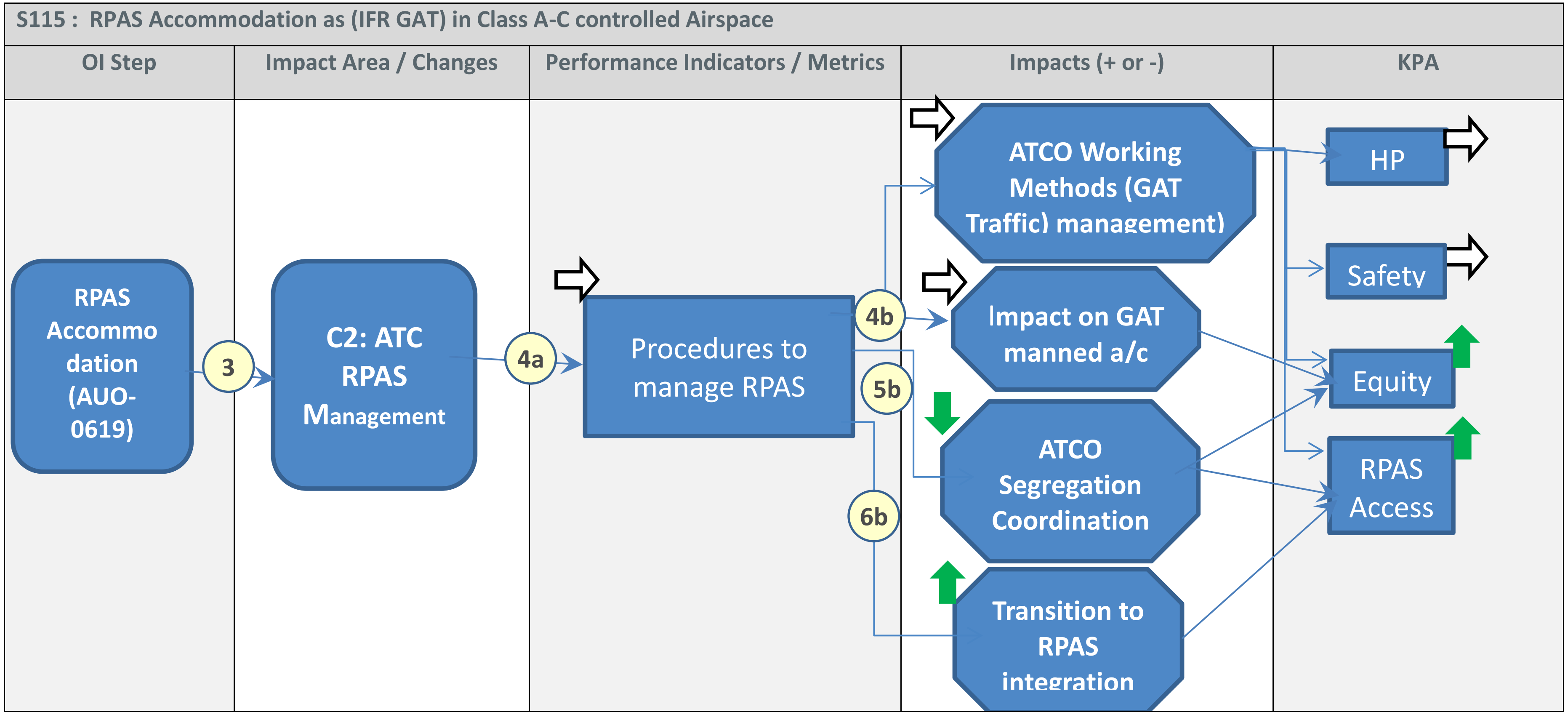
Table 37: Costs and Benefit Mechanisms Identification of impacts

S115 : Accommodation of RPAS (IFR GAT) in Class A-C controlled Airspace				
OI Step	Impact Area / Changes	Performance Indicators / Metrics	Impacts (+ or -)	KPA



RPAS Accommodation (OI AUO-0619) : C1 : RPAS access airspace with no segregation with manned traffic	
(1)	RPAS routine access and transit through airspace with IFR GAT flight Plans, without the need/use of segregated airspace
(2a)	Controlled airspace for RPAS transit fully shared with other manned GAT traffic (i.e. no need for segregated volumes/corridors) Controlled IFR/GAT airspace for RPAS transit fully shared with other manned GAT traffic (i.e. no need for segregated volumes/corridors) Decreased segregation restrictions
(2b)	No need to prepare and use segregated volumes/corridors

Table 38: Solution 115 Benefits Mechanisms and Impacts C1



RPAS Accommodation (OI AUO-0619) : C2 : ATC RPAS management with manned GAT traffic	
(3)	ATC manages IFR/GAT RPAS and other manned GAT traffic in airspace
(4a)	Procedures that ATCO applies to manage RPAS under IFR/GAT within other GAT manned traffic

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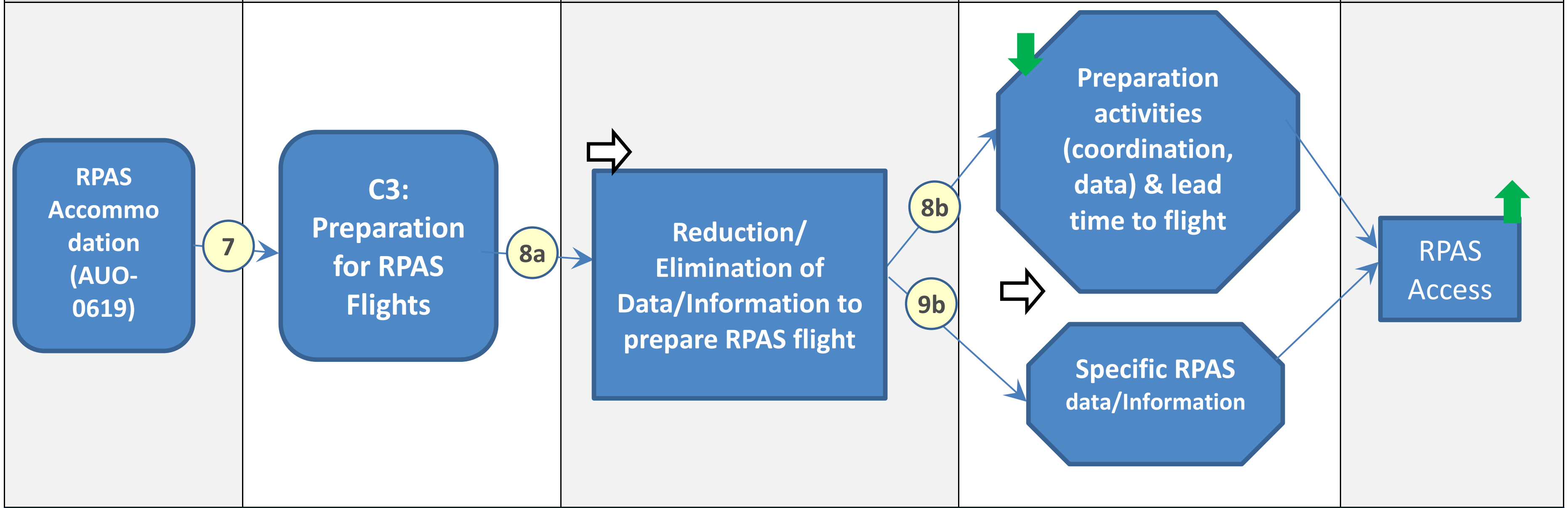
(4b)	ATCO working methods are not impacted for procedures already existing, applicable to both RPAS & manned a/c and are suitable for RPAS management. Impact to be evaluated on working methods due to specific procedures for RPAS (contingencies).
	ATCO minimizes impact on other manned / unmanned a/c when managing RPAS
(5b)	ATCO working methods do not require segregation and ASM coordination (e.g. with MIL / OAT controller) during GAT transit segment (entry/exit excluded)
(6b)	Procedures/Operating methods allow transition to next phase RPAS integration

Table 39: Solution 115 Benefits Mechanisms and Impacts C2

S115 : RPAS Accommodation as IFR GAT in Class A-C controlled Airspace				
OI Step	Impact Area / Changes	Performance Indicators / Metrics	Impacts (+ or -)	KPA



RPAS Accommodation (OI AUO-0619) : C3 : Reduction of preparation activities for RPAS Flight	
(7)	Preparation for RPAS flights (e.g. preparation/coordination with the military, creation/data on areas of flight, Airspace design/route design,
(8a)	Specific data/Information prepared for RPAS flights
(8b)	ATC data preparation reduced/eliminated (e.g. segregated areas + configuration on ATCO CWP)
(9b)	Other RPAS specific data/Information required prior to flight to manage RPAS flight

Table 40: Solution 115 Benefits Mechanisms and Impacts C3

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Appendix B Technical and Interface Specification (TS/IRS)

B.1 SESAR Solution Impacts on Architecture

B.1.1 Target Solution Architecture

B.1.1.1 SESAR Solution Overview

Refer **section 3.1** of the present document.

B.1.1.1.1 Deviations with respect to the SESAR Solution definition

Refer **section 3.1.1** of the present document.

B.1.1.1.2 Relevant Use Cases

Refer **present document, sections:**

- **3.2.2.2.1** : [NOV-5] Preparation and Filing of RPAS Flight Plan
- **3.2.2.2.2** : [NOV-5] IFR RPAS Nominal Operations
- **3.2.2.2.3** : [NOV-5] IFR RPAS Contingency Operations (C2LL)
- **3.2.2.2.4** : [NOV-5] IFR RPAS Emergency Operations

System Process Description:

System Process	Description
[NSV4] Preparation and Filing of RPAS Flight Plan	This view describes the systems resources providing functionalities to support the Use Case described within the Activity view '[NOV5] Preparation and Filing of RPAS Flight Plan'. No major new functionalities will be necessary to support the RPAS Accommodation concept.
[NSV4] IFR RPAS Nominal Operations	This view describes the systems resources providing already existing functionalities to support the Use Case described within the Activity view '[NOV5] IFR RPAS Nominal Operations'. No major new functionalities will be necessary to support the RPAS Accommodation concept.
[NSV4] IFR RPAS Contingency Operations	This view describes the systems resources providing existing functionalities to support the Use Case described within the Activity view '[NOV5] IFR RPAS Contingency Operations'. No major new functionalities will be necessary to support the RPAS Accommodation concept.
[NSV4] IFR RPAS Emergency Operations	This view describes the systems resources providing already existing functionalities to support the Use Case described within the Activity view '[NOV5] IFR RPAS Emergency Operations'. No major new functionalities will be necessary to support the RPAS Accommodation concept.

Table 41: System Process Description

B.1.1.1.3 Applicable Standards and Regulations

Refer **section 3.2.4** of the present document.

B.1.1.2 Capability Configurations required for the SESAR Solution

Capability Configurations for IFR RPAS Pre Flight Operations

[Context] IFR RPAS PRE Flight				
CC	**Op Env**	**Capability**	**Node**	**Stakeholder**
ER ACC (PJ.13-W2-115)	En-Route;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service Provider;
ER ACC (PJ.13-W2-115)	En-Route;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service Provider;
Communication Infrastructure	Airport; En-Route; NET-Network; Network; Terminal Airspace;	Communication; Messaging;		Civil CNS Service Provider; Military CNS Service Provider;
Communication Infrastructure	Airport; En-Route; NET-Network; Network; Terminal Airspace;	Communication; Messaging;		Civil CNS Service Provider; Military CNS Service Provider;
ER ACC (PJ.13-W2-115)	En-Route;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route

				Service Provider;
ER ACC (PJ.13-W2-115)	En-Route;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service Provider;
Regional ATFCM (PJ.13-W2-115)	Network;	Air Traffic Flow Management;	Air Traffic Flow and Capacity Management;	Network Manager;
Regional ATFCM (PJ.13-W2-115)	Network;	Air Traffic Flow Management;	Air Traffic Flow and Capacity Management;	Network Manager;
RPS (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned Aircraft System;
RPS (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned Aircraft System;
State AU Operations Centre (PJ.13-W2-115)	En-Route; Terminal Airspace;		Airspace User Ops Support;	Military Wing Operations Centre;
State AU Operations Centre (PJ.13-W2-115)	En-Route; Terminal Airspace;		Airspace User Ops Support;	Military Wing Operations Centre;
Sub-Regional/Local	NET-Network;		Air Traffic Flow and Capacity	Civil ATS Approach

ATFCM (PJ.13-W2-115)			Management;	Service Provider; Civil ATS En-Route Service Provider;
Sub-Regional/Local ATFCM (PJ.13-W2-115)	NET-Network;		Air Traffic Flow and Capacity Management;	Civil ATS Approach Service Provider; Civil ATS En-Route Service Provider;

Table 42: Capability Configuration IFR RPAS Pre Flight Operations

Capability Configurations for IFR RPAS Nominal Operations

[Context] IFR RPAS Nominal Operations				
CC	**Op Env**	**Capability**	**Node**	**Stakeholder**
ER ACC (PJ.13-W2-115)	En-Route;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service Provider;
APP ACC (PJ.13-W2-115)	Terminal Airspace;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS Approach Service Provider; Military ATS Approach Service Provider;
Communication Infrastructure	Airport; En-Route; NET-Network; Network; Terminal Airspace;	Communication; Messaging;		Civil CNS Service Provider; Military CNS Service Provider;
Civil Aircraft	Airport; En-Route; Terminal Airspace;	Optimised Descent Execution; Optimised Take-Off / Landing Execution; PinS Operations Execution; RNP based Operations Execution;	Flight Deck;	Civil Business Aviation-Fixed Wing; Civil Business Aviation-Rotorcraft; Civil Scheduled Aviation;
Civil Aircraft	Airport; En-Route; Terminal Airspace;	Optimised Descent Execution; Optimised Take-Off / Landing Execution; PinS Operations Execution; RNP based Operations Execution;	Flight Deck;	Civil Business Aviation-Fixed Wing; Civil

				Business Aviation-Rotorcraft; Civil Scheduled Aviation;
APP ACC (PJ.13-W2-115)	Terminal Airspace;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS Approach Service Provider; Military ATS Approach Service Provider;
APP ACC (PJ.13-W2-115)	Terminal Airspace;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS Approach Service Provider; Military ATS Approach Service Provider;
ER ACC (PJ.13-W2-115)	En-Route;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service Provider;
ER ACC (PJ.13-W2-115)	En-Route;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service Provider;
RPA (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned

				Aircraft System;
RPA (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned Aircraft System;
RPS (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned Aircraft System;
RPS (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned Aircraft System;
Surveillance Infrastructure En-Route	En-Route;			Civil CNS Service Provider; Military CNS Service Provider;
Surveillance Infrastructure En-Route	En-Route;			Civil CNS Service Provider; Military CNS Service Provider;

Table 43: Capability Configuration IFR RPAS Nominal Operations

Capability Configurations for IFR RPAS Contingency Operations (C2LL)

[Context] IFR RPAS Contingency Operations				
CC	**Op Env**	**Capability**	**Node**	**Stakeholder**
ER ACC (PJ.13-W2-115)	En-Route;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service Provider;
APP ACC (PJ.13-W2-115)	Terminal Airspace;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS Approach Service Provider; Military ATS Approach Service Provider;
Communication Infrastructure	Airport; En-Route; NET-Network; Network; Terminal Airspace;	Communication; Messaging;		Civil CNS Service Provider; Military CNS Service Provider;
Communication Infrastructure	Airport; En-Route; NET-Network; Network; Terminal Airspace;	Communication; Messaging;		Civil CNS Service Provider; Military CNS Service Provider;
Civil Aircraft	Airport; En-Route; Terminal Airspace;	Optimised Descent Execution; Optimised Take-Off / Landing Execution; PinS Operations Execution; RNP based Operations Execution;	Flight Deck;	Civil Business Aviation-Fixed Wing; Civil Business Aviation-Rotorcraft; Civil

				Scheduled Aviation;
Civil Aircraft	Airport; En-Route; Terminal Airspace;	Optimised Descent Execution; Optimised Take-Off / Landing Execution; PinS Operations Execution; RNP based Operations Execution;	Flight Deck;	Civil Business Aviation-Fixed Wing; Civil Business Aviation-Rotorcraft; Civil Scheduled Aviation;
APP ACC (PJ.13-W2-115)	Terminal Airspace;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS Approach Service Provider; Military ATS Approach Service Provider;
APP ACC (PJ.13-W2-115)	Terminal Airspace;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS Approach Service Provider; Military ATS Approach Service Provider;
ER ACC (PJ.13-W2-115)	En-Route;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service Provider;
ER ACC (PJ.13-W2-115)	En-Route;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service

				Provider;
RPA (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned Aircraft System;
RPA (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned Aircraft System;
RPS (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned Aircraft System;
RPS (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned Aircraft System;
Surveillance Infrastructure En-Route	En-Route;			Civil CNS Service Provider; Military CNS Service Provider;
Surveillance Infrastructure En-Route	En-Route;			Civil CNS Service Provider; Military CNS Service

				Provider;

Table 44: Capability Configuration IFR RPAS Contingency Operations

Capability Configurations for IFR RPAS Emergency Operations

[Context] IFR RPAS Emergency Operations				
CC	Op Env	Capability	Node	Stakeholder
APP ACC (PJ.13-W2-115)	Terminal Airspace;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS Approach Service Provider; Military ATS Approach Service Provider;
APP ACC (PJ.13-W2-115)	Terminal Airspace;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS Approach Service Provider; Military ATS Approach Service Provider;
Communication Infrastructure	Airport; En-Route; NET-Network; Network; Terminal Airspace;	Communication; Messaging;		Civil CNS Service Provider; Military CNS Service Provider;
Civil Aircraft	Airport; En-Route; Terminal Airspace;	Optimised Descent Execution; Optimised Take-Off / Landing Execution; PinS Operations Execution; RNP based Operations Execution;	Flight Deck;	Civil Business Aviation-Fixed Wing; Civil Business Aviation-Rotorcraft; Civil Scheduled Aviation;
Civil Aircraft	Airport; En-Route; Terminal Airspace;	Optimised Descent Execution; Optimised Take-Off / Landing Execution; PinS Operations Execution; RNP based Operations Execution;	Flight Deck;	Civil Business Aviation-Fixed Wing; Civil

				Business Aviation-Rotorcraft; Civil Scheduled Aviation;
ER ACC (PJ.13-W2-115)	En-Route;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service Provider;
ER ACC (PJ.13-W2-115)	En-Route;	Separation Service Provision (airspace);	En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service Provider;
RPA (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned Aircraft System;
RPA (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned Aircraft System;
RPS (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned

				Aircraft System;
RPS (PJ.13-W2-115)	En-Route; Terminal Airspace;	Execute Trajectory;		Civil Unmanned Aircraft System; Military Unmanned Aircraft System;
State AU Operations Centre (PJ.13-W2-115)	En-Route; Terminal Airspace;		Airspace User Ops Support;	Military Wing Operations Centre;
State AU Operations Centre (PJ.13-W2-115)	En-Route; Terminal Airspace;		Airspace User Ops Support;	Military Wing Operations Centre;
Surveillance Infrastructure En-Route	En-Route;			Civil CNS Service Provider; Military CNS Service Provider;
Surveillance Infrastructure En-Route	En-Route;			Civil CNS Service Provider; Military CNS Service Provider;
TWR (PJ.13-W2-115)	Airport;		Aerodrome ATS;	Civil ATS Aerodrome Service Provider; Military ATS Aerodrome Service Provider;
TWR (PJ.13-W2-115)	Airport;		Aerodrome ATS;	Civil ATS Aerodrome Service Provider; Military ATS

				Aerodrome Service Provider;

Table 45: Capability Configuration IFR RPAS Emergency Operations

B.1.2 Changes imposed by the SESAR Solution on the Baseline Architecture

Enabler	Element type	Element name	Impact	Change

Not Applicable.

B.2 Technical Specifications

B.2.1 Functional Architecture Overview

Functions required to perform needed Operational Activities can be allocated to Resources of a different type: Human Role, Infrastructure System or Functional Block.

B.2.1.1 Resource Connectivity View for Pre Flight Operations

Presentation:

This contextual view represent the interactions between capabilities configurations needed to support the necessary information exchanges for the Pre Flight Operations Use Case already described in the operational views.

All resource interactions instantiated in this view are contextual as this is the Pre Flight case.

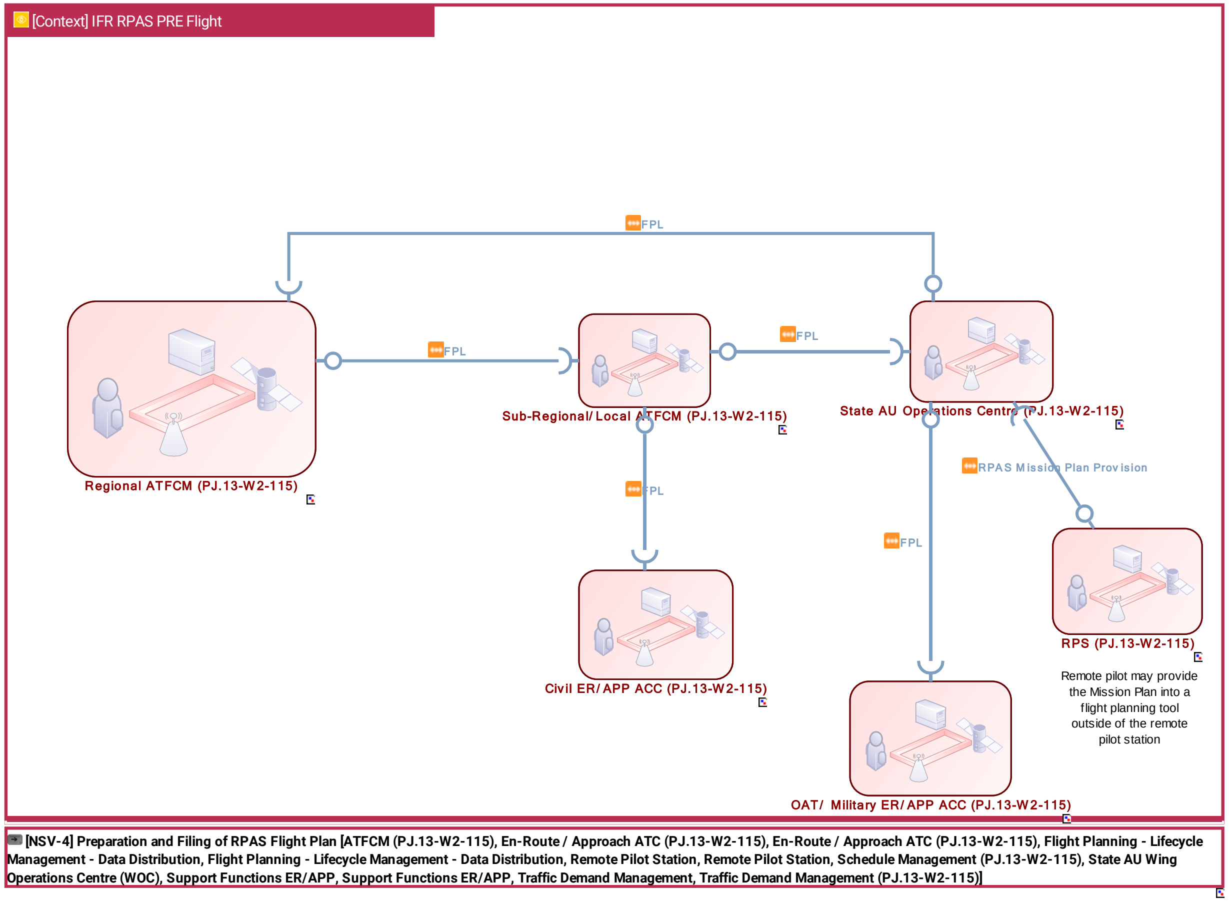
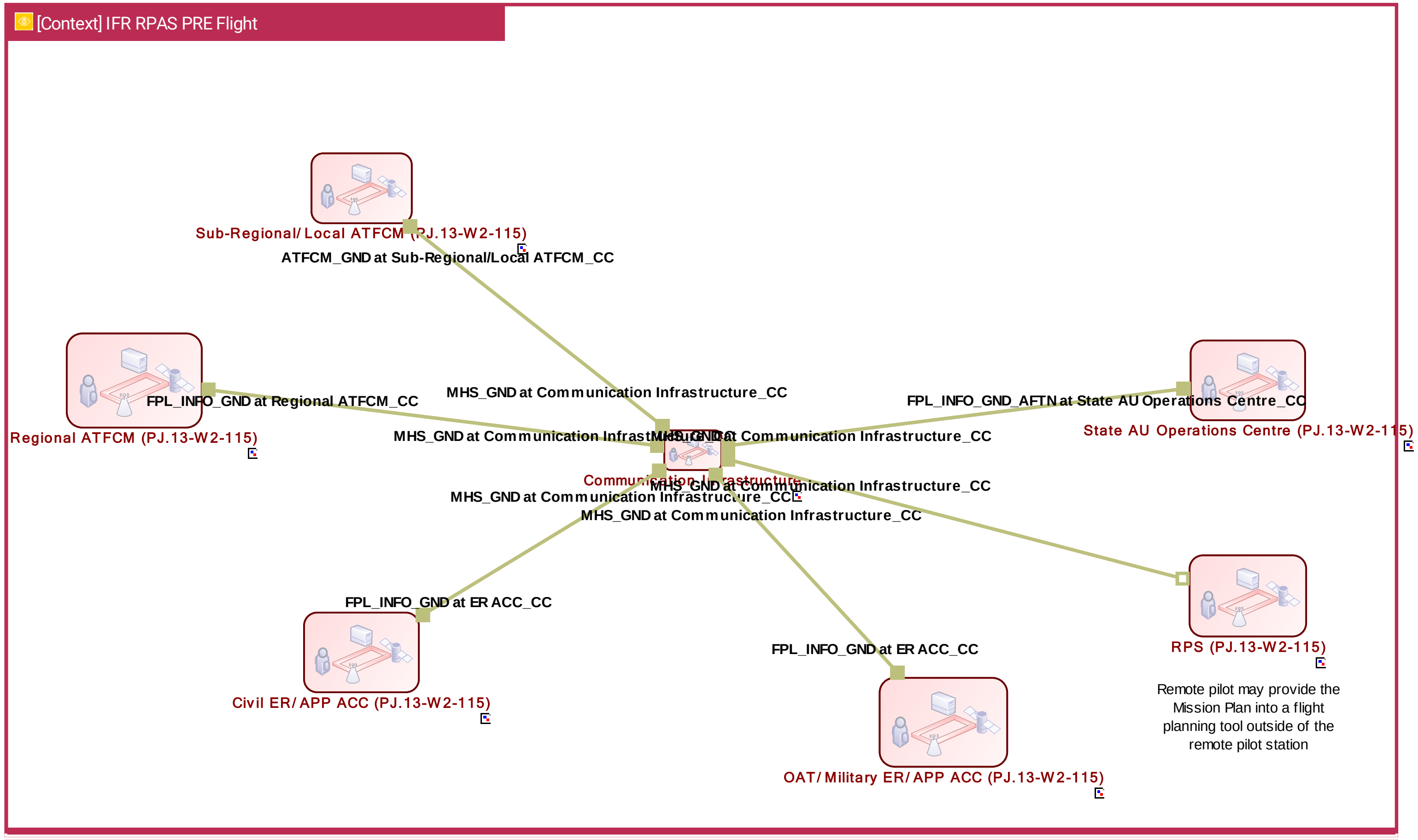


Figure 14 : EATMA [NSV-1] Context IFR RPAS Pre Flight Operations



[NSV-4] Preparation and Filing of RPAS Flight Plan [ATFCM (PJ.13-W2-115), En-Route / Approach ATC (PJ.13-W2-115), En-Route / Approach ATC (PJ.13-W2-115), Flight Planning - Lifecycle Management - Data Distribution, Flight Planning - Lifecycle Management - Data Distribution, Remote Pilot Station, Remote Pilot Station, Schedule Management (PJ.13-W2-115), State AU Wing Operations Centre (WOC), Support Functions ER/APP, Support Functions ER/APP, Traffic Demand Management, Traffic Demand Management (PJ.13-W2-115)]

Figure 15 : EATMA [NSV-2] Context IFR RPAS Pre Flight Operations

B.2.1.1.1 Resource Infrastructure View

Not Applicable.

B.2.1.1.2 Resource Orchestration View

B.2.1.1.2.1 [NSV4] IFR RPAS Preparation and Filing of RPAS Flight Plan

Presentation:

This view describes the systems resources providing functionalities to support the Use Case described within the Activity view '[NOV5] Preparation and Filing of RPAS Flight Plan'. There is no new functionalities.

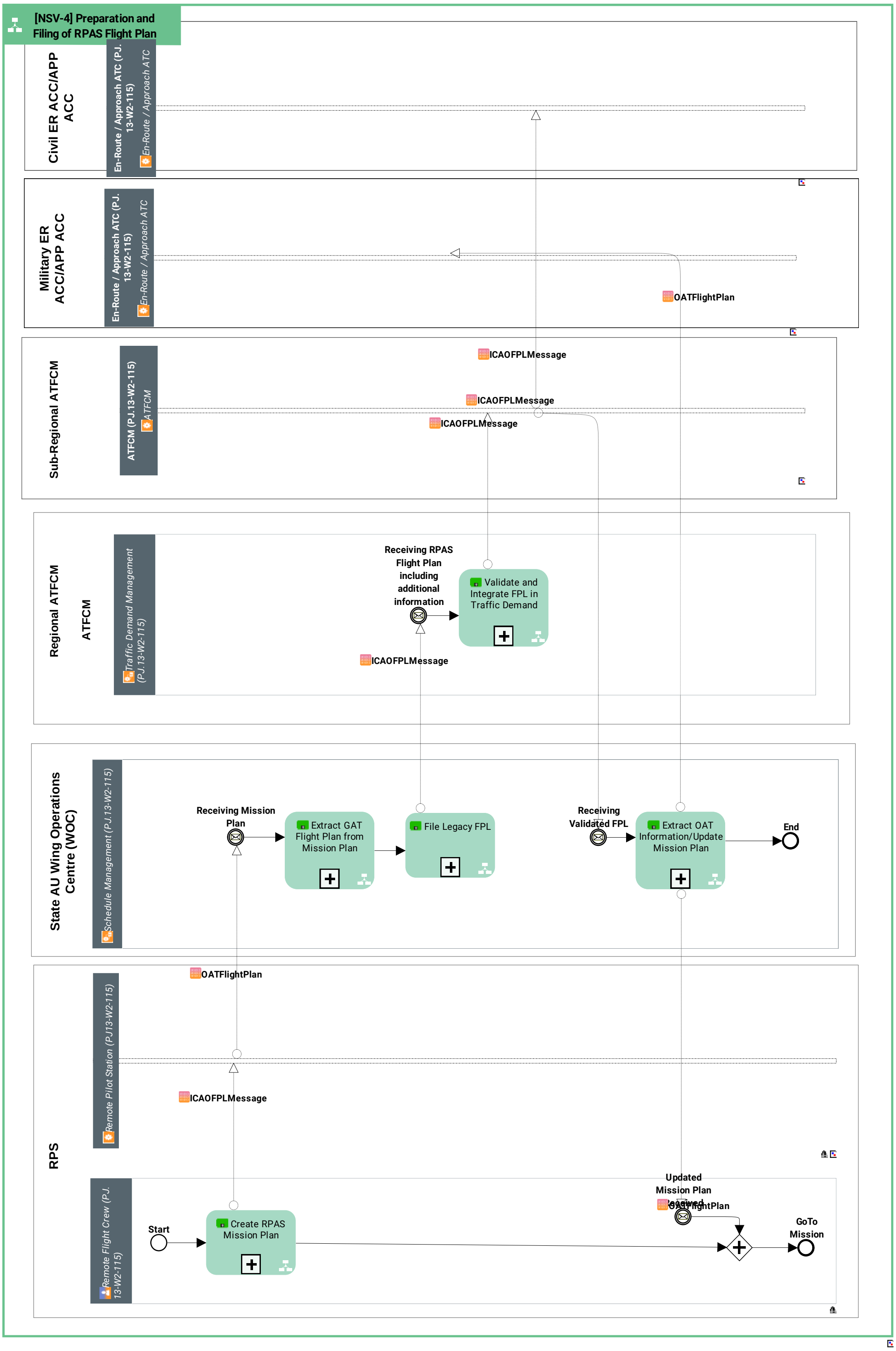


Figure 16 : EATMA [NSV-4] IFR RPAS Pre Flight Functional Diagram

Functions by Role and Functional Block:

Role	Functional Block	Function
	Flight Planning - Lifecycle Management - Data Distribution	Task;
	Flight Planning - Lifecycle Management - Data Distribution	Task;
	Schedule Management (PJ.13-W2-115)	Extract GAT Flight Plan from Mission Plan; Extract OAT Information/Update Mission Plan; File Legacy FPL;
	Support Functions ER/APP	Task;
	Support Functions ER/APP	Task;
	Traffic Demand Management	Validate and Integrate FPL in Traffic Demand;
	Traffic Demand Management (PJ.13-W2-115)	Validate and Integrate FPL in Traffic Demand;

Table 46: Solution 115 Roles & Functional Blocks IFR RPAS Pre Flight Operations

Functions Description:

Function	Description
Create RPAS Mission Plan	Function related to a Flight Mission Planning tool to introduce the Mission Plan in addition to the Flight Plan.
Extract GAT Flight Plan from Mission Plan	Extract GAT segment of Flight Plan from Mission Plan
Extract OAT	Extract OAT segment and Information, and/or Update the Mission Plan

Information/Update Mission Plan	
File Legacy FPL	Submits Legacy ICAO FPL to Initial Flight Plan Processing System
Validate and Integrate FPL in Traffic Demand	IFPS function to Validate and Integrate FPL in Traffic Demand

Table 47: Solution 115 Functions Description IFR RPAS Pre Flight Operations

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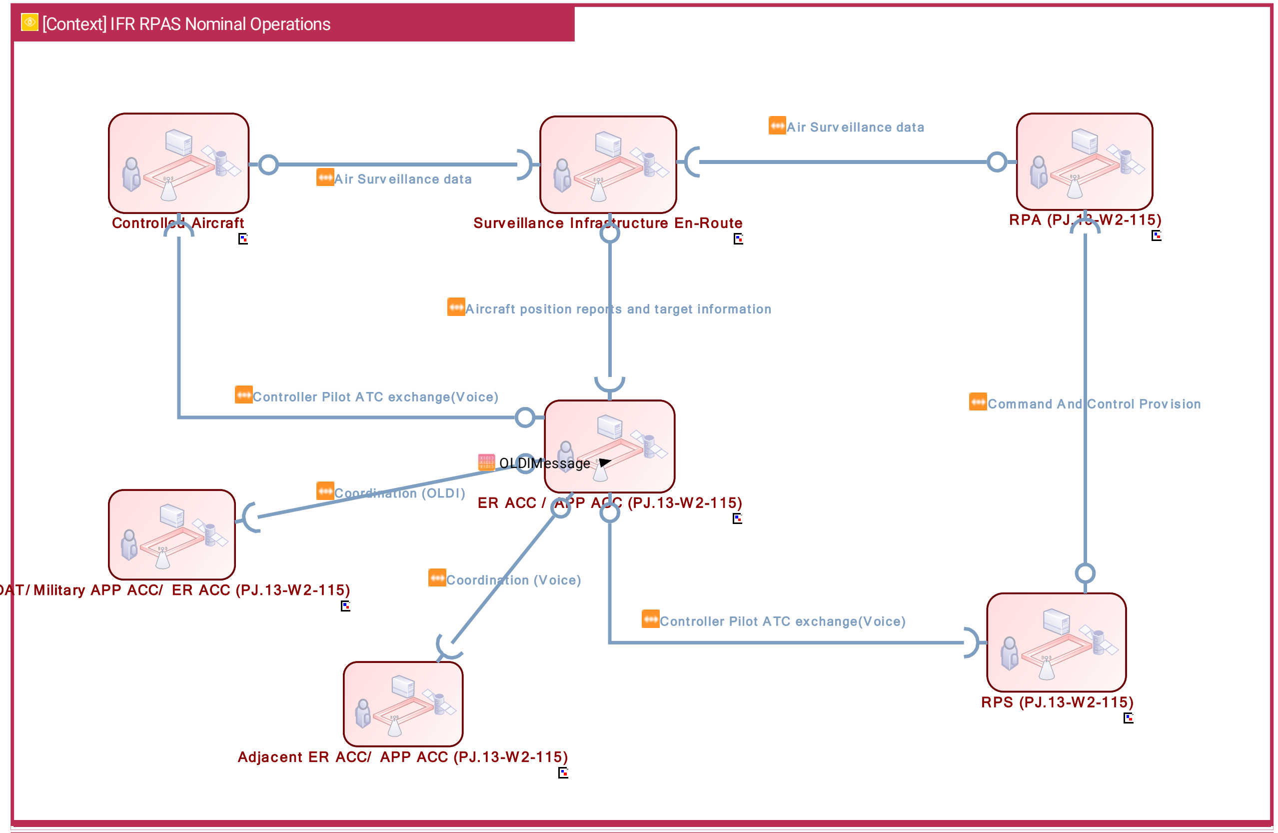
B.2.1.2 Resource Connectivity View for Nominal Operations

Presentation:

This contextual view represent the interactions between capabilities configurations needed to support the necessary information exchanges for the Nominal Operations Use Case already described in the operational views.

All resource interactions instantiated in this view are contextual as this is the nominal case.



[NSV-4] IFR RPAS Nominal Operations [A/G Voice Communication (PJ.13-W2-115), ATC Executive Controller (PJ.13-W2-115), ATC Executive Controller (PJ.13-W2-115), ATC Executive Controller (PJ.13-W2-115), Command and Control, Controlled Aircraft, Controller Human Machine Interaction Management ER/APP (PJ.13-W2-115), Coordination and Transfer (PJ.13-W2-115), En-Route / Approach ATC, En-Route / Approach ATC, Flight Plan Management (PJ.13-W2-115), Mode C/S (PJ.13-W2-115), Remote Flight Crew (PJ.13-W2-115), Remote Pilot Station (PJ13-W2-115), Surveillance (PJ.13-W2-115), Surveillance Infrastructure En-Route, Voice (PJ.13-W2-115)]

Figure 17 : EATMA [NSV-1] Context IFR RPAS Nominal Operations

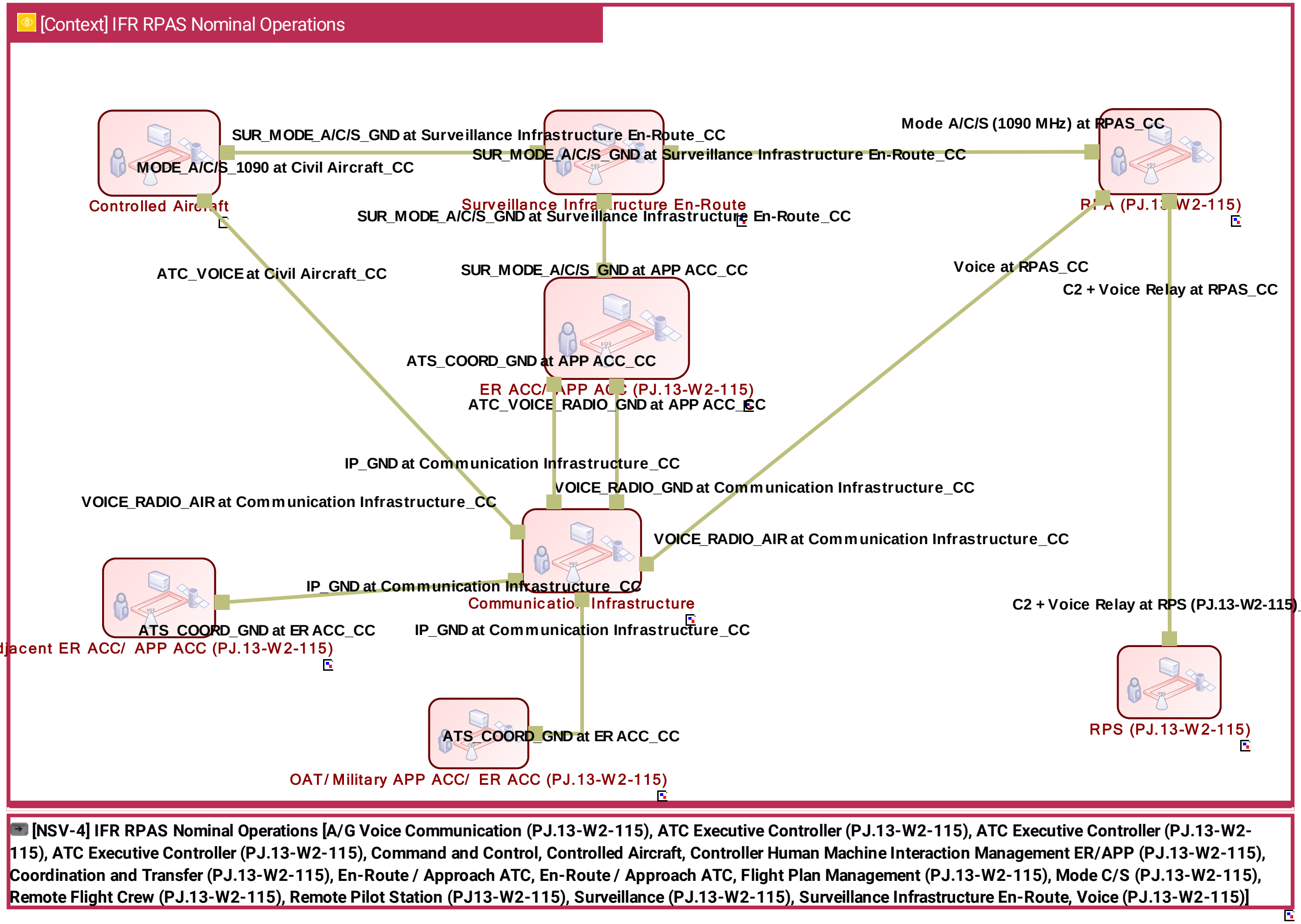


Figure 18 : EATMA [NSV-2] Context IFR RPAS Nominal Operations

B.2.1.2.1 Resource Infrastructure View

Not Applicable.

B.2.1.2.2 Resource Orchestration View

B.2.1.2.2.1 [NSV4] IFR RPAS Nominal Operations

Presentation:

This view describes the systems resources providing already existing functionalities to support the Use Case described within the Activity view '[NOV5] IFR RPAS Nominal Operations'. No major new functionalities will be necessary to support the RPAS Accommodation concept.

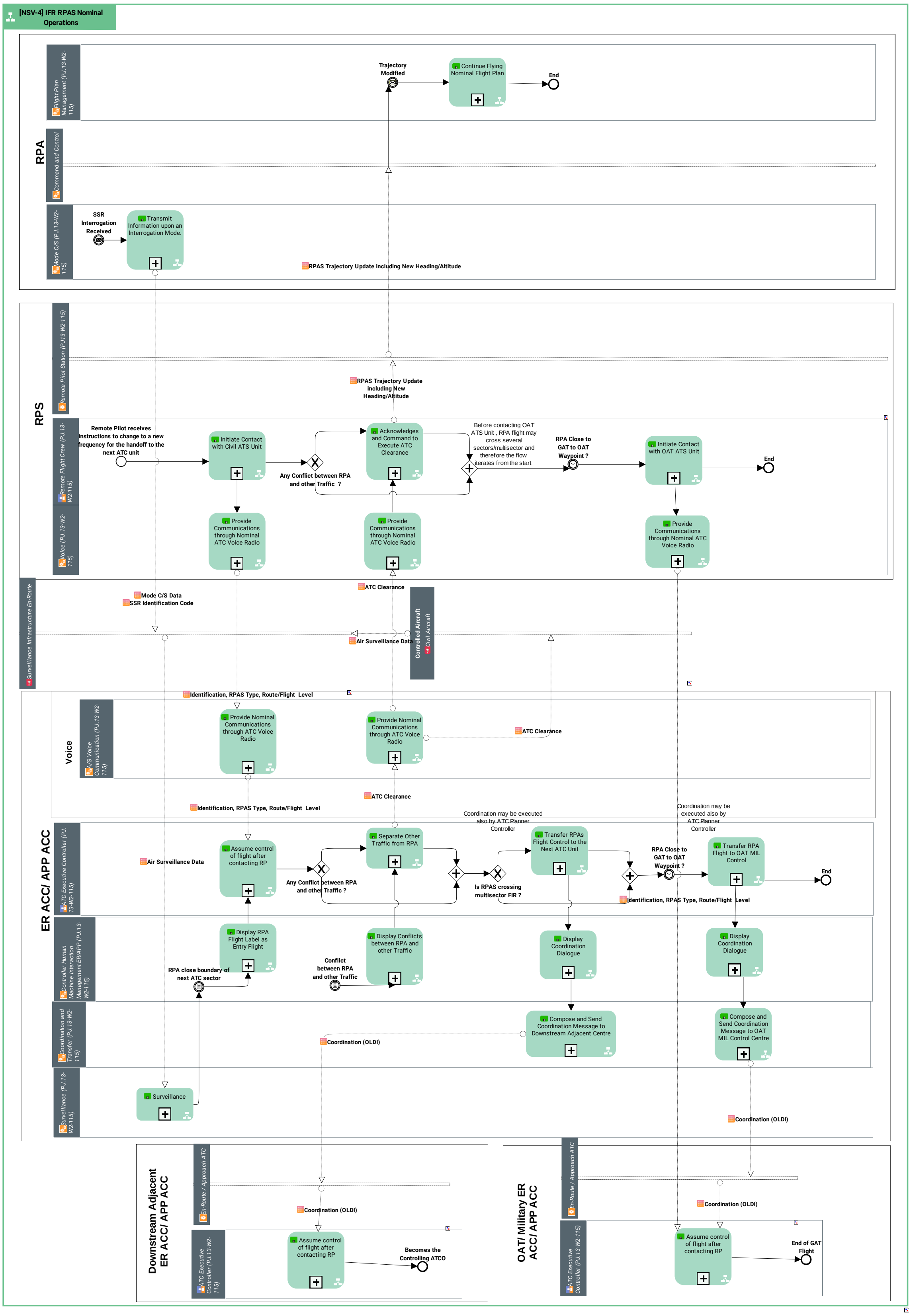


Figure 19 : EATMA [NSV-4] IFR RPAS Nominal Functional Diagram

Functions by Role and Functional Block:

Function	Description
Acknowledges and Command to Execute ATC Clearance	Remote Pilot Acknowledges ATC Clearance and Command to the RPA to implement the trajectory update.
Acknowledges and Command to Resume Flight Plan	Acknowledges and Command to Resume Flight Plan
Assume control of flight after contacting RP	ATCO assumes control of the flight and may now issue ATC clearances and instructions to the flight.
Compose and Send Coordination Message to Downstream Adjacent Centre	Compose and Send Coordination Message to Downstream Adjacent Centre
Compose and Send Coordination Message to OAT MIL Control Centre	Compose and Send Coordination Message to OAT MIL Control Centre
Continue Flying Nominal Flight Plan	Flight Management System function to command to the autopilot to fly the nominal flight plan previous to the C2 link loss contingency
Display Conflicts between RPA and other Traffic	Display Conflicts between RPA and other Traffic
Display Coordination Dialogue	Display Coordination Dialogue
Display RPA Flight Label as Entry Flight	Once RPA is under an adapted parameter distance to the boundary of the incoming ATC sector, RPA Flight Label appears as entry flight to the next ATCO to control the flight
Initiate Contact with Civil ATS Unit	Remote Pilot initiate contact with Civil ATS Unit, to readback the sector frequency, and callsign and flight level to the ATCO
Initiate Contact with OAT ATS Unit	Remote Pilot initiate contact with OAT ATS Unit, to readback the sector frequency, and callsign and flight level to the ATCO

Provide Communications through Nominal ATC Voice Radio	Provide Communications through Nominal ATC Voice Radio
Provide Nominal Communications through ATC Voice Radio	Provide Nominal Communications through ATC Voice Radio
Separate Other Traffic from RPA	ATCO will separate other traffics from the RPA
Surveillance	The Surveillance functional block merges traffic data provided by surveillance sources (PSR, SSR, ADS-C for oceanic flights, ADS-B, WAM) to provide a unique, system-wide reference of the actual air traffic situation. The resultant system tracks are supplemented with flight data and are distributed to other functional blocks for use in controller tools and for display at the CWP, and also to external systems (Airports, Air defence, etc.). The Surveillance functional block may also receive weather data from PSR sources, which it distributes for display at the CWP.
Transfer RPA Flight to OAT MIL Control	Transfer RPA Flight to OAT MIL Control
Transfer RPAs Flight Control to the Next ATC Unit	Transfer RPAs Flight Control to the Next ATC Unit
Transmit Information upon an Interrogation Mode.	Provides multiple information formats to a selective interrogation

Table 48: Solution 115 Roles & Functional Blocks IFR RPAS Nominal Operations

Functions Description:

Function	Description
Acknowledges and Command to Execute ATC Clearance	Remote Pilot Acknowledges ATC Clearance and Command to the RPA to implement the trajectory update.
Acknowledges and Command to Resume Flight Plan	Acknowledges and Command to Resume Flight Plan
Assume control of flight after contacting RP	ATCO assumes control of the flight and may now issue ATC clearances and instructions to the flight.
Compose and Send Coordination Message to Downstream Adjacent Centre	Compose and Send Coordination Message to Downstream Adjacent Centre
Compose and Send Coordination Message to OAT MIL Control Centre	Compose and Send Coordination Message to OAT MIL Control Centre
Continue Flying Nominal Flight Plan	Flight Management System function to command to the autopilot to fly the nominal flight plan previous to the C2 link loss contingency
Display Conflicts between RPA and other Traffic	Display Conflicts between RPA and other Traffic
Display Coordination Dialogue	Display Coordination Dialogue
Display RPA Flight Label as Entry Flight	Once RPA is under an adapted parameter distance to the boundary of the incoming ATC sector, RPA Flight Label appears as entry flight to the next ATCO to control the flight
Initiate Contact with Civil ATS Unit	Remote Pilot initiate contact with Civil ATS Unit, to readback the sector frequency, and callsign and flight level to the ATCO

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Initiate Contact with OAT ATS Unit	Remote Pilot initiate contact with OAT ATS Unit, to readback the sector frequency, and callsign and flight level to the ATCO
Provide Communications through Nominal ATC Voice Radio	Provide Communications through Nominal ATC Voice Radio
Provide Nominal Communications through ATC Voice Radio	Provide Nominal Communications through ATC Voice Radio
Separate Other Traffic from RPA	ATCO will separate other traffics from the RPA
Surveillance	The Surveillance functional block merges traffic data provided by surveillance sources (PSR, SSR, ADS-C for oceanic flights, ADS-B, WAM) to provide a unique, system-wide reference of the actual air traffic situation. The resultant system tracks are supplemented with flight data and are distributed to other functional blocks for use in controller tools and for display at the CWP, and also to external systems (Airports, Air defence, etc.). The Surveillance functional block may also receive weather data from PSR sources, which it distributes for display at the CWP.
Transfer RPA Flight to OAT MIL Control	Transfer RPA Flight to OAT MIL Control
Transfer RPAs Flight Control to the Next ATC Unit	Transfer RPAs Flight Control to the Next ATC Unit
Transmit Information upon an Interrogation Mode.	Provides multiple information formats to a selective interrogation

Table 49: Solution 115 Functions Description IFR RPAS Nominal Operations

B.2.1.3 Resource Connectivity View for Contingency Operations

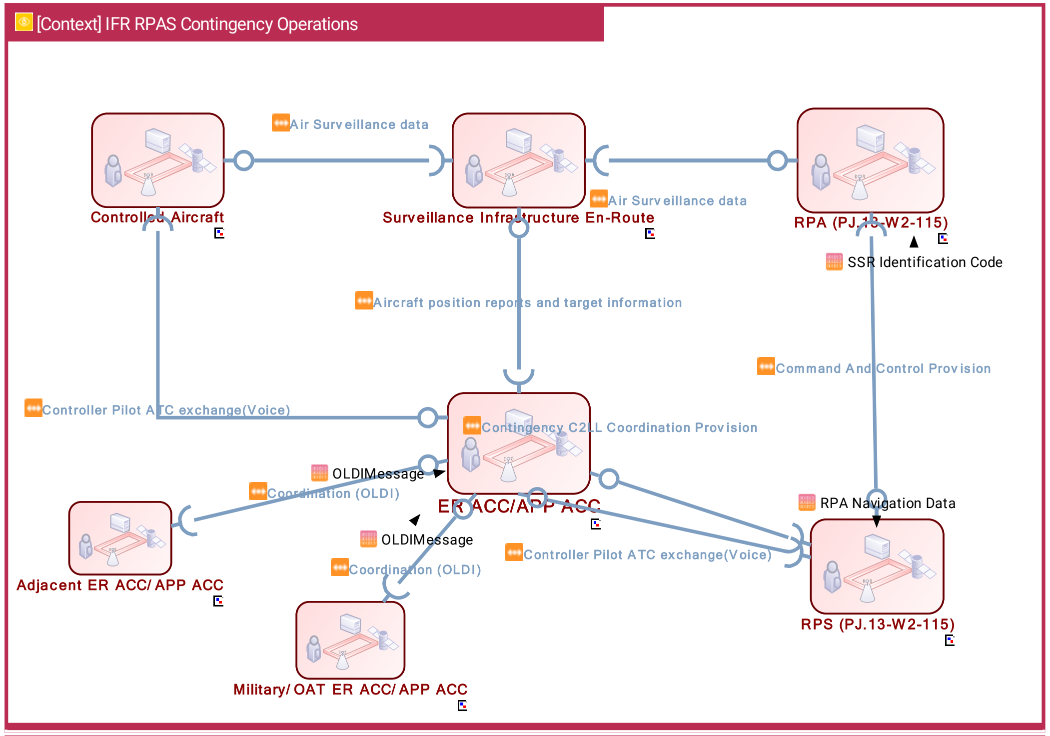
Presentation:

This contextual view represent the interactions between capabilities configurations needed to support the necessary information exchanges for the Contingency Operations Use Case already described in the operational views.

No new services are contemplated for this use case, the legacy interactions are represented through the resource interactions introduced in this view:

- Command and Control resource interaction:
    - Already described in the STANAG 4660 standard.
    - Added the messages of the new SSR Code provided by the RPS to the RPA when normal mode is re-established from contingency mode.
    - Added the messages of RPA Air Navigation Data provided by the RPA to RPS through the C2 Link.

- Contingency C2LL resource interaction:
    - Voice exchange through a telephone line between the ATCO and the RPA Pilot to coordinate the contingency situation.



[NSV-4] IFR RPAS Contingency Operations [Aircraft, ATC Executive Controller (PJ.13-W2-115), ATC Executive Controller (PJ.13-W2-115), ATC Executive Controller (PJ.13-W2-115), ATC Planning Controller (PJ.13-W2-115), Command and Control (PJ.13-W2-115), Conflict management (PJ.13-W2-115), Controlled Aircraft (PJ.13-W2-115), Controller Human Machine Interaction Management ER/APP (PJ.13-W2-115), Controller Human Machine Interaction Management ER/APP (PJ.13-W2-115), Coordination and Transfer, Coordination and Transfer, Coordination and Transfer (PJ.13-W2-115), Correlation Management, Correlation Management (PJ.13-W2-115), En-Route / Approach ATC (PJ.13-W2-115), En-Route / Approach ATC (PJ.13-W2-115), Flight Control Computer, Flight Control Computer (PJ.13-W2-115), Ground Control Station, Remote Flight Crew (PJ.13-W2-115), RPS, Surveillance Infrastructure TMA/En-Route (PJ.13-W2-115), Voice, Voice (PJ.13-W2-115)]

Figure 20 : EATMA [NSV-1] Context IFR RPAS Contingency Operations

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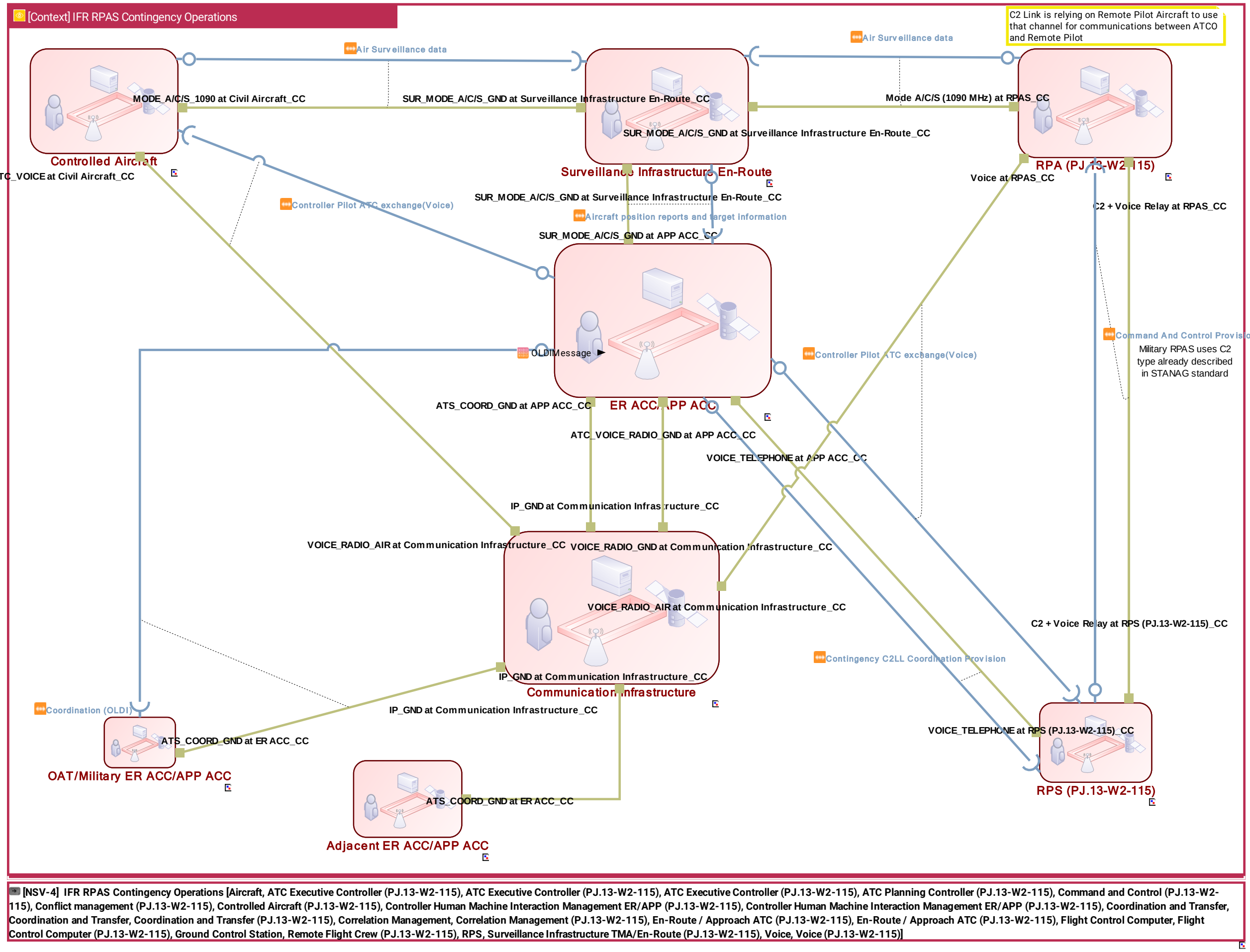

Figure 21 : EATMA [NSV-2] Context IFR RPAS Contingency Operations

B.2.1.3.1 Resource Infrastructure View

Not Applicable.

B.2.1.3.2 Resource Orchestration View

B.2.1.3.2.1 [NSV4] IFR RPAS Contingency Operations

Presentation:

This view describes the systems resources providing existing functionalities to support the Use Case described within the Activity view '[NOV5] IFR RPAS Contingency Operations'. No major new functionalities will be necessary to support the RPAS Accommodation concept.

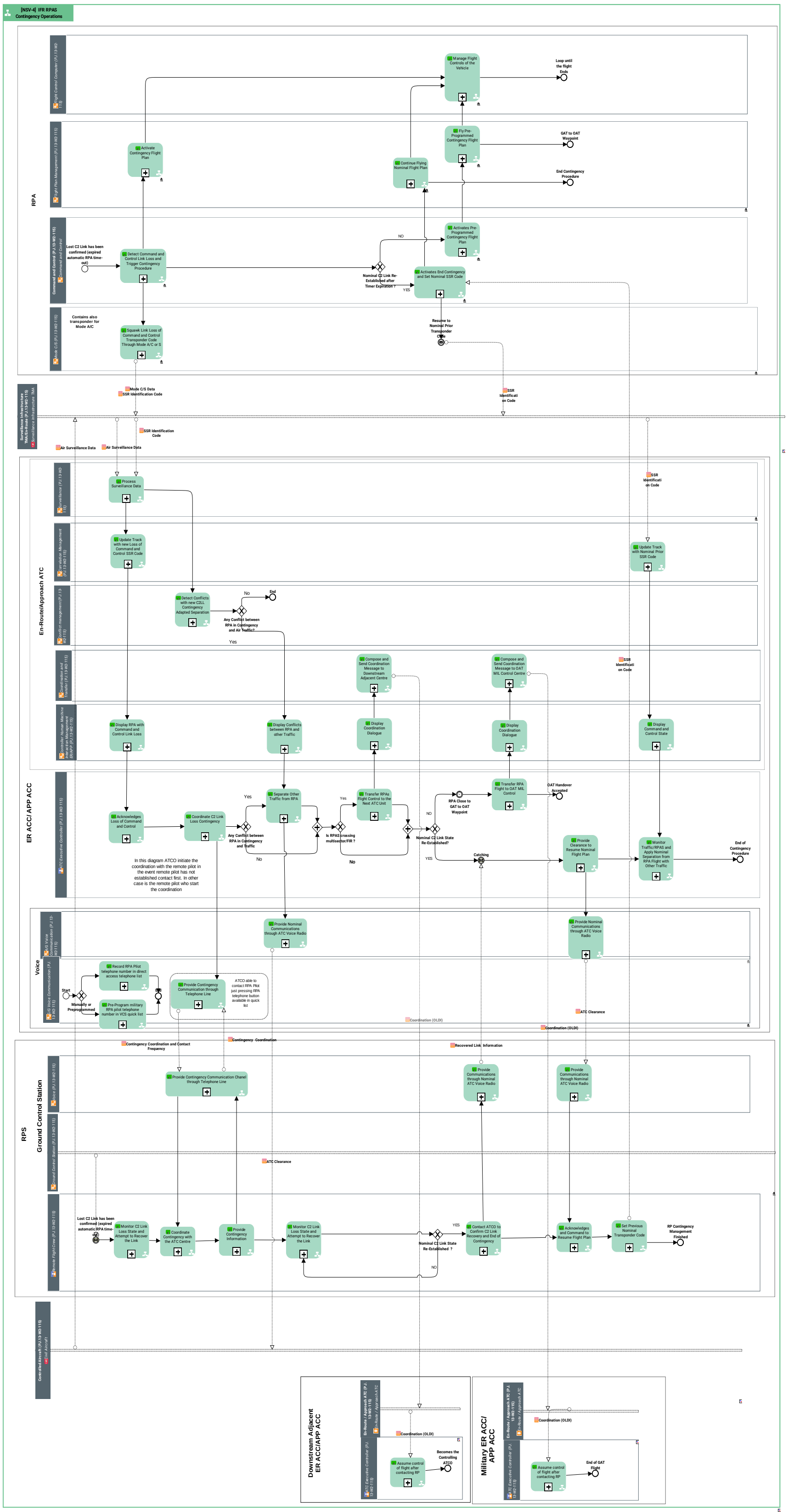

Figure 22 : EATMA [NSV-4] IFR RPAS Contingency Functional Diagram

Functions by Role and Functional Block:

Role	Functional Block	Function
ATC Executive Controller (PJ.13-W2-115)		Acknowledges Loss of Command and Control; Coordinate C2 Link Loss Contingency; Monitor Traffic/RPAS and Apply Nominal Separation from RPA Flight with Other Traffic; Provide Clearance to Resume Nominal Flight Plan; Separate Other Traffic from RPA; Transfer RPA Flight to OAT MIL Control; Transfer RPAs Flight Control to the Next ATC Unit;
ATC Executive Controller (PJ.13-W2-115)		Assume control of flight after contacting RP;
ATC Executive Controller (PJ.13-W2-115)		Assume control of flight after contacting RP;
	Command and Control	Activates End Contingency and Set Nominal SSR Code; Activates Pre-Programmed Contingency Flight Plan; Detect Command and Control Link Loss and Trigger Contingency Procedure; Squawk Link Loss of Command and Control Transponder Code Through Mode A/C or S; Task; Task; Task; Task;
	Conflict management (PJ.13-W2-115)	

	Controller Human Machine Interaction Management ER/APP (PJ.13-W2-115)	Task; Task; Display Command and Control State; Display Command and Control State; Display Conflicts between RPA and other Traffic; Display Coordination Dialogue; Display Coordination Dialogue; Display RPA with Command and Control Link Loss;
	Controller Human Machine Interaction Management ER/APP (PJ.13-W2-115)	
	Coordination and Transfer	Coordination and Transfer;
	Coordination and Transfer (PJ.13-W2-115)	Compose and Send Coordination Message to Downstream Adjacent Centre; Compose and Send Coordination Message to OAT MIL Control Centre;
	Correlation Management	Update Track with Nominal Prior SSR Code; Update Track with new Loss of Command and Control SSR Code;
	Correlation Management (PJ.13-W2-115)	Update Track with new Loss of Command and Control SSR Code; Update Track with new Loss of Command and Control SSR Code; Update Track with Nominal Prior SSR Code;
	Flight Control Computer (PJ.13-W2-115)	Manage Flight Controls of the Vehicle;
	Ground Control Station	Task; Task;

		Task;
Remote Flight Crew (PJ.13-W2-115)		Acknowledges and Command to Resume Flight Plan; Contact ATCO to Confirm C2 Link Recovery and End of Contingency; Coordinate Contingency with the ATC Centre; Monitor C2 Link Loss State and Attempt to Recover the Link; Monitor C2 Link Loss State and Attempt to Recover the Link; Provide Contingency Information; Set Previous Nominal Transponder Code;
	Voice (PJ.13-W2-115)	Provide Communications through Nominal ATC Voice Radio; Provide Communications through Nominal ATC Voice Radio; Provide Contingency Communication Chanel through Telephone Line;

Table 50: Solution 115 Roles & Functional Blocks IFR RPAS Contingency Operations

Functions Description:

Function	Description
Acknowledges and Command to Resume Flight Plan	Acknowledges and Command to Resume Flight Plan
Acknowledges Loss of Command and Control	ATCO acknowledges to the Remote Pilot the loss of command and control of Remote Piloted Aircraft.
Airborne Lateral Navigation (LNAV)	Steering of the in-flight lateral portion of A/C trajectory.
Assume control of flight after contacting RP	ATCO assumes control of the flight and may now issue ATC clearances and instructions to the flight.
Compose and Send Coordination Message to Downstream Adjacent Centre	Compose and Send Coordination Message to Downstream Adjacent Centre
Compose and Send Coordination Message to OAT MIL Control Centre	Compose and Send Coordination Message to OAT MIL Control Centre
Contact ATCO to Confirm C2 Link Recovery and End of Contingency	Contact ATCO to Confirm C2 Link Recovery and End of Contingency
Continue Flying Nominal Flight Plan	Flight Management System function to command to the autopilot to fly the nominal flight plan previous to the C2 link loss contingency
Coordinate C2 Link Loss Contingency	ATCO initiate contingency coordination with the remote pilot in case the remote pilot has not established contact with the ATCO. Also Remote Pilot can initiate the contingency coordination to inform of the C2 link loss and the possibility provide the contingency information

Coordinate Contingency with the ATC Centre	Coordinate Contingency with the ATC Centre
Detect Conflicts with new C2LL Contingency Adapted Separation	Detect Conflicts with new C2LL Contingency Adapted Separation
Display Command and Control State	HMI highlights a track (RPA) that is having loss of command and control (squawking 7400).
Display Conflicts between RPA and other Traffic	Display Conflicts between RPA and other Traffic
Display Coordination Dialogue	Display Coordination Dialogue
Display RPA with Command and Control Link Loss	Display in the flight label of the controller human machine display the contingency C2 link loss SSR code and the contingency situation for that RPA flight
Fly the RPAS according to the RA	To fly the RPAS according to the RA
Monitor C2 Link Loss State and Attempt to Recover the Link	Monitor C2 Link Loss State and Attempt to Recover the Link
Monitor Traffic/RPAS and Apply Nominal Separation from RPA Flight with Other Traffic	Monitor Traffic/RPAS and Apply Nominal Separation from RPA Flight with Other Traffic
Pre-Program military RPA pilot telephone number in VCS quick list	Pre-Program military RPA pilot telephone number in VCS quick list
Process Surveillance Data	This function merges traffic data provided by surveillance sources (PSR, SSR, ADS-C for oceanic flights, ADS-B, WAM) to provide a unique, system-wide reference of the actual air traffic situation.

Provide Clearance to Resume Nominal Flight Plan	Monitor Traffic/RPAS and Apply Nominal Separation from RPA Flight with Other Traffic
Provide Communications through Nominal ATC Voice Radio	Provide Communications through Nominal ATC Voice Radio
Provide Contingency Communication Chanel through Telephone Line	This function is allocated to the available telephone line located at the Remote Pilot Ground Station
Provide Contingency Communication through Telephone Line	This function is allocated to the available telephone line located at the ATC Centre
Provide Contingency Information	Provide Contingency Information
Provide Nominal Communications through ATC Voice Radio	Provide Nominal Communications through ATC Voice Radio
Record RPA Pilot telephone number in direct access telephone list	This functionality allows to manually register the RPA Pilot telephone number within the quick access telephone list available to the ATCO voice system display
Separate Other Traffic from RPA	ATCO will separate other traffics from the RPA
Set Previous Nominal Transponder Code	Set Previous Nominal Transponder Code
Transfer RPA Flight to OAT MIL Control	Transfer RPA Flight to OAT MIL Control
Transfer RPAs Flight Control to the Next ATC Unit	Transfer RPAs Flight Control to the Next ATC Unit

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Update Track with new Loss of Command and Control SSR Code	Performs a track update when it receives the new Loss of Command and Control SSR Code. If FP is not eligible it is automatically decorrelated.
Update Track with Nominal Prior SSR Code	Update Track with Nominal Prior SSR Identification four digits Octal Code

Table 51: Solution 115 Functions Description IFR RPAS Contingency Operations

B.2.1.4 Resource Connectivity View for Emergency Operations

Presentation:

This contextual view represent the interactions between capability configurations needed to support the necessary information exchanges for the Emergency Operations Use Case already described in the operational views.

The new or updated resource interactions introduced in this view are:

- Command and Control resource interaction:
    - Added the messages related to the RPA Emergency, RPA Emergency Trajectory, Engine Failure, Trajectory Update, ACK RPAS Emergency Trajectory.

- RPAS Emergency Coordination Resource interaction:
    - Provision of the RPAS Emergency Trajectory from the RPS or from State AU Operation Centre, to the Civil or Military ATC Centre or to the Tower Centre.

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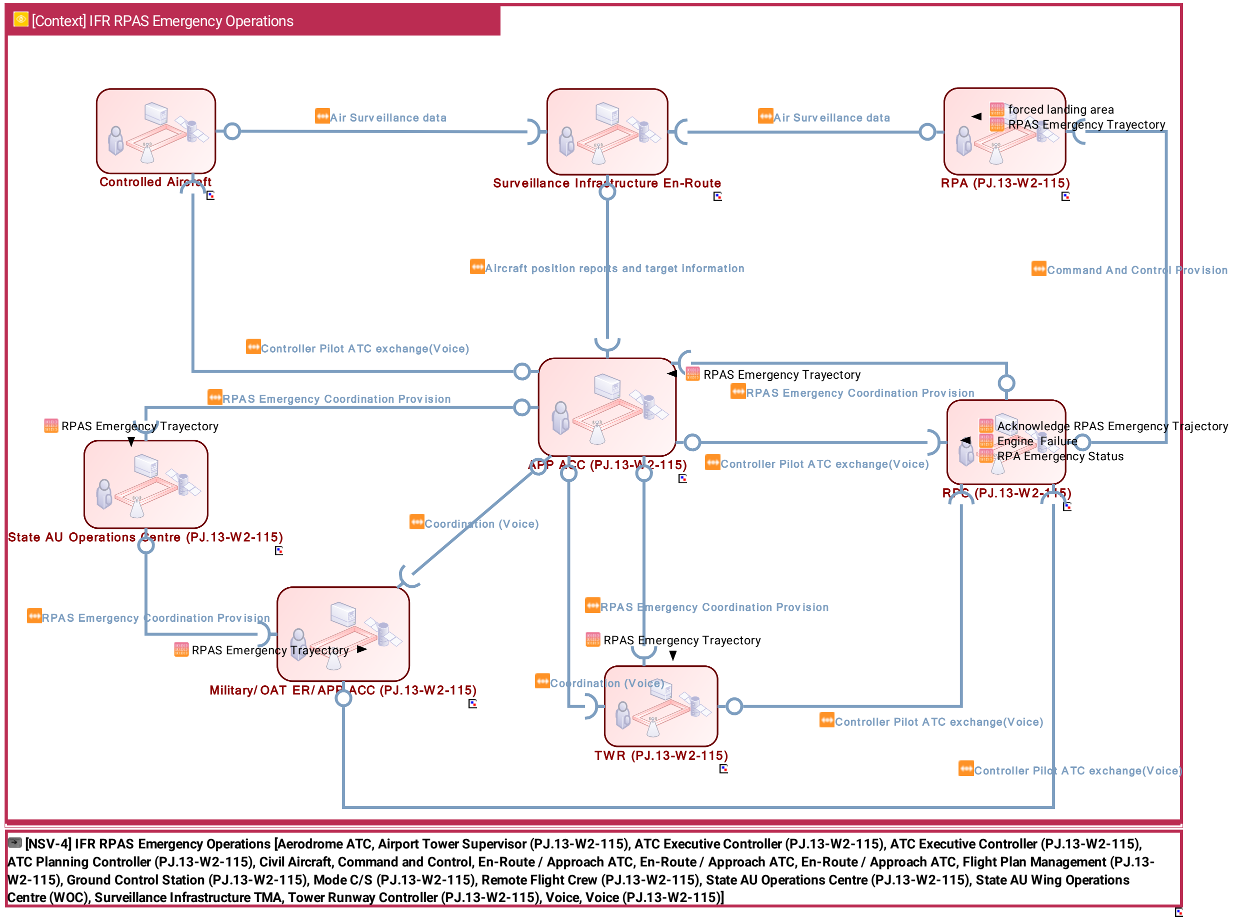

Figure 23 : EATMA [NSV-1] Context IFR RPAS Emergency Operations

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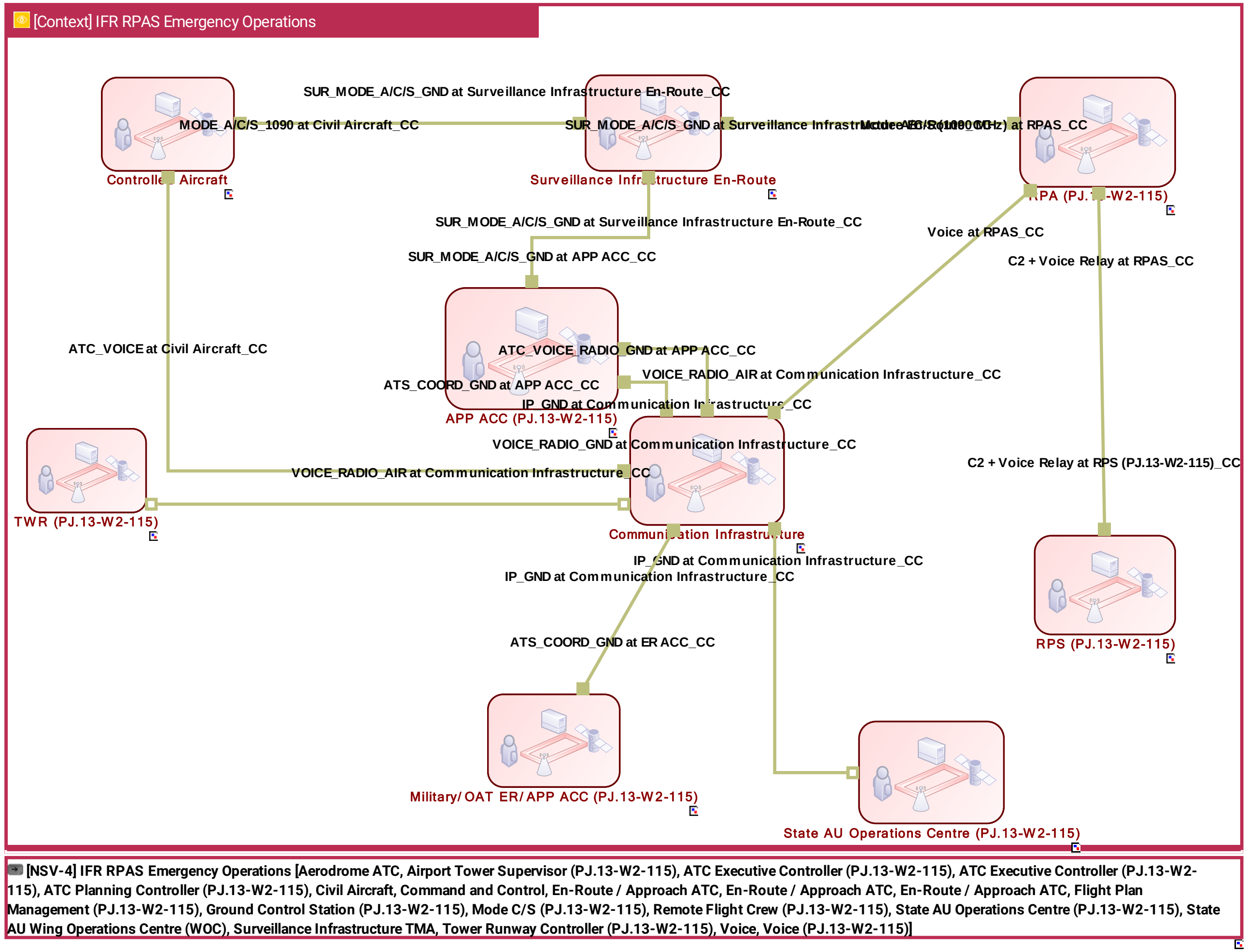

Figure 24 : EATMA [NSV-2] Context IFR RPAS Emergency Operations

B.2.1.4.1 Resource Infrastructure View

Not Applicable.

B.2.1.4.2 Resource Orchestration View

B.2.1.4.2.1 [NSV4] IFR RPAS Emergency Operations

Presentation:

This view describes the systems resources providing already existing functionalities to support the Use Case described within the Activity view '[NOV5] IFR RPAS Emergency Operations'. No major new functionalities will be necessary to support the RPAS Accommodation concept.

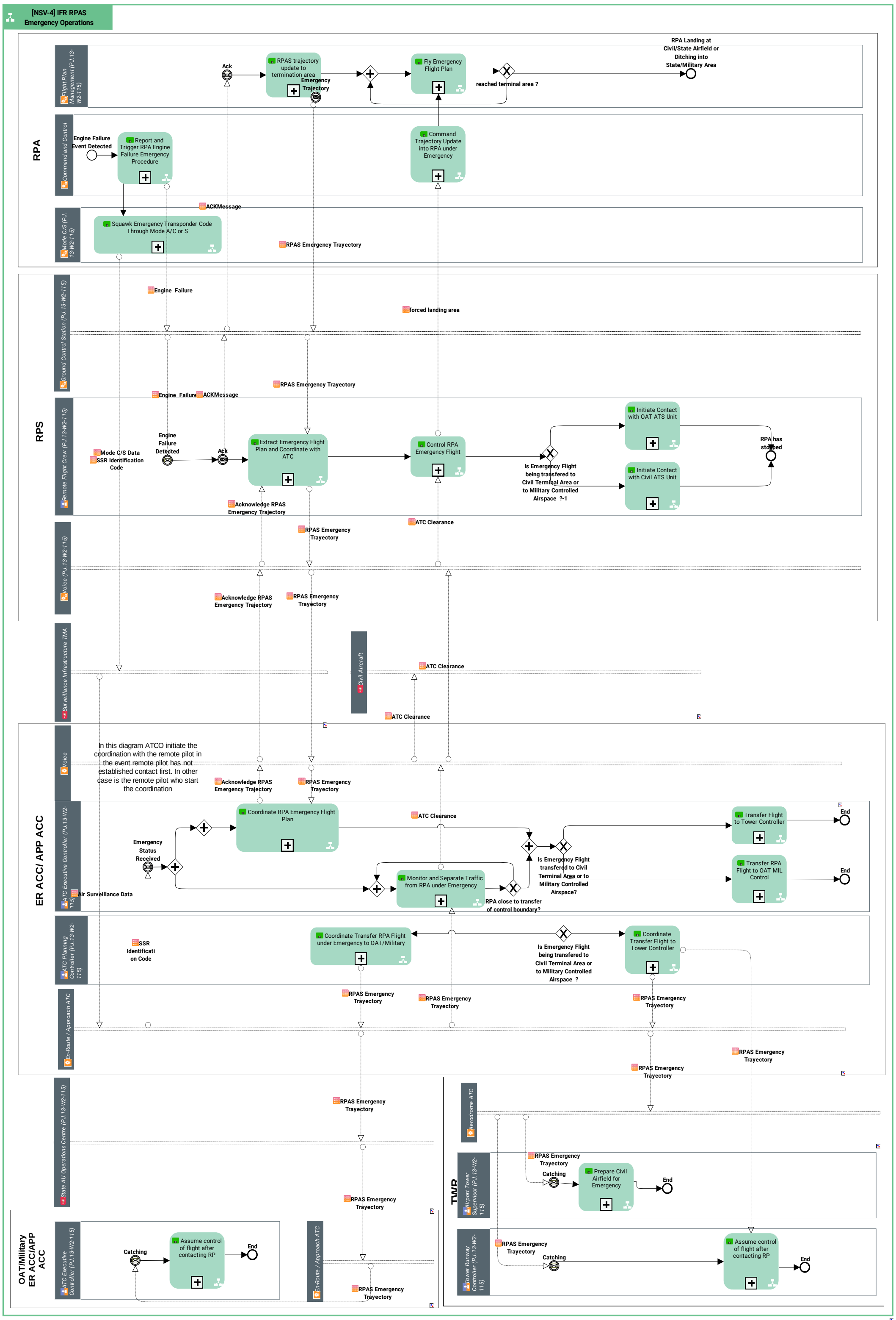

Figure 25 : EATMA [NSV-4] IFR RPAS Emergency Functional Diagram

Functions by Role and Functional Block:

Role	Functional Block	Function
Airport Tower Supervisor (PJ.13-W2-115)		Prepare Civil Airfield for Emergency;
ATC Executive Controller (PJ.13-W2-115)		Assume control of flight after contacting RP;
ATC Executive Controller (PJ.13-W2-115)		Coordinate RPA Emergency Flight Plan; Monitor and Separate Traffic from RPA under Emergency; Transfer Flight to Tower Controller; Transfer RPA Flight to OAT MIL Control;
ATC Planning Controller (PJ.13-W2-115)		Coordinate Transfer Flight to Tower Controller; Coordinate Transfer RPA Flight under Emergency to OAT/Military;
	Command and Control	Command Trajectory Update into RPA under Emergency; Report and Trigger RPA Engine Failure Emergency Procedure;
	Flight Plan Management (PJ.13-W2-115)	Fly Emergency Flight Plan; RPAS trajectory update to termination area;
	Mode C/S (PJ.13-W2-115)	Squawk Emergency Transponder Code Through Mode A/C or S;
Remote Flight Crew (PJ.13-W2-115)		Command Trajectory Update into RPA under Emergency; Control RPA Emergency Flight; Extract Emergency Flight Plan and Coordinate with ATC; Initiate Contact with Civil ATS Unit; Initiate Contact with OAT ATS Unit;
Tower Runway Controller (PJ.13-W2-115)		Assume control of flight after contacting RP;

Table 52: Solution 115 Roles & Functional Blocks IFR RPAS Emergency Operations

Functions Description:

Function	Description
Assume control of flight after contacting RP	ATCO assumes control of the flight and may now issue ATC clearances and instructions to the flight.
Command Trajectory Update into RPA under Emergency	Command Trajectory Update into RPA under Emergency
Control RPA Emergency Flight	Control RPA Emergency Flight
Coordinate RPA Emergency Flight Plan	Coordinate RPA Emergency Flight Plan
Coordinate Transfer Flight to Tower Controller	Coordinate Transfer Flight to Tower Controller
Coordinate Transfer RPA Flight under Emergency to OAT/Military	Coordinate Transfer RPA Flight under Emergency to OAT/Military
Extract Emergency Flight Plan and Coordinate with ATC	Extract Emergency Flight Plan and Coordinate with ATC
Fly Emergency Flight Plan	Flight Management System function to Fly the specific Emergency Flight Plan
Initiate Contact with Civil ATS Unit	Remote Pilot initiate contact with Civil ATS Unit, to readback the sector frequency, and callsign and flight level to the ATCO
Initiate Contact with OAT ATS Unit	Remote Pilot initiate contact with OAT ATS Unit, to readback the sector frequency, and callsign and flight level to the ATCO
Monitor and Separate Traffic from RPA under Emergency	Monitor and Separate Traffic from RPA under Emergency

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Prepare Civil Airfield for Emergency	Implemented by Civil Airport Supervisor allows to provide list of actions and relevant information (Time of arrival on area) to Civil ATS Aerodrome Service Provider.
Report and Trigger RPA Engine Failure Emergency Procedure	Command and Control functionality to Report Engine Failure Emergency Procedure after the Engine Failure Emergency event has been triggered
RPAS trajectory update to termination area	Extract and/or Update Emergency Flight Plan
Squawk Emergency Transponder Code Through Mode A/C or S	Squawk Emergency Transponder Code Through Mode A/C or S
Transfer Flight to Tower Controller	Transfer Flight to Tower Controller
Transfer RPA Flight to OAT MIL Control	Transfer RPA Flight to OAT MIL Control

Table 53: Solution 115 Functions Description IFR RPAS Emergency Operations

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B.2.1.5 Resource Composition

B.2.1.5.1 Remote Pilot Station (PJ13-W2-115)

This technical system allows Remote Pilot to perform all the on-board AU operations transmitting/receiving data to the Remote Piloted Aircraft.

B.2.1.5.1.1 Composition

B.2.1.5.1.2 System Interfaces Diagram

Not Applicable.

B.2.1.5.2 Remotely Piloted Aircraft (PJ.13-W2-115)

It represents the vehicle (aircraft) which is piloted by the Remote Pilot using a Remote Pilot Station

B.2.1.5.2.1 Composition

B.2.1.5.2.2 System Interfaces Diagram

Not Applicable.

B.2.1.6 Service View

B.2.1.6.1 Service Description

Service	Service description
ExtendedFlightPlanSubmission	The Submission service supports the Airspace User to: - request the validation of an Extended Flight Plan (FPL) message before its submission; - request the submission of Extended FPL/Extended Modification/Extended Delay message; - request the cancellation of an Extended Flight Plan; to the Network Manager and supports the Network Manager to: - send the reply of the validation request (ACK, REJ) to the Airspace User; - send the reply of the submission request (ACK, MAN, REJ) to the Airspace User; - send the status of a specific flight plan to the Airspace User and ATC units. The status may be “Suspended” or “De-suspended”.
FlightPlanDataDistribution	The FlightPlanDataDistribution Service supports the service provider (Network Manager) to: - send a copy of a valid Extended Flight Plan (EFPL) message, Extended Modification (ECHG) message, Extended Delay (EDLA) message to the service consumers concerned by the flight that want to receive extended flight plan messages; - send to all of other service consumers concerned by the flight only a copy of the ICAO Flight Plan included in the EFPL message or a copy of a ‘simple’ modification (CHG) message or a copy of a ‘simple’ delay (DLA) message; - notify to the service consumers the cancellation of a specified flight plan; - send a specific Flight Plan (in Extended or ICAO format) following a specific request from a service consumer.
OATFlightDataDistribution	Service to provide the interfaces for the distribution of OAT Flight Data from NM to the consumers of that information. The NM consumes the service but provides the data. The Consumers of the data provide the service.
OATFlightPlanSubmission	The OAT Flight Plan Submission service supports the State user (usually the WOC), in enabling them to validate and then inform, the NM of its intention to operate one or more aircraft on a flight operating under OAT flight rules. The OAT Flight Plan is communicated to the NM for validation and onward distribution based on internal rules and the trajectory of the flight.

Table 54: Solution 115 Services Description

B.2.1.6.2 Service Provisioning

Interaction	Consumer CC	Consumer System	Provider CC	Provider System
RPAS Emergency Coordination Provision	APP ACC (PJ.13-W2-115)		RPS (PJ.13-W2-115)	
RPAS Emergency Coordination Provision	Military/OAT ER/APP ACC (PJ.13-W2-115)		State AU Operations Centre (PJ.13-W2-115)	
RPAS Emergency Coordination Provision	TWR (PJ.13-W2-115)		APP ACC (PJ.13-W2-115)	
Coordination (Voice)	Military/OAT ER/APP ACC (PJ.13-W2-115)	Voice;	APP ACC (PJ.13-W2-115)	En-Route / Approach ATC; Voice;
Air Surveillance data	Surveillance Infrastructure En-Route	Secondary Radar; ADS-B Ground Station; Wide Area Multilateration;	Controlled Aircraft	Aircraft;
Command And Control Provision	RPA (PJ.13-W2-115)		RPS (PJ.13-W2-115)	
Controller Pilot ATC exchange(Voice)	RPS (PJ.13-W2-115)		TWR (PJ.13-W2-115)	Voice;
Air Surveillance data	Surveillance Infrastructure En-Route	Secondary Radar; ADS-B Ground Station; Wide Area Multilateration;	RPA (PJ.13-W2-115)	Remotely Piloted Aircraft (PJ.13-W2-115);
Controller Pilot ATC exchange(Voice)	Controlled Aircraft	Aircraft;	APP ACC (PJ.13-W2-115)	Voice;
Coordination (Voice)	TWR (PJ.13-W2-115)	Voice;	APP ACC (PJ.13-W2-115)	En-Route / Approach ATC; Voice;
RPAS Emergency Coordination Provision	State AU Operations Centre (PJ.13-W2-115)		APP ACC (PJ.13-W2-115)	
Aircraft position reports and target information	APP ACC (PJ.13-W2-115)	En-Route / Approach ATC;	Surveillance Infrastructure En-Route	Secondary Radar; ADS-B Ground Station; Wide Area Multilateration; Primary Radar;
Controller Pilot ATC exchange(Voice)	RPS (PJ.13-W2-115)		APP ACC (PJ.13-W2-115)	Voice;

Interaction	Consumer CC	Consumer System	Provider CC	Provider System
Controller Pilot ATC exchange(Voice)	RPS (PJ.13-W2-115)		Military/OAT ER/APP ACC (PJ.13-W2-115)	Voice;
Aircraft position reports and target information	ER ACC/APP ACC	En-Route / Approach ATC;	Surveillance Infrastructure En-Route	Secondary Radar; ADS-B Ground Station; Wide Area Multilateration; Primary Radar;
Aircraft position reports and target information	ER ACC/APP ACC	En-Route / Approach ATC;	Surveillance Infrastructure En-Route	Secondary Radar; ADS-B Ground Station; Wide Area Multilateration; Primary Radar;
Air Surveillance data	Surveillance Infrastructure En-Route	Secondary Radar; ADS-B Ground Station; Wide Area Multilateration;	Controlled Aircraft	Aircraft;
Controller Pilot ATC exchange(Voice)	RPS (PJ.13-W2-115)		ER ACC/APP ACC	Voice;
Controller Pilot ATC exchange(Voice)	Controlled Aircraft	Aircraft;	ER ACC/APP ACC	Voice;
Air Surveillance data	Surveillance Infrastructure En-Route	Secondary Radar; ADS-B Ground Station; Wide Area Multilateration;	RPA (PJ.13-W2-115)	Remotely Piloted Aircraft (PJ.13-W2-115);
Coordination (OLDI)	Adjacent ER ACC/APP ACC	En-Route / Approach ATC;	ER ACC/APP ACC	En-Route / Approach ATC;
Coordination (OLDI)	Military/OAT ER ACC/APP ACC	En-Route / Approach ATC;	ER ACC/APP ACC	En-Route / Approach ATC;
FPL	Military/OAT ER ACC/APP ACC	En-Route / Approach ATC;	ER ACC/APP ACC	En-Route / Approach ATC;
RPAS Mission Plan Provision	State AU Operations Centre (PJ.13-W2-115)		RPS (PJ.13-W2-115)	
FPL	State AU Operations Centre (PJ.13-W2-115)		RPS (PJ.13-W2-115)	
FPL	State AU Operations Centre (PJ.13-W2-115)		RPS (PJ.13-W2-115)	

Interaction	Consumer CC	Consumer System	Provider CC	Provider System
FPL	State AU Operations Centre (PJ.13-W2-115)		RPS (PJ.13-W2-115)	
FPL	State AU Operations Centre (PJ.13-W2-115)		RPS (PJ.13-W2-115)	
Command And Control Provision	RPA (PJ.13-W2-115)		RPS (PJ.13-W2-115)	
Coordination (OLDI)	OAT/Military APP ACC/ ER ACC (PJ.13-W2-115)	En-Route / Approach ATC;	ER ACC / APP ACC (PJ.13-W2-115)	En-Route / Approach ATC;
Coordination (Voice)	Adjacent ER ACC/ APP ACC (PJ.13-W2-115)	En-Route / Approach ATC; Voice;	ER ACC / APP ACC (PJ.13-W2-115)	En-Route / Approach ATC; Voice;
Command And Control Provision	RPA (PJ.13-W2-115)		RPS (PJ.13-W2-115)	
Controller Pilot ATC exchange(Voice)	RPS (PJ.13-W2-115)		ER ACC / APP ACC (PJ.13-W2-115)	Voice;
Air Surveillance data	Surveillance Infrastructure En-Route	Secondary Radar; ADS-B Ground Station; Wide Area Multilateration;	Controlled Aircraft	Aircraft;
Controller Pilot ATC exchange(Voice)	Controlled Aircraft	Aircraft;	ER ACC / APP ACC (PJ.13-W2-115)	Voice;
Air Surveillance data	Surveillance Infrastructure En-Route	Secondary Radar; ADS-B Ground Station; Wide Area Multilateration;	RPA (PJ.13-W2-115)	Remotely Piloted Aircraft (PJ.13-W2-115);
Aircraft position reports and target information	ER ACC / APP ACC (PJ.13-W2-115)	En-Route / Approach ATC;	Surveillance Infrastructure En-Route	Secondary Radar; ADS-B Ground Station; Wide Area Multilateration; Primary Radar;
Coordination (OLDI)	OAT/Military ER ACC/APP ACC	En-Route / Approach ATC;	ER ACC/APP ACC	En-Route / Approach ATC;
Command And Control Provision	RPA (PJ.13-W2-115)		RPS (PJ.13-W2-115)	
Air Surveillance data	Surveillance Infrastructure En-Route	Secondary Radar; ADS-B Ground Station; Wide Area Multilateration;	Controlled Aircraft	Aircraft;

Interaction	Consumer CC	Consumer System	Provider CC	Provider System
Air Surveillance data	Surveillance Infrastructure En-Route	Secondary Radar; ADS-B Ground Station; Wide Area Multilateration;	RPA (PJ.13-W2-115)	Remotely Piloted Aircraft (PJ.13-W2-115);
Contingency C2LL Coordination Provision	RPS (PJ.13-W2-115)		ER ACC/APP ACC	
Controller Pilot ATC exchange(Voice)	RPS (PJ.13-W2-115)		ER ACC/APP ACC	Voice;
Contingency C2LL Coordination Provision	RPS (PJ.13-W2-115)		ER ACC/APP ACC	
Controller Pilot ATC exchange(Voice)	Controlled Aircraft	Aircraft;	ER ACC/APP ACC	Voice;

Table 55: Solution 115 Service Provisioning

B2.1.6.3 Service Realization

B2.1.6.3.1 Interaction Air Surveillance data

System Port: Mode A/C/S (1090 MHz) at RPAS_CC

Protocol Stack	Protocol
Mode A/C/S 1090MHz	
	DF00
	DF04
	DF05
	DF11
	DF16
	DF20
	DF21
	DF24

System Port: SUR_MODE_A/C/S_GND at Surveillance Infrastructure En-Route_CC

Protocol Stack	Protocol
Surveillance radar target reports	
	Asterix Cat01
	Asterix Cat48
	UDP
	IP

B2.1.6.3.2 Interaction Air Surveillance data

B2.1.6.3.3 Interaction Air Surveillance data

B2.1.6.3.4 Interaction Air Surveillance data

System Port: SUR_MODE_A/C/S_GND at Surveillance Infrastructure En-Route_CC

Protocol Stack	Protocol
Surveillance radar target reports	
	Asterix Cat01
	Asterix Cat48
	UDP
	IP

System Port: MODE_A/C/S_1090 at Civil Aircraft_CC

Protocol Stack	Protocol
Mode A/C/S 1090MHz	
	DF00
	DF04
	DF05
	DF11
	DF16
	DF20
	DF21
	DF24

B2.1.6.3.5 Interaction Aircraft position reports and target information

B2.1.6.3.6 Interaction Aircraft position reports and target information

System Port: SUR_MODE_A/C/S_GND at APP ACC_CC

Protocol Stack	Protocol
Surveillance radar target reports	
	Asterix Cat01
	Asterix Cat48
	UDP
	IP

System Port: SUR_MODE_A/C/S_GND at Surveillance Infrastructure En-Route_CC

Protocol Stack	Protocol
Surveillance radar target reports	
	Asterix Cat01
	Asterix Cat48
	UDP
	IP

B2.1.6.3.7 Interaction Command And Control Provision

B2.1.6.3.8 Interaction Command And Control Provision

B2.1.6.3.9 Interaction Command And Control Provision

System Port: C2 + Voice Relay at RPS (PJ.13-W2-115)_CC

Protocol Stack	Protocol

System Port: C2 + Voice Relay at RPAS_CC

Protocol Stack	Protocol

B2.1.6.3.10 Interaction Contingency C2LL Coordination Provision

System Port: VOICE_TELEPHONE at RPS (PJ.13-W2-115)_CC

Protocol Stack	Protocol

System Port: VOICE_TELEPHONE at APP ACC_CC

Protocol Stack	Protocol
Voice Telephone	
	PSTN

B2.1.6.3.11 Interaction Contingency C2LL Coordination Provision

B2.1.6.3.12 Interaction Controller Pilot ATC exchange(Voice)

System Port: VOICE_RADIO_AIR at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice air	
	VHF - AM 25kHz/8.33kHz
	HF - AM 25kHz
OPC (Operational) Voice air	
	VHF
	HF (selcal)

NOTE : inherited data ; Only VHF for ATC voice cummunications is expected to be used during accommodation

System Port: ATC_VOICE at Civil Aircraft_CC

Protocol Stack	Protocol

ATC Voice air	
	VHF - AM 25kHz/8.33kHz
	HF - AM 25kHz

NOTE : inherited data ; Only VHF for ATC voice cummunications is expected to be used during accommodation

B2.1.6.3.13 Interaction Controller Pilot ATC exchange(Voice)

B2.1.6.3.14 Interaction Controller Pilot ATC exchange(Voice)

B2.1.6.3.15 Interaction Controller Pilot ATC exchange(Voice)

System Port: ATC_VOICE_RADIO_GND at APP ACC_CC

Protocol Stack	Protocol
Voice Radio	
	4/6/8-wire E_M

System Port: C2 + Voice Relay at RPAS_CC

Protocol Stack	Protocol

System Port: Voice at RPAS_CC

Protocol Stack	Protocol

System Port: VOICE_RADIO_AIR at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice air	
	VHF - AM 25kHz/8.33kHz
	HF - AM 25kHz
OPC (Operational) Voice air	
	VHF
	HF (selcal)

NOTE : inherited data ; Only VHF for ATC voice cummunications is expected to be used during accommodation

B2.1.6.3.16 Interaction Coordination (OLDI)

B2.1.6.3.17 Interaction Coordination (OLDI)

B2.1.6.3.18 Interaction Coordination (OLDI)

System Port: ATS_COORD_GND at ER ACC_CC

Protocol Stack	Protocol
FMTP ground	
	FMTP
	TCP
	IP

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

B2.1.6.3.19 Interaction Air Surveillance data

B2.1.6.3.20 Interaction Air Surveillance data

B2.1.6.3.21 Interaction Aircraft position reports and target information

B2.1.6.3.22 Interaction Command And Control Provision

B2.1.6.3.23 Interaction Command And Control Provision

B2.1.6.3.24 Interaction Command And Control Provision

B2.1.6.3.25 Interaction Controller Pilot ATC exchange(Voice)

B2.1.6.3.26 Interaction Controller Pilot ATC exchange(Voice)

B2.1.6.3.27 Interaction Controller Pilot ATC exchange(Voice)

B2.1.6.3.28 Interaction Controller Pilot ATC exchange(Voice)

B2.1.6.3.29 Interaction Coordination (Voice)

B2.1.6.3.30 Interaction Coordination (Voice)

B2.1.6.3.31 Interaction RPAS Emergency Coordination Provision

B2.1.6.3.32 Interaction RPAS Emergency Coordination Provision

B2.1.6.3.33 Interaction RPAS Emergency Coordination Provision

B2.1.6.3.34 Interaction RPAS Emergency Coordination Provision

B2.1.6.3.35 Interaction Air Surveillance data

B2.1.6.3.36 Interaction Air Surveillance data

B2.1.6.3.37 Interaction Aircraft position reports and target information

B2.1.6.3.38 Interaction Command And Control Provision

B2.1.6.3.39 Interaction Controller Pilot ATC exchange(Voice)

B2.1.6.3.40 Interaction Controller Pilot ATC exchange(Voice)

B2.1.6.3.41 Interaction Controller Pilot ATC exchange(Voice)

B2.1.6.3.42 Interaction Coordination (OLDI)

B2.1.6.3.43 Interaction Coordination (Voice)

B2.1.6.3.44 Interaction ExtendedFlightPlanSubmission

Service Interface Definition	
FlightPlanCoordinator	
Standard	**MEP, Security Configuration, Interface Bindings**
FlightPlanCoordinatorInterface.YP.WS SOAP	MEPs Supported: SRR PSPUSH PSPULL Security Configuration: Interface Binding Traceability: REQ-14.01.04-TS-0901.0790 REQ-14.01.04-TS-0901.0795 REQ-14.01.04-TS-0901.0304 REQ-14.01.04-TS-0901.0305 REQ-14.01.04-TS-0901.0325

Service Interface Definition
FlightStatusConsumer

Service Interface Definition
FlightStatusProvider

B2.1.6.3.45 Interaction FlightPlanDataDistribution

Service Interface Definition
FlightPlanDataConsumer

Service Interface Definition
FlightPlanDataPublisher

Service Interface Definition	
FlightPlanProvider	
Standard	**MEP, Security Configuration, Interface Bindings**
FlightPlanProviderInterface.YP.WS SOAP	MEPs Supported: SRR PSPUSH PSPULL Security Configuration: Interface Binding Traceability: REQ-14.01.04-TS-0901.0790 REQ-14.01.04-TS-0901.0795 REQ-14.01.04-TS-0901.0304 REQ-14.01.04-TS-0901.0305 REQ-14.01.04-TS-0901.0325

B2.1.6.3.46 Interaction FlightPlanDataDistribution

Service Interface Definition
FlightPlanDataConsumer

Service Interface Definition
FlightPlanDataPublisher

Service Interface Definition	
FlightPlanProvider	
Standard	**MEP, Security Configuration, Interface Bindings**
FlightPlanProviderInterface.YP.WS SOAP	MEPs Supported: SRR PSPUSH PSPULL Security Configuration: Interface Binding Traceability: REQ-14.01.04-TS-0901.0790 REQ-14.01.04-TS-0901.0795 REQ-14.01.04-TS-0901.0304 REQ-14.01.04-TS-0901.0305 REQ-14.01.04-TS-0901.0325

B2.1.6.3.47 Interaction FlightPlanDataDistribution

Service Interface Definition
FlightPlanDataConsumer

Service Interface Definition
FlightPlanDataPublisher

Service Interface Definition	
FlightPlanProvider	
Standard	**MEP, Security Configuration, Interface Bindings**
FlightPlanProviderInterface.YP.WS SOAP	MEPs Supported: SRR PSPUSH PSPULL Security Configuration: Interface Binding Traceability: REQ-14.01.04-TS-0901.0790 REQ-14.01.04-TS-0901.0795

	REQ-14.01.04-TS-0901.0304 REQ-14.01.04-TS-0901.0305 REQ-14.01.04-TS-0901.0325

B2.1.6.3.48 **Interaction FPL**

B2.1.6.3.49 **Interaction FPL**

B2.1.6.3.50 **Interaction FPL**

B2.1.6.3.51 **Interaction FPL**

B2.1.6.3.52 **Interaction FPL**

B2.1.6.3.53 **Interaction FPL**

B2.1.6.3.54 **Interaction OATFlightDataDistribution**

B2.1.6.3.55 **Interaction OATFlightDataDistribution**

B2.1.6.3.56 **Interaction OATFlightPlanSubmission**

Service Interface Definition
OATFlightPlanConsumer

Service Interface Definition	
OATFlightPlanProvider	
Standard	**MEP, Security Configuration, Interface Bindings**
OATFlightPlanSubmissionInterface.YP.WS SOAP	MEPs Supported: SRR PSPUSH PSPULL Security Configuration: Interface Binding Traceability: REQ-14.01.04-TS-0901.0790 REQ-14.01.04-TS-0901.0795 REQ-14.01.04-TS-0901.0304 REQ-14.01.04-TS-0901.0305 REQ-14.01.04-TS-0901.0325

Service Interface Definition
OATFlightPlanSynchProvider

B2.1.6.3.57 Interaction RPAS Mission Plan Provision

Appendix C Feedback

C.1 ANSP information collected on RPAS management methods

C.1.1 DSNA (Fr) inputs

During PJ10-05, the purpose of DSNA demonstrations was to fly an RPAS in controlled airspace with the existing airspace design, the existing rules of the air (SERA) and the current RCA (Réglement pour la Circulation Aérienne) in France.

The experimentation took place in Aquitaine Bordeaux TMA, Pyrénées TMA, Toulouse TMA and Cognac Military TMA. The objective was to accommodate a STATE RPAS (military) in civil traffic without creating any segregated area. To achieve that, a tailored Concept of Operations and an ATC safety assessment have been produced. These documents provide information on the operational procedures, human and technical means, aeronautical information and communication.

1. Concept of Operations – adapted separation (DSNA inputs):

The RPAS flew in airspaces Class C and D airspaces managed by civil ATC, in low traffic density conditions. The RPAS was not equipped with a certified DAA system. This is why the aircraft had to be maintained in airspaces where all the traffic was known. To this end, the management of IFR/VFR was adapted and increased separation criteria have been used both in class C and class D.

The RPAS operator and ATC centres agreed on pre-defined trajectories. Trajectories were optimized in order to reduce the interaction between the RPAS and SID/STAR followed by airliners at airports not involved in the experimentation (i.e. Pau, Toulouse). When necessary, military existing ZRTs were used to guaranty the segregation between the RPAS and VFR flights.

Several transfer procedures between different ATC centres were organized. A dedicated direct phone line, with a backup, was set up between the ATC centres and the remote pilot.

Two flight plans were submitted: one for the first part of the flight, SID and cruise until entering a military segregated area, and a second one existing area for the second part of the flight including Carcassonne RNP approach. IFF codes were allocated for the two flight plans: the first one before the start up clearance and the second one was given during the flight by ATC.

Instruction was given to ATC to apply increased lateral separation minima (5 NM instead of 3NM), while vertical separation was set to 1000 ft for both IFR and VFR flights. Traffic information to the Remote pilot was given by ATC as soon as any aircraft was localized at 10NM. With this information, the RPAS was able to acquire in a real converging situation an infrared vision of the traffic.

A NOTAM was published in order to prohibit VFR flights near the pre-defined RPAS trajectory.

Minimum meteorological conditions were (those were specific to the type of RPAS flown, the Harfang): no icing condition, no thunderstorm on the pre-defined trajectory and the alternate one (in case of engine failure).

Degraded modes and the associated procedures were defined.

Civil and military ATC as well as the RPAS remote pilot were informed by briefing or instructions before the experimentation. Information includes flight scenario, normal and abnormal procedures.

2. Concept of Operations – SMART SEGREGATION WITH SEGREGATION OF ACTIVITIES (DSNA inputs):

The French air force MALE RPAS are used to fly in temporary reserved airspace as described in the French AIP and by SUP AIP when the zones are temporary restricted or dangerous.
In order to simplify and standardized the different procedures, such as activation – de-activation of the zones or in case of non-nominal situation, a new protocol has been defined.
A safety assessment and risks mitigation study supports this new procedure.

2.1 The concept:

A segregation concept called “**smart segregation with the segregation of activities**”, derived from the existing operating method. It is suitable when the RPAS trajectory requires peculiar attention. In this operating method, the IFR RPAS remains in segregated volumes under control of an OAT entity. Legacy manned aircraft may fly though the segregated volumes with civil/GAT ATC coordination with the OAT entity if the volumes are unoccupied. This concept provides some level of access / equity of previously blocked airspace to legacy manned aircraft airspace users.*

For smart segregation with the segregation of activities:

- RPAS requires temporary reserved airspace via AIP and/or NOTAM, which establishes corridors to transit airspace.
- Corridors and RPAS flight are managed by an OAT/Military Authority
- RPAS is under radar surveillance in the reserved area allowing a segregation of activity
- Coordination is performed between GAT/civil ATC Authorities and OAT Military Authorities to allow other aircraft to enter the reserved corridor
- Separation:
    - RPA trajectory/reserved area boundary : 500 feet vertically and 2.5 Nm laterally
    - RPA/aircraft outside segregated area: 1000 feet vertically and 5 Nm horizontally.

A network of corridors (ZRT/ZDT) have been set across the French territory, allowing STATE RPAs to transit in the National airspace.
Some specific areas, usually with of cylindrical shape, called ZRT LIFT or DELAY, allow the RPAs to reach a zone above or below.
Working zones above the national territory are 15 Nm square with a minimum height of 1000 feet. If the height is more than 1000 feet, segment of 1000 feet thickness can be activated or de-activated.
The minimum thickness of a corridor is 1000 feet and the width is 5 Nm.

Each ZRT/ZDT is activated by the managing authority with a 10 minutes notification period minimum (up to 20 minutes for certain ZRT/ZDT) and the pilot requests the activation of the next ZRT/ZDT for coordination between the control units involved.
A ZRT/ZDT is de-activated as soon as the RPA is 2.5 Nm inside the next segment.

The drone flies under radar surveillance in a reserved area allowing a segregation of activity between the drone and other aircraft authorized to enter the volume. This segregation of activity is possible after a safety assessment and risk mitigation study has been performed and approved by the Civil Aviation Authority (CAA).

2.2– Spacing and separation:

The distance between the RPA trajectory and zone boundaries shall be at least 500 feet vertically and 2.5 Nm laterally.

The minimum radar separation between the RPA and any aircraft outside the segregated area is 1000 feet vertically and 5 Nm horizontally.

2.3– Non-nominal situation:

In case of emergency, ZRT/ZDT are permeable and a civil aircraft could cross the zone after direct tactical coordination between the civil and military air traffic controllers.

In case of failure, which does not allow the RPA to stay inside the ZRT/ZDT, the RPAS squawk 7700 and the military controller informs the civil control unit.

2.4– Pros and cons:

Benefits	Drawbacks
▪ Preparation/coordination time reduction because of the protocol in place ▪ Flight complexity reduction for ATCO and RPAS operator (ZRT/ZDT are known) ▪ Decrease of capacity reduction due to the possibility for a GAT to cross a restricted area with coordination and the de-activation of the zone once the RPA is 2.5 Nm inside the next segment ▪ This approach is applicable to civil RPAS as compliant with the Chicago convention	▪ Only concerns transits which trajectories are included in a ZRT/ZDT and impose a trajectory to the RPAS ▪ Do not solve the issue when the RPA is constrained to leave the segregated area in case of emergency or contingency ▪ Crossing a ZRT/ZDT for civil aircraft still requires coordination, which implies an increase of ATCO workload ▪ Controller working position radar display could be overloaded with ZRT ▪ Some technical constraints may appear when creating the new zone of the controller display ▪ Heavy in terms of aeronautical information messages and it needs anticipation to create and publish the new airspace design (other

Benefits	Drawbacks
	example: if an airspace is changing its design and then include a ZRT which was previously outside there is a need to change the SUP AIP and the letter of agreement)

Table 56: Smart Segregation with Segregation of Activities Pros and Cons

Smart segregation is not seen as the best solution due to the following reasons:

- This solution is heavy in terms of aeronautical information messages and it needs anticipation to create and publish the new airspace design
- In case of non-nominal situation, there is no guaranty that the aircraft will stay in the segregated airspace.

What is preferred today is a separation, which preserves the safety; this solution is not in conformance with Chicago Convention and can be used only for State RPAS. The separation distance could vary depending on the area where the RPAS flies (en-route or TMA).

C.1.2 ENAIRE / ISDEFE (Es) inputs

Here I attach the document in which we give a brief description of the way in which drones are managed nowadays in Spanish airspace and our proposal for the smart segregation concept definition.

1. Smart segregation concept definition (ENAIRE):

There are currently several limitations to the operation of RPAS in Spanish controlled airspace, most of them depend on where the operation is taking place and what is flying over or near such location.

In terms of altitude, specialized operation with drones or RPAS have an elevation restriction of 120 meters or 400 feet AGL.

Only RPAS with EASA approved DAA systems or those performing experimental operations in segregated airspace can exceed 120 meters AGL within the controlled airspace, flying in BVLOS mode up to the distance that the RPAS C2 link RLOS permits.

BVLOS operations above 120 meters AGL do not really exist, as there are currently no AADS systems approved by EASA in Spain. Any request for coordination of SSOP operations above 120 AGL in non-segregated airspace will therefore require a specific risk analysis to be carried out and submitted to the supervisory authority.

2. S115 Smart Segregation Concept Definition:

An assessment of the different proposals for the concept reviewed by the Spanish ANSP is done in the following paragraphs.

3. Augmented separation for the management of RPAS:

This would consist in establishing an augmented separation for RPAS flying in the controlled airspace. It would not suppose a big change from the current way in which Spanish ATCO are working nowadays, since augmented separations already happen as a function of the size, performance and equipment of the aircraft.

For instance, when flying above FL290 the RVSM is applied, except for those aircraft whose equipment do not have enough precision for it to be applied. Therefore, this augmented separation already happens.

Regarding C2 link latency, it could be compensated using this augmented separation for RPAS, or in case of a large number of latency values, the separation minima could be further increased (although this concept would not be effective and is further explored in the next section).

New procedures should be incorporated specifically for RPAS. The ATCO should be able to recognize RPA flying in their segment immediately through some kind of special marking such as “*” or “#” in their HMIs and in the FPL prior to fly.

Addressing the capacity of the sector, this is a function of the complexity of the airspaces (i.e. ascends and descents, paths crossing, number of aerodromes in the vicinity…) rather than the separation of the aircraft flying. So, the capacity of the sectors would not be significantly affected due to the accommodation of RPAS. New contingency procedures for RPAS could affect the sector capacity but in the same way that already happens with manned aircraft nowadays.

Few issues may arise during the initial accommodation phase, but they would be mitigated planning a careful and smooth transition with proper training of both the pilots and the controllers.

To conclude, this proposal seems feasible from a technological and operational point of view, as only few adaptations would be needed in the ATC systems and in the ATC operations.

From the operational point of view, ATCOs are already familiar to work with augmented separation as a function of the performances and characteristics of the different manned aircraft, and ATC system only would need minor changes so it would be a feasible and efficient solution for accommodation.

4. Dynamic separation minima:

Another proposal is to have an augmented separation as a function of the latency values observed by a performance tracker of the C2 link.

This option is still not technologically feasible, and it would require developing the systems in a way that would not fit the concept of accommodation due to the timeframe of the solution.

It would rather fit in the concept of segregation.

5. Smart segregation successive volumes

Activation and de-activation of segments of the airspace where there are RPAS flying that could fly simultaneously with manned aviation.

Although it might be feasible, it is not efficient.

Current ATC systems could assume at some point the implementation of segregated airspaces based on time since the activation of areas is fixed nowadays but with prior time for planification to move these areas of the following aircraft.

C.1.3 ENAV (It) inputs

The accommodation method in place in Italy are mainly the ones used in Military Operations. Today "smart" or dynamic "segregation" operating methods are commonly applied and used for (Military) RPAS missions or for missions cooperated with military forces (e.g. Frontex missions).

Those dynamic segregation techniques are based on the definition of Temporary Reserved Areas (TRA) and Corridors, which are activated through Notam (so communicated at latest 24h in advance).

Each area is composed of a set of sectors, which are actually the areas of operation. The Remote Pilot is in contact with an ATS unit with is in charge to control the flight according to the mission evolution.

During the execution phase of the flight, on tactical Military needs, one or more sectors could be de-activated in order to be possible to flight over. The ATS unit communicate the Remote Pilot the activation, which is aware of the new configuration.

As an additional means, the concept of increased separation (usually a double separation) is used in some mission to integrate STATE aircraft/RPAS in the airspace. From our experience in Italy with military traffic and Frontex ops. Only vertical double separation was used (not horizontal due the fact that mission area was in segregated airspace).

Contingencies management example (in relationship to Frontex example).

For loss of c2 link, RPA goes in dedicated areas through use of dedicated corridors (all segregated from manned traffic) and remains in holding to try to re-gather the signal. Once in contingency, the RPA SQWAK a dedicated transponder code. The TWR in contact with the Remote Pilot inform all nearby ATS units giving information about status and position of RPA (this is communicated from the Remote pilot)

It is important to underline that currently a debate with the national Civil Airspace regulator and actors like ANSP (ENAV) and operators is in place about the options for managing the future RPAS traffic in controlled airspaces, but it is ongoing with no initial outcomes available.

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C.1.4 EUROCONTROL inputs

1. SAFE AND SMART SEGREGATION (Eurocontrol inputs):

Safe and smart segregation addresses a pertinent mean of a dynamic and flexible application of airspace management within the framework of Flexible Use of Airspace (FUA) [ref: EU regulation 2150 / 2005]. It allows a timely activation and deactivation of individual segments used by a RPA reducing their activation time to the absolute minimum instead of activating a whole training areas (ARES).

2. Segmentation:

As a protection measure, a corridor has to be established for the transit of RPA through the required airspace. For legal reasons, the corridor might have to be split into a restricted area (ARES) according to national aviation law. The corridor will be a “netto” airspace, the ACC / UAC shall keep a distance to the corridor boundaries of XNM laterally and X000ft vertically (to be defined individually).

The complete RPA corridor is comprised out of segments from A to N. These segmentations shall be defined by segments. The status of the corridors should be:

- “not used” - Area published - usable by ATC
- “Used” - Area published - NOT usable by ATC

The entry of a RPA into a segment of the RPA corridor shall be precisely organised (e.g.) like the respective ACC / UAC receives an estimate latest 10 minutes prior entry of the RPA into a segment. The respective segment changes its status from not used to used when the RPA passes the segment boundary. The segment used by RPA (status: used) changes its status to not use when the RPA passes the segment boundary.

> In case of a C2 or a C1 leading to an early return of the RPA, the return shall be coordinated with the ACC / UAC units responsible for the segments corresponding to the flightpath. Distances to the area according to the defined rules shall be complied with.

C.1.5 HC (Hu) inputs

During the several progress meetings regarding PJ.13_115 OSED, 2 main procedural methods have been identified by partners of the solution:

- **ATCO applies increased separation minima (as with manned a/c in different situation)**
- ATCO activates/deactivates specific limited volumes as RPAS flies (Smart segregation)

HC's preference is to apply a **predefined increased separation minima** to accommodate IFR RPAS into Airspace class A-C.

Solution 115 and HC have made some assumptions, proposed requirements, and listed possible limiting factors for consideration.

1. Assumptions:

- Sol. 115's scope is to focus only on Low and Medium complexity and density environment
- Solution 115 expects that during Accommodation's timeframe, only State RPAS will be present and will drive the demand for the new operating method
- Cross-Border operations:
- The fact that EU states are mostly NATO members, mostly simple coordination (for example Open-Sky initiative) can be sufficient even for STATE and civil IFR RPAS mission
- C2-Link loss and Latency has the biggest impact on the level of Safety
- Smart Segregation could result in increased coordination effort, also increase the number of published information
- ICAO regulation shall be fully adapted:
    - Smart Segregation: can be applied for all RPAS (Civil and State)
    - Increased Separation Minima: only applicable for State RPAS
    - Theoretically, it is possible to not fulfil completely ICAO regulations, but it has to be published via national AIPs

C.1.6 ON (Lt) inputs

We do prefer / and also already ATCO using - increased separation minima (with manned a/c).

It is not officially approved, but ATCOs using it as a precautionary measures. Usually it is around 7 NM. At the moment it is only one possibility to ensure safe separation between flying RPAS and manned aircraft.

1. Prons and cons of that method:

(-) Increased complexity in the airspace, because of slow reaction or sometimes even rejection to change the heading / altitude (because of mission specifity);

(-) decreased HP, and as a consequence decreased sector capacity, impact on application of CDO / CCO techniques by manned A/C. At the moment it is very hard to define precise metric in percent, because of different impact level of flying RPAS depending on altitude and mission place (in the vicinity of aerodrome with impact on usage of SID /STARs / En-route sector where a lot of routes intersected).

(+) the same method applied as in use by ATCOs when solving conflicts (and ensuring safe separation) between slow and faster aircraft.

We do not use “smart and safe segregation concept” (to Activate/Deactivate specific limited volumes as RPAS flies), because this procedure do not approved in Lithuania.

Detailed description of overall context and procedures in use in Lithuania provided in Capture document.

Proposal: during VAL exercise to try both methods and by experiment to establish which one is safer and more efficient.

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C.2 ANSP feedback on current RPAS methods used

ANSP name	Method currently used for regular RPAS flight in airspace	RPAS flight type (OAT or GAT)	RPAS under control of which organisation (Civil ATC, Military)	How is civil a/c managed *if applicable*
ENAIRE	Full segregation	OAT	Military under the Spanish Military regulation of 2011 published by the Air force Chief in Command	N/A. Only for RPAS of the open and specific category under the standard scenarios specified by JARUs and adopted by EASA and the Spanish Civil Aviation Authority.
	Smart Segregation	OAT	Military (GND, APP)/Civil or military (En-route), depending on the airspace. If it's within an established segregated area within the AIP, the control is military. If it is within another area, the control is civil although the airspace has to be segregated under the Spanish Military regulation of 2011 published by the Air force Chief in Command.	N/A. Only for RPAS of the open and specific category under the standard scenarios specified by JARUs and adopted by EASA and the Spanish Civil Aviation Authority.
	Adapted Separation	N/A	Currently not used in Spain	N/A. Only for RPAS of the open and specific category under the standard scenarios specified by JARUs and adopted by EASA and the Spanish Civil Aviation Authority.
MUAC	Full segregation			
	Smart Segregation	OAT	It is always MUAC who is controlling the UAS. During activation times of the Special Operations Sector Group, ATCO's with a limited civil endorsement but a full OAT	Civil licenced ATCOs will ensure the separation with the corridor.

ANSP name	Method currently used for regular RPAS flight in airspace	RPAS flight type (OAT or GAT)	RPAS under control of which organisation (Civil ATC, Military)	How is civil a/c managed *if applicable*
			endorsement will control the UAS. Outside this timeframe, ATCOs of the standard sectors with a limited OAT endorsement will work the traffic.	
	Adapted Separation			
ENAV	Full segregation			
	Smart Segregation	OAT Military	STATE RPAS are in coordination with both Military ATC and Civil ATC according to operations. Segregated airspaces and corridors are mainly established over the sea and published either in the Italian AIP (when permanent) or activated with a NOTAM (when Temporary). RPAS are : • Under control of Military ATS	Double separation on vertical is applied. Lateral separation from segregated corridor is provided (2.5 NM from corridor/area borders).

ANSP name	Method currently used for regular RPAS flight in airspace	RPAS flight type (OAT or GAT)	RPAS under control of which organisation (Civil ATC, Military)	How is civil a/c managed *if applicable*
			• Coordination with civil ATC In transition portion of segregated airspace (corridors) and for activation and de-activation of segregated airspace and corridors. ATC service is not provided to STATE RPAS.	
	Adapted Separation			
DSNA	Full segregation (in zones reserved to military)	OAT	Military ATCO	N/A ; the civil aircraft avoids the segregated area
	Smart Segregation	OAT	Military ATCO	Segregation of activity is applied as a smart segregation concept. A Civil aircraft may transit across the segregated area under coordination with the military controller. The separation between the civil aircraft and the segregated area is minimum 2.5NM horizontally (up to 5.5NM in certain zone) and 500 feet vertically. The separation between a civil aircraft crossing the segregated area and the RPAS is minimum 5NM and 1000 feet.

ANSP name	Method currently used for regular RPAS flight in airspace	RPAS flight type (OAT or GAT)	RPAS under control of which organisation (Civil ATC, Military)	How is civil a/c managed *if applicable*
	Adapted Separation			
[Oro navigacija]()	Full segregation	OAT / GAT	Note: In Lithuania there are no MIL ATCOs, only civil	D-1 MIL through the ASM process reserve respective ARES. D-0 Civil ATCOs ensure separation of GAT traffic with activated TSA or other ARES
	Smart Segregation	N/A		
	Adapted Separation	GAT	Note: In Lithuania, there are no MIL ATCOs, only civil. Note: In Lithuania, special agreement is in place to allow this mode with MIL-NATO (TBC).	MIL MALE operator should: 1. Request ATCOs clearance before start-up or entering controlled airspace; 2. Execute the same altimeter setting procedure as for manned aircraft; 3. Follow all further clearances / instructions of ATCO, even, if due to operational situation, coordinated during pre-tactical phase route, changes (GAT flight for ATCO); 4. Coordinate each evolution with respective active ATCO; 5. Use ICAO phraseology Active ATCO should ensure: 6. Safe flow of civil aircraft and RPAS;

ANSP name	Method currently used for regular RPAS flight in airspace	RPAS flight type (OAT or GAT)	RPAS under control of which organisation (Civil ATC, Military)	How is civil a/c managed *if applicable*
				7. 2000 feet vertical separation between RPAS and manned aircraft; 8. Safe and timely transfer of control to the next controlled sector
LFV	Full segregation	OAT and GAT	In Sweden, all airspace is controlled by civil ATC. However, specific sectors can be segregated for military control (delegated by civil ATC)	
	Smart Segregation	OAT and GAT	In Sweden, all airspace is controlled by civil ATC. However, specific sectors can be segregated for military control (delegated by civil ATC)	
	Adapted Separation	Not used		
NATS	Full segregation	OAT	Military ATC	N/A ; civil aircraft avoid the segregated area

ANSP name	Method currently used for regular RPAS flight in airspace	RPAS flight type (OAT or GAT)	RPAS under control of which organisation (Civil ATC, Military)	How is civil a/c managed *if applicable*
	Smart Segregation	OAT	Civil ATC	Civil ATC operating Shanwick (Oceanic) airspace ensure smart separation of RPAS. A mobile protected volume of airspace is implemented around the RPAS. As the current RPAS flight is at FL500 it does not interfere with normal traffic so no specific separations are used.
	Adapted Separation			

Table 57: ANSPs Feedbacks on current RPAS method used

C.3 Operators feedback

C.3.1 EDA & RPAS Operators coordinated inputs

1. Background:

EDA is participating in the Technical Advisory Committee on SESAR 2020 Wave 2 Solution 115 Accommodation IFR RPAS A-C. Following a detailed discussion of C2 Link Loss contingencies (Lost C2 Link, following ICAO's notation), more information was sought on some details currently not covered in the EDA-EASA guidelines for the Accommodation of Military IFR RPAS into A-C[20] [31]:

- Occurrence of vectoring in current RPAS operations: current RPAS operation request/receive vectors from ATC (e.g. heading instructions – open loop instructions) or the RPA will stick to the flight plan always (closed loop instructions - unless emergency)?
- Coordination between the RP and ATC on C2LL during vectoring: In case the RPA is under vectoring, if a loss of C2 condition is declared while following a vector/heading, how does this impact the management of the contingency?
- Automatic set up of the squawk in C2LL: It is assumed that the code is changed automatically in case of lost C2 event to 7X00? If the C2 link is recovered would the transponder code switch back to normal (assumed previous squawk) automatically or must the transponder be modified from the emergency code to another code by the Remote Pilot?

EDA contacted Member States with known MALE RPAS operations in European airspace. NATO was also contacted due to their operational experience with HALE RPAS, which have some commonalities with MALE RPAS operations. Finally, although the questions were related to current operations, in other to have a complete picture of state-of-art platforms and upcoming operations, EDA also gathered the Eurodrone's current design choices in this domain.

The next section provides the responses received and a comment/suggestions from EDA.

2. RPAS C2LL Procedures:

2.1 Occurrence of vectoring in current RPAS operations:

France: No vectoring is required in nominal operations. Vectoring for current Reaper ops is mainly used in emergency situations.

Spain: Not relevant as current operations carried in in segregated airspace.

NATO: Vectors are given in nominal operations.

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[20] https://eda.europa.eu/docs/default-source/documents/guidelines-male-rpas.pdf.

EuroDrone current design: the platform will be ready for vectoring in nominal operations.

EDA recommendation to Sol115: Sol115 to consider vectoring in current military operations.

2.2 Coordination between the RP and ATC on C2LL during vectoring:

France: The internal flight plan (i.e. the flight plan uploaded/updated to the RPA, which might be different to the filled Flight Plan, FP) includes also the contingency route that normally will wait 7 minutes before going back to the next waypoint in the FP.

Spain: Not relevant as current operations carried in in segregated airspace.

NATO: Normally the RPAS will wait for 7 minutes in current vector and then go direct to the next waypoint in the original Flight Plan. Other possibilities such as going to maximum altitude and hold are possible since this is a HALE operation this contingency is not disrupting air traffic.

EuroDrone current design: The internal flight plan (i.e. the flight plan uploaded/updated to the RPA, which might be different to the filled Flight Plan, FP) includes different contingency routes, each one containing a specific entry point, along the nominal Flight Plan. The active contingency route is automatically changed along the route. In case of C2LL while vectoring the RPA will follow 7 minutes (although this can be customised during flight planning activities) the current vector and then go direct to the entry point of the active contingency route. The active contingency route can be also the original Flight Plan.

EDA recommendation to Sol115: Military operations aim at ICAO compliance as much as possible. If C2LL occurs during vectoring, unless agreed otherwise, the RPA will continue 7 minutes in the current vector and then go directly to the following waypoint (the one after the vectoring was started) in the original Flight Plan.

2.3 Automatic set up of the squawk in C2LL:

France: The transponder is set up automatically to the C2LL code (currently 7600, although 7400 is expected in the near future). The transponder is set up manually by the Remote Pilot in case the datalink is recovered.

Spain: The RPA will switches the transponder to C2LL code (currently 7400) 10 seconds after the C2LL has been detected (i.e. C2LL confirmed after 10 seconds). The RPA will automatically change the transponder code if the datalink is recovered.

NATO: The transponder is set up automatically to the C2LL code (currently 7600). The transponder is set up manually by the Remote Pilot in case the datalink is recovered.

EuroDrone current design: The concept of C2LL is wider than communication failure. This code shall be squawked also if e.g. there is a failure in the RPS. Thus, the Remote Pilot shall be responsible of ensuring that the RPA is under control before reverting the transponder to the previous settings when C2 link is recovered. The C2LL code will be customisable in the Eurodrone to cope with upcoming international agreement (7400)

EDA recommendation to Sol115: In most of the cases, the transponder is set up to the previous code by the Remote Pilot, once C2 link is recovered and it is confirmed that the RPA is under control.

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C.3.2 DASSAULT (Operational RPAS pilot) inputs

Operational MIL pilot

- multiple operational flight experience including Harfang RPAS
- RP on Harfang RPAS in various Europe/Mediterranean/Middle-East flights.

1. Airspace/ATC feedback:

- Efficient Civil/Mil coordination; No problems to fly this type of MALE RPAS in the ATC environment.
- Current Instruction MIL-1550 imposes segregated operations (national airspace)

2. Flight preparation/Backup tel. line feedback:

- Unaware of what is in the "booklet"
- ATC usually needs information on the performance (e.g. climb rates)
- Backup comm. preparation :
  - ATC tel. (sometimes can have 2) / Contact / e-mail of each ATSU that concerns flight prepared from Aeronautical doc
  - RP contact : 2 fixe & 2 portable (Malta flight feedback)
  - At start of flight / initial contact : RP/ATCO confirms backup contact information

3. Normal flight RPA control:

- In addition to programmed Navigation,

  RP can select Autopilot direct entries: Heading, Altitude, and Speed

4. Contingency behaviour preparation:

- Several trajectory elements can be pre-programmed, prior to flight and in-flight (in nominal conditions, C2L available)
- Orbit (both directions L or R) – for this type of RPA the orbit is approx. 1Nm
- Pre-programmed route, including Return Home; Usually, for non-critical missions, the return behaviour is to return home in case of contingency
- For ALT and SPEED, a pre-programmed ALT, SPEED can be set at each WPT of the route

5. C2 links / Latency:

- Generally 3 C2 links : one of the 3 are used depending on context :
  - LOS bande Ku

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- LOS UHF (backup, limited control data)
- BLOC satellite bande Ku, et bande C ;
- LOS ranges is approx. 150 Nm max. - used for departure/arrival-landing

- Latency:
  - Feedback/technical system capability: ~1.7 sec. on BRLOS SAT system used. This value has not generated any significant operational problems with controllers. General feedback: no significant delay compared to a manned a/c pilot receiving/processing/executing an instruction.
  - BLOS latency is even compatible with other mission need, such as camera tracking movements

6. C2 link loss delay trigger:

- Confirmation that C2 link loss event is only triggered at RPA after a programmed delay of several seconds, when no interchange is received from RPS.
  This is to avoid instable (transient) event trigger/cancellation. Delay takes into account:
  - LOS or BLOS: typically 10/15 sec.
  - BLOS 2 min. This also takes into account that short outages of SAT can occur due to external (non RPAS caused) SAT events – one typical case is SAT systems maintenance action which causes ~1min. outage.
- At the RPS, monitoring tools alert the RP : general monitoring philosophy - yellow (information), amber (action, can be delayed, necessary), red (critical, immediate action)

7. Contingency/Emergency situations (general):

- When a contingency problem occurs, there is no fixed order of contact (between ATCO and RP) – the first that sees the problem contacts the other
  - Mediterranean flight experience: ATCOs contacted the RP
  - RPs had telephone contact list of all FIR/ATSUs contact information in the RPS (cf. Flight Preparation)
  - Pilot briefs ATCO on the situation, and expected (programmed) contingency behaviour. This may include termination zone in worst case.
- In general, the RPAS contingency/emergency philosophy is:
  - Orbiting pattern for a programmed time (to allow RP to prepare/re-organize)
  - Pre-programmed Heading, diverging from initial route
  - Return home – shortest route.
- No issue regarding RP workload during a Contingency/Emergency :
  - When needed another pilot/assistant can assist the current RP (several roles : assistant / task offload, strategic, analyst depending on situation and criticality)

8. Wake Vortex risk / Traffic awareness:

- As for a manned aircraft, in addition to ATO spacing margin, when the RP identifies a risk of wake with certain aircraft types – RP will explicitly request hold / additional spacing. => The traffic around the RPA can be provided/displayed to RP (in the RPS). Several means exist.

Mediterranean/Middle-East flight experience: this generally occurred in airport proximity with very large MIL airlift aircraft.

9. Additions on Emergency and Link-Loss behaviour:

Failure Causes are displayed to the Remote Pilot with severity colour codes Red, Amber, Brown, through RPS display:

- Master Caution ,
- Warning Lights Identification,
- Warning list and failure impact
- Status of elements that have failed
- Checklist that opens for operator to apply the checklist instructions

Emergency causes:

1. **With C2 Link**

    - Engine problem.

- Battery problem (as cannot restart engine if engine stopped, and remaining battery power for equipment will be lost).
    - Automatic setting of transponder code 7700 or Alert to operator to switch to emergency. Harfang & Reaper, programmed auto or manual.
- Alternator problem (same consequence as battery).
    - Programmed manual - operator decides to switch to emergency or not.
- If several multiple failures (e.g. +fuel outage) such that the RPA will be unable to reach landing point, leading to irremediable crash :
    - The emergency procedure will also trigger several warnings to other forces (rescue, police, firefighting, hospitals), which depends on the rescue plan setup on the crash site.
    - Programmed auto if after link loss and RPA calculates that it cannot reach its landing point.
- GPS loss or the differential GPS failure
    - Programmed manual - operator decides to switch to emergency or not.
- Simultaneous Inertial Ref. loss (risk that the RPA can no longer maintain its trajectory)
    - Programmed manual - operator decides to switch to emergency or not.
- Landing Gear problem

2. **With no C2 Link**

- As above
    - Always programmed auto

C2 Link loss

- Link loss - reversion to programmes route and instructions
- Recovery after link loss :
  - RP – ATC controller dialogue
  - This leads to decision to keep transponder on code or revert to previous code
    - (This is because the reversion situation can still encompass other failures; nominal reversion – the operator will switch the transponder to previous code on controller instruction)

3. Remote Piloting station failure

Differential GPS loss – affects final approach

C.3.3 SAFRAN inputs

In case of C2 link lost situation, the ATCO is immediately informed through the transponder code change.

- For the Patroller, since 2020, our flight manual describes operations for “Single Pilot Operation”. But in practice, there will always be an additional operator besides (more or less corresponding to the Pilot Monitoring).
- This additional operator is equivalent to a “tactical coordinator”, or a “head of mission” we could say. In principle, he is the one who is in charge of contacting the ATCO in case of contingency.
- He also answers to the phone when the ATCO calls the Ground Control Station. In this situation, the information discussed by the ATCO and the GCS are the confirmation for the RPA intentions and its predicted trajectory. In general these trajectories are known by the ATCO (as they are discussed/negotiated with the ATCO before flying).

In case of GNSS denied (but to my knowledge, it never occurs for us), the “tactical coordinator” (or “head of mission”) would assume the same role.

C.3.4 French MIL (DSAé) inputs

C3.4.1. Reaper in En-Route phase, assumed under IFR GAT:

1. Do current MALE RPAS operation request/receive vectors from ATC (e.g. heading instructions – open loop instructions) or the RPA will stick to the flight plan always (closed loop instructions - unless emergency)? In case the RPA is under vectoring, if a loss of C2 condition is declared while following a vector/heading, how this impacts of the management of the contingency?

We don't specially request vectors from ATC. We're either able to follow pre-planned routes, modify a route on request (i.e. direct to a specific point) or obey to open loop instructions (for safety purposes for example, or weather). We will modify our Emergency Mission "in live" to respect the flight rules or the last orders in case of "Lost Link" (i.e. maintain last for 7 minutes then back on planned route, or other as requested). In case of "Lost Link", the advantage with RPA is that we can still contact the ATC via phone.

2. If a loss of C2 condition is declared but the C2 datalink is recover afterwards, would the transponder code (assumed changed to 7400, 7600 or 7700) switch back to normal (assumed previous squawk) automatically or must the transponder be modified from the emergency code to another code by the Remote Pilot?

In case of "Lost Link", the aircraft will switch 7600, will follow its "Emergency Mission" (will respect the flight rules and the flight plan), and we will lose the radio (the crew will contact the control agency via phone). As soon as we recover the link with the aircraft, we regain the control on the RPA and the radio with the ATC, and the pilot will switch back transponder to normal manually (sometimes the crew miss this step, so the ATC can reminds it if necessary).

Inputs / Experience from RPAS flights as GAT with civil ATC control

20170904-DSAE-DIRC
AM-NP-CR Expérimer

C3.4.2 Feedback on existing RPAS contingency trajectory and reprogramming:

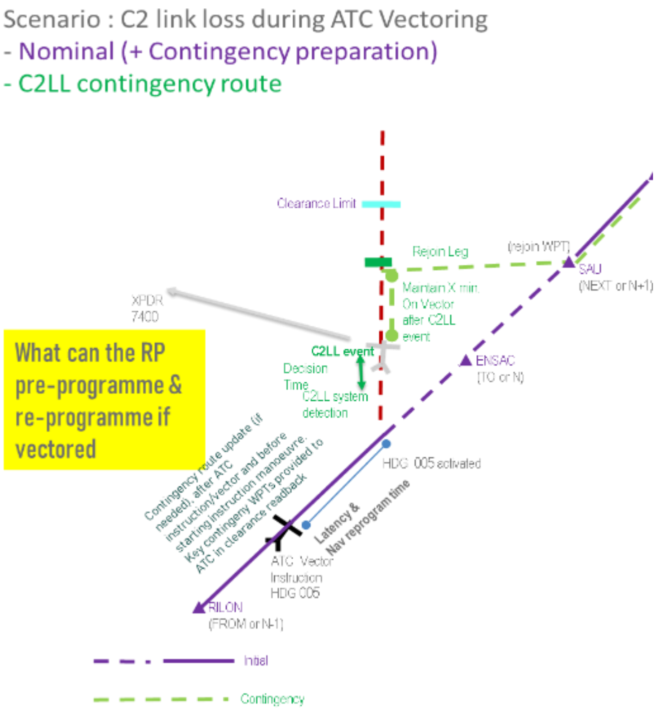
1. Lors d'un scénario de C2 Link Loss et d'une panne moteur concomitante, combien de solutions emergency scénario peuvent être enregistrés dans le système en fonction de la position du drone au moment de la panne ?
   ⇨ Lors d'une double panne, il n'y a qu'une trajectoire mémorisée dans le système, celle de l'E-Msn. Que cela soit doublé ou pas d'une autre panne, la trajectoire utilisée sera la même.

   1. In a C2 link loss scenario combined with an engine failure, what are the number of emergency trajectories stored in the system linked to the position of the drone at the time of the failures ?

   = > In this dual failure or not, there is only one single pre-programmed trajectory in the system – the E-Msn [*the solution uses the term C2LL contingency trajectory – Ed.*]

2. Dans le PPT joint la diapo 5 montre un scénario de perte de lien lors d'un ordre de vectoring par le contrôle, à ce moment-là, quel est la durée intégrée dans le système où le drone maintient son cap avant de rejoindre sa route en emergency procédure ?
   ⇨ 2a) De base, si rien n'est fait par le pilote, le système garde le cap pendant 10 secondes, puis rejoint son premier point d'E-Msn (dans l'exemple, SAU) ;
   •

- 2. The illustrated scenario is a vectored instruction during which a C2 link loss occurs. At this point, what is the duration integrated in the system for the drone to maintain its heading before rejoining its pre-programmed route
- = > 2a) Basic behaviour: with no pilot action, the system maintains the heading for 10 seconds, and then flies to the first E-Msn point (SAU in the illustrated example)
  •



•

⇨ 2b) Si on souhaite maintenir le cap plus longtemps, le pilote doit alors reprogrammer l'E-Msn en fonction des ordres du contrôle, et la renvoyer à l'avion. **Il ne va pas programmer un temps** mais va créer un point dans l'axe, puis rejoindre l'itinéraire initial ensuite. Le point dans l'axe peut être créer à n'importe quelle distance ;

= > 2b) If the desired behaviour is to maintain heading longer, the remote pilot will have to reprogram the E-Msn and load it into the RPA. In such a case the RP will not reprogram a time, but a will create a waypoint along the heading axis, which can be created at any distance, and then to the desired [*initial - Ed.*] route

2c) ATTENTION : Dans le cas d'une modification d'E-Msn, la vélocité de l'opérateur va déterminer la rapidité de prise en compte de la nouvelle E-Msn par l'aéronef. Une telle modification est viable dans le cas d'une clairance directe vers un point, ou dans le cas d'un évitement prolongé (cause météo par exemple, ou pour un espacement prolongé). Il est difficile d'envisager une telle modification pour un simple ordre d'évitement ponctuel (de 2 minutes par exemple) puis un retour sur la trajectoire normale (contraignant, vu le temps nécessaire à la modification de l'E-Msn). Cf ci-dessous ma proposition de test ;

= > 2c) IMPORTANT : If the E-Msn is modified, the time the RP takes to reprogram will determine when the RPA is loaded with the re-programmed trajectory. Such reprogramming is feasible when cleared direct to another waypoint, or for a long deviation (e.g. weather avoidance). It is difficult to perform such a modification for a small/short vector of a few minutes, which would then return to the original trajectory.

- Cela signifie également que, dans le cas d'un ordre d'évitement donné, suivi d'une perte de lien satellite rapide, le drone rejoindra son premier point d'E-Msn (sélectionné par le pilote), après 10 secondes. Si on souhaite, de façon systématique, conserver l'avion au cap durant 5mn (par exemple), il faut que les équipages préparent et modifient l'E-Msn de façon adéquate => Ceci est envisageable bien que compliqué, mais est à tester lors des vols SESAR. Le RETEX des équipages dira ensuite si c'est une solution viable ou pas ;
- This implies that if the drone is flying a vectored instruction, during which a C2 link loss occurs, it will rejoin the first E-Msn waypoint (selected [*pre-programmed – Ed.*] by the RP) after 10 seconds. If the desired behaviour is to systematically maintain the heading for a longer time (5 min. for example) the RPAS crew will have to prepare and modify the E-Msn in a suitable way => this is feasible although complicated, and could be tested through SESAR flight trials to obtain crew feedback on feasibility.

⇨ 2d) Il est également possible de créer une Ops Mission, et d'ignorer la perte de liaison (le drone poursuit sa route sur son Ops Mission) jusqu'à un certain point où on dit à l'avion de prendre en compte l'E-Msn. Cette solution présente globalement le mêmes contraintes que précédemment, puisqu'il est nécessaire de mettre l'Ops Msn à jour lorsqu'un ordre de cap est donné par le contrôle.

= > 2d) It is also possible to use the Ops Mission (Ops Msn) route and not change behaviour at time of C2 link loss (the drone continues flying its Ops Mission route) until a pre-programmed waypoint where the RPA will then use the E-Msn trajectory. Globally this has the same constraints as above: as the Ops Msn will have to be prepared, modified and uploaded when the vector instruction is given by ATC.

C.4 Feedback on FPL

C.4.1 Frequentis & Eurocontrol inputs on improved OAT (iOAT) FPL

- Likely to pass through existing systems
- It is built on top of ICAO FPL Format and Structure - Designed to be compatible
    - Uses same messages as ICAO FPL 2012 [51]; Minimal changes
        - Item 8 – P might need adaption of system
        - Item 15 – STAY xxx indicators might need adaption of system
        - Item 18 – PIC and RALT might need adaption of system (could be put in a RMK)
- Likely to be further evolved in eFPL / FIXM
- The improved OAT FPL implementation may require systems adaptions

iOAT FPL – Items 7, 8,9,10...

FPL Item	iOAT FPL Harmonisation input
#7 Aircraft Identifier	Insert the three letter ICAO telephony designator for the aircraft operating agency, followed by the flight identification (e.g. BAW123) or the Registration Marking of the aircraft (e.g. FGZCF) Information regarding call sign must match exactly what is entered in the Mode S Aircraft Identification (also known as Flight ID) input device in the cockpit. Tactical call signs (aircraft identification) will not be used in Item 7 For formation flights, insert the call sign of the leader aircraft. Further information on the formation in Item 18, sub-field 'FOR'.
#8 Flight Rules and Type of Flight	Insert M for military flight, in combination with indications in Item 15 and 18, to allow unambiguous distinction between **military** aircraft flying in accordance with either national rules or EUROAT or mixed rules combined with ICAO rules and provisions. 'M' in Item 8 + 'EUR/OAT' in Item 18 Insert "P" for military unmanned aircraft flight.
#9 Number and Type of Aircraft and Wake Turbulence Category	Insert the number of aircraft for formation flight Insert military aircraft designators as specified in ICAO Doc 8643 [59]. Insert ZZZZ if no aircraft designator is available for military aircraft type or when formation consists of different aircraft types and specify in Item 18, the (numbers and) type(s) of aircraft Insert the wake turbulence category for military aircraft type.
#10 Equipment	Insert radio communication, navigation and approach aid equipment and capabilities as specified in EUROCONTROL Network Operations Handbook - IFPS User Manual. Insert in item 18 equipment and capabilities relevant to military aircraft not specified in IFPS Manual.
#13 Departure Aerodrome and Time	Insert ZZZZ if no location indicator has been assigned for Departure aerodrome Insert EOBT (estimated time at which the aircraft will commence movement associated with departure) for military flight.

FPL Item	iOAT FPL Harmonisation input
	When EOBT is not considered desirable for military flight operating e.g. from aircraft carrier, ETD might be used with a note to this effect contained in appropriate AIPs
#15 Route	Insert the intended route and respective parameters of the flight in accordance with the IFPS user manual requirements. Insert STAY indicator when flight intends to conduct special activities along the flight route. In the flight route description, insert (if intended) a designator of the volume of restricted/reserved airspace (ARES) as specified in AIP under STAY indicator. In the route description, insert the significant point to the STAY ARES indicating the entry and the exit point/points of ARES or other special activity. The entry and the exit point may be the same. In the route description, insert (if intended) the significant point to the STAY HOLDING indicating the entry and the exit point for aircraft performing holding or loitering activities. The entry and the exit point may be the same. In the route description, insert (if intended) the ICAO 4-letter aerodrome location indicator under STAY AERODROME indicator for training flight with multiple approaches over selected airfield. In the route description, insert (if intended) designated Initial Approach Fix (IAF) followed by STAY indicator with the Aerodrome ICAO 4-letter aerodrome location indicator and training time duration for training flight with multiple approaches over selected airfield. Specify in item 18 the reason for STAY in plain text on temporary need for segregated airspace (also for RPAS, now and in the future)
#16 Destination aerodrome and total estimated elapsed time, alternate aerodrome(s)	Insert ZZZZ for destination and alternative aerodromes not compliant with ICAO four-letter location indicator as specified in ICAO Doc 7910, Location Indicators. Specify in Item 18 the name and location of the destination or alternative aerodrome, preceded by DEST/ or ALT/ Insert EET that exceeds 24.00 for specific type of the manned and unmanned aircraft operations (not exceeding 96 hours).
#18 Other info	Insert 0 (zero) if no other information Insert any other necessary information in the sequence and the form of the appropriate indicator selected for ICAO FPL format in ICAO Doc 444 and the sequence and the form defined in the IFPS user manual. Insert additional indicators identified for military IFR manned and unmanned flights: 'EUR/OAT' for the flights operating in accordance with EUROAT and national rules or mixed rules combined with ICAO rules and provisions. "TYP/" followed by number and type for formation with different aircraft type "EET/00.00" time to the point over entry into ARES accumulating estimated time from take-off to such point.

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FPL Item	iOAT FPL Harmonisation input
	"RMK/RTECOORATC" for flights that are not compliant with constraints and restrictions and for which the flight route is coordinated prior with relevant ACC/UAC (RAD, AIP) 'DCN/' for flights which require Diplomatic clearance when requested by national authorities "POB/' moved from item 19 to ensure availability for ATS when requested by national author 'END/' moved from item 19 to ensure availability for ATS when requested by national authorities **"PIC/"followed by telephone number for RPAS pilot in command (could be landline, mobile or VoIP)** "RALT/" for unmanned flights requiring en-route alternative aerodromes

Table 58: iOAT FPL Harmonisation Inputs

C.4.2 ANSP feedback on FPL

1. Preliminary info:

- EUROCONTROL and Frequentis provided input on an iOAT FPLN mechanism candidate to be used between the RPAS operator and the Network Manager centralised flight plan processing system (IFPS).
- This OAT FPLN mechanism is an improved interface to file both OAT and OAT/GAT flight plans (thus with a structure to accommodate specific OAT trajectories portions, typical of MALE RPAS missions, and GAT portions which are based on ICAO FPLN 2012).
  - [Reminder: PJ13/S115 does not deal with sole OAT flights]
- iOAT was validated in previous SESAR Wave 1 (PJ 07.03 and PJ 07.40) – it has reached maturity level V3.
- EURCONTROL also informed the team that the NM will deploy iOAT in in 2022, release 27.

In particular, related to RPAS GAT needs in SESAR PJ13:

- iOAT can convey additional information related to RPAS :
- The additional information (according to EUROCONTROL and Frequentis input provided) is conveyed in items 7,8,9,10,13,15,16,18;
- Most relevant for RPAS according to the input provided, the additional RPAS information can be conveyed in :
  Item 8 – Type P (RPAS identifier -> type P)
  Item 16 – EET (“+24.00“) (Flight > 24 h)
  Item 18 – Contact for RPAS pilot,
  And RALT (en-route Alternate aerodrome for RPAS).

2. ANSP requested feedback:

- iOAT FPLN as a basis : will this be compatible with your organisation interfacing to the iOAT deployed by EUROCONTROL NM from 2022 ?
- At which Timeframe?
- Does the additional information / interface above meet your organisation’s requirements to manage RPAS as GAT
- If not, or for other reasons :
  - Which other specific elements related to RPAS FPLN information are required by your organisation to manage IFR RPAS by ATC as GAT in class A-C airspace?
  - How will your organisation acquire the additional RPAS FPLN information needed?

ENAIRE feedback

From: Celorrio Camara, Fernando <fccamara@e-crida.enaire.es>
Currently SACTA is managing OAT FP as it is ready to read ICAO format and ADXP.
Differences with iOAT affects SACTA and ENAIRE'S messaging manager as currently there are some fields not included or the values in existing fields are not possible to fill them nowadays.
There is no still complete information about messaging flow is going to be managed between ENAIRE's systems and NM.
There are some issues with id STAY/ and subfield STS/ which is being assessed.
Currently, what is defined as OAT segments are only displayed in military positions (CAO) and GAT in civil ones.

So, iOAT FPLs can be used but they are not fully implemented with all the fields.
We asked for an estimated timeframe for fully implementation but we have not answer yet but those issues should be solved before 2023 but I will contact you when I have an answer.

On the other hand, regarding published information, ENAIRE's guide for filling FP for RPAS specify the information for the different items,

ENAIRECARO -
2019-03 - Guía Planes

Specially:

ITEM 18 is used for:

- DEP
- DEST
- OPR (complete name of RPAS operator)
- TYP (if ITEM 9 is ZZZZ , this field shall show drone type and MTOW)
- RMK (everything related to operational flight plan helping to identify working area and the mission planning -limited to 400 characters -)

ITEM 19:

- Quantity of people on board (0 in this unmanned aircraft)
- Autonomy (in time)
- Pilot (remote pilot)
- Colour and marks (to help identification)
- Observations (RP o RS contact telephone)

I have been looking for documentation in English but everything is in Spanish, if you think it is needed I will translate more information from those documents. I am also waiting for feedback from ASM-FUA coordination department about iOAT FP.

From: García Gutiérrez, Marta

As required, we have coordinated with the rest of the ENAIRE group the inputs requested. There are two aspects we would like to address:

- A remaining comment about the issues discussed in Tuesday's 2nd February OSED meeting.
- Inputs required last 28th January meeting.

Regarding the first bullet, apart from the inputs already sent from our group, we want to share our opinion with the open item related to:

1. "ATCO Specific instructions to other a/c during a link loss situation".
   Just to clear up that ENAIRE's Group agrees with NATS in using a generic requirement. Since the contingency flight path of RPAS will be known, ATC will clear or protect it.

2. "FPLN / Additional information, and use of "Comments"(i.e. fields 18 and 19)" ENAIRE's Group has decided to finally use field 18. There was a misleading while understanding the terminology "comment box".

About the second bullet, we directly answer on your last email in green colour. You will see there are still some pending issues we have to discuss internally with the operations area. Once we know all the answers, we will let you know.

AIP: Explicit list of permanent information (conveyed by AIP): which permanent information are needed? Waiting for operations' area to answer this question.

FPLN preparation: Can iOAT be used for the accommodation scope (implementation timeframe and suitability for GAT transit phase vs. standard FPLN filing). Specific mail has already been sent to partners on this subject. Already answered in an email sent by Fernando Celorrio (2nd February). => ABOVE

RPAS FPL preparation and filing (by WOC) / is it thorough ANSP (local national interface), or directly to IFPS
FPL preparation and filling is done thorough ANSP regarding EANIRE's case.

- It could be dependent on local/national situations ;
- Q. to team: what is the target solution at the accommodation timeframe? ENAIRE's Group agrees with NATS (target for accommodation in line with manned flights).
  (NATS feedback: through chat: Currently RPAS flight plans are submitted direct to NATS. Target for accommodation in line with manned flights => the operator files a flight plan into their system, which goes direct to the Network Manager operations centre (IFPS), and is then forwarded on to the various centres/units (as addressed on the flight plan).

Feedback needed from partners on additional Information (RPAS flight related) in the flight plan: Provide explicit list of information needed in the flight plan? In the last meeting we shared that the information to fill in the fields to register flight plans for RPAS is registered in a document available on the official ENAIRE website drones_controlled_by_enaire, => ABOVE IN ATTACHMENT
and it specifies which information can be entered for RPAS. Also attached in this email, you will find the

corresponding guide.
We have looked at your attachment … a few questions to help us in the accommodation solution construction
- Is our understanding correct that RPAS flight plans (including in En-Route controlled Class A-C?) are filed through ICARO, directly to the ANSP; - We assume for flights inside Spain ? Are those flight MALE RPAS as GAT?
- We understand your system can handle through ICARO fields 18 and 19 several addition items that filed … are they available to the ATCO? In bold the ones of most interest to the accommodation additional FPLN information.

Would it be the same FPL / items management if the FPL was filed to the EUROCONTROL IFPS and redistributed to you?

======

DEP/DEST including geographical coordinates,

Additional RPAS type & Weight (MTOM)

Remark section (RMK) – up to 400 char. Text => info related to operational flight / work zone => could this also have information on the contingency route or contingency option the operator will use

ALTN (but only for VFR) => how will the IFR ALTN and/or Contingency destinations be known?

=====

People On-board (0)
EET / Autonomy
PIC
RPAS Operator (OPR)
Observations: Other information associated with the operation: RPAS pilot telephone number

Discussion on actors / FPLN submission process

State RPAS: Crew prepares the FPLN. Partners to confirm that the role of FPLN preparation (state aircraft/operator) is done by the Remote Pilot/RPAS. ENAIRE’s Group confirms.

==

NSV (system) views: require a specific (differentiated) Voice channel during Contingency (this is the Telephone Voice G-G link), the other Voice channel is the operational (VHF Radio A-G link relayed to RPS), but this is no longer. ENAIRE’s Group agrees. It may be necessary to communicate with the pilot until the A-G voice connection via RPAS is recovered in order to try to obtain certain information that the pilot on the ground can obtain from the RPAS such as images, range, trajectory, intentions, etc.

ON feedback

Question	ON Answer
• If the solution takes the iOAT FPLN as a basis, will this be compatible with your organisation interfacing to the iOAT deployed by EUROCONTROL NM from 2022, and at which Timeframe	In principle we are looking to implement those features, however at the moment we cannot give an exact answer, that we will be fully compatible with iOAT FPL concept by 2022.
• Does the additional information / interface above meet your organisation's requirements to manage RPAS as GAT	Yes
If not, or for other reasons :	
• which other specific elements related to RPAS FPLN information are required by your organisation to manage IFR RPAS by ATC as GAT in class A-C airspace	At the moment and till iOAT FPL will be implemented: In the plan field 8 – M (Military), and in the 18 field – RMK: Unmanned acft. All MALE RPASes flying in LT airspace are Military.
• How will your organisation acquire the additional RPAS FPLN information needed?	At the moment and till iOAT FPL will be implemented: In the plan field 8 – M (Military), and in the 18 field – RMK: Unmanned acft. All MALE RPASes flying in LT airspace are Military.

Table 59: ANSPs (ON) Feedback on FPL

SUMMARY

Currently: All MALE RPASes flying in LT airspace are Military.
Flight plan fields used are 8 – M (Military), and 18 – RMK: Unmanned acft

Future:
ON cannot confirm iOAT FPL implementation.

ON confirms additional ICAO FPLN 2012 information / interface need in FPLN to manage GAT MALE RPAS:
Item 8 – Type P (RPAS identifier -> type P)
Item 16 – EET ("+24.00") (Flight > 24 h)
Item 18 – Contact for RPAS pilot, and RALT (en-route Alternate aerodrome for RPAS)
Additional question: Assuming these fields will be filled for future GAT MALE RPAS, will the information be accessible to the ATCOs on your ITEC system & CWP.
-New iTEC can work with OAT FPLs (item 15) and we are very interested future enhancements (Type P, EET +24.00H),

But we need to coordinate the implementation of these features with Indra (supplementary contract). Consequently, those new features will have impact not only on FPLN part, but respectively on iTEC system & CWP.

Additional systems algorithm (what to do with P flights), probably colour and index indication of RPAS on CWP, etc.

ENAV feedback

Regarding the use of iOAT interface and subjects of mail below, we agree with such use for accommodation scope.

Suggested additional element for RPAS in particular for field 8, 16, 18 are fundamental for the management of those flights.

We have a suggestion regarding the insertion of alternate airports, the flight plan shall provide the possibility of inserting alternate airports during en route phases (RALT) depending on the position of the RPAS (waypoint).

In addition, in case during the flight is planned a handover of RPS, such information need to be reported also in terms of:

- Waypoint / position of the RPAS on which the handover is performed
- Contacts of all pilots + RPS involved in the flight

Additionally in my opinion will be important to report inside if the flight is in BRLOS, RLOS etc. (Field18? Field10?)

DFS feedback

I would like to emphasize that Andreas Udovic (DFS) and I discussed your questions from the national point of view and came up with the following answers (marked in blue).

1. Requested feedback:

- If the solution takes the iOAT FPLN as a basis, will this be compatible with your organisation interfacing to the iOAT deployed by EUROCONTROL NM from 2022, and at which Timeframe
    - The iOAT FPLN solution reached initial V3 by the end of 2020 -> a deployment initiative called MIDI started to involve major stakeholders in the core area of the European airspace. MIDI addresses the deployment of the iOAT FPLN within the usual time frame as dictated by European Operational Concept Validation Methodology (E-OCVM). The network manager intends to integrate the necessary software (IFPS) to facilitate the iOAT FPLN within RELEASE#27 for 2023;
    - The Deutsche Flugsicherung (DFS) will adapted the new FPLN digital format FF-ICE with contain elements related to RPAS. This will include discriminators for RPAS like:
        - status if the aircraft is manned or unmanned;
        - lost C2 link procedure i.a.w. ICAO regulations;
        - flight duration (more than 99 hrs);
    - DFS likes to mention that related to Field 18 the provided phone number could be difficult particularly for Sol 117 due to the flexible combination of RPA to different RPS planed on ICAO level;
    - DFS is participating in the MIDI project and intends to use the iOAT FPLN as a solution for military manned & unmanned flight operations (OAT; mixed OAT & GAT);

- Does the additional information / interface above meet your organisation's requirements to manage RPAS as GAT
    - For the accommodation phase of RPAS in the short term time frame only military flight operations are expected.
    - For transfer flights (A to B) the standard ICAO FPLN format is sufficient. To reflect specific military requirements for the majority of RPAS flights, the iOAT FPLN provides the pertinent format, therefore the answer is YES;
    - For the integration phase no additional information are needed due to the adaptation of the FPLN by ICAO with RPAS topics, therefore for the integration phase the answer is NO;

- If not, or for other reasons :
    - which other specific elements related to RPAS FPLN information are required by your organisation to manage IFR RPAS by ATC as GAT in class A-C airspace
        - NONE;
    - How will your organisation acquire the additional RPAS FPLN information needed?
        - via FF-ICE;

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HC feedback

- If the solution takes the iOAT FPLN as a basis, will this be compatible with your organisation interfacing to the iOAT deployed by EUROCONTROL NM from 2022, and at which Timeframe

  HC:
  - After internal consultation, the conclusion is, that currently there is no ongoing activity/plan to deploy an iOAT interface to the main operating ATM system.
  - However, interfacing to our ATM Backup system is considered.
    At the current stage, I am not able to give any more information.

- Does the additional information / interface above meet your organisation's requirements to manage RPAS as GAT

  HC:
  - Yes, it would be sufficient from an Ops. point of view

- If not, or for other reasons :
  - which other specific elements related to RPAS FPLN information are required by your organisation to manage IFR RPAS by ATC as GAT in class A-C airspace

  HC:
  - No additional is required, most important:
    - Item 18 – Contact for RPAS pilot – Totally agree
    - En-route Alternate aerodrome for RPAS – Agree, but it is also mandatory for other manned a/c, as well, so it is not RPAS specific requirement in our view

  - How will your organisation acquire the additional RPAS FPLN information needed?

  HC:
  - N/A

Appendix D Focus Teams Outputs

D.1 Regulatory & DAA Focus Team Output

D.1.1 Aviation Standards & regulations discussion

Two particular situations exist for S115:

1. ICAO:

1.1 General:

The basis of international aviation rules is the **1944 Chicago Convention**, also the origin of the International Civil Aviation Organisation (ICAO) responsible for developing international harmonised interoperable technical on operational standards.

ICAO develops and updates these through Standards And Recommended Practices (SARPs), (originally the 18 Annexes to the Chicago convention), procedures (PANS documents) providing implementation means and guidance. ICAO SARPS are globally agreed means to meet aviation safety and interoperability needs and form the basis for the civil aviation regulatory framework of ICAO member States.

However, such **ICAO provisions are not directly applicable within a State** and cannot be enforced by ICAO[21] . As for any international treaty or agreement, such can only be committed to, possibly with reservations. Once **transposed into the national legal framework, they are enforced by the respective State**.

In Europe, aviation regulations are adopted by the European Commission (EC) and supported by material decided by the European Aviation Safety Agency (EASA) (e.g. means of compliance (AMC), certification specifications (CS), guidance material (GM)).

The implementation of the operational regulatory provisions (e.g. Part SERA, Part AIR-Operations) remains the responsibility of each member State, while in certain cases EASA also acts as competent authority (e.g. for third countries operator (TCO)). However, Airworthiness activities remains under EASA responsibility.

[21] They are international law and States undertake an international legal obligation

1.2 Dispositions for specific aircraft

The “Convention on International Civil Aviation” (Chicago Convention) contains high-level principles for all types of civil aircraft, which are supplemented by the SARPs contained in its Annexes.. In particular:

- **Article 3** of the Chicago Convention foresees that the **Convention is applicable only to civil aircraft**, not state aircraft: the latter defined as any aircraft used in military, customs or police services.
- **Article 8**[22] of the Chicago Convention lays out a high-level disposition for **‘pilotless aircraft’**, applicable to civilian ones per article 3. This is to formalise a **risk management precautionary principle at individual State level**.

The solution scope is remotely piloted RPAS, the initial ones in operation being state and ‘pilotless’ and it is also applicable to future civil RPAS. Future civil RPAS are under the ‘pilotless’ provision. The RPAS accommodation concept of operations is for all RPAS types, initially State and future civil to operate, be managed by civil ATM as non-segregated En-route transit IFR GAT. With regard to the dispositions above, all RPAS (including future civil ones) may be operated under specific provisions and with special authorisations, ensuring that such aircraft are controlled as to obviate danger to civil aircraft.

For a civil pilotless aircraft (MALE RPAS in the case of this solution) to fly over a contracting State to the Chicago Convention, authorisation will be required from that State using the future Implementing Rule (IR and associated regulation), assumed resulting from EASA Rulemaking Tasks RMT.0230C & RMT.0230E.

For earlier RPAS Accommodation, a specific category “Accommodated RPAS” may have to be considered under a specific agreement and special authorisations can also be considered per ICAO Cir 328 AN/190.

<u>Conclusion 1:</u>

To provide a RPAS accommodation solution means that during the accommodation period:

- A State regulatory provision based on a future Implementing Rule (IR) and associated regulation, assumed resulting from RMT.0230C & RMT.0230E, will be available for civil MALE RPAS operations.

- If not, State or European level authorizations and/or special agreements are set by national competent authorities for future civil applications[23], with a supporting safety analysis case.

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[22] “No aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization. Each contracting State undertakes to ensure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft.”

[23] As EASA or EU are responsible for Regulations definition not yet existing for RPAS. Case-by-case authorisations remain under each European State’s responsibility.

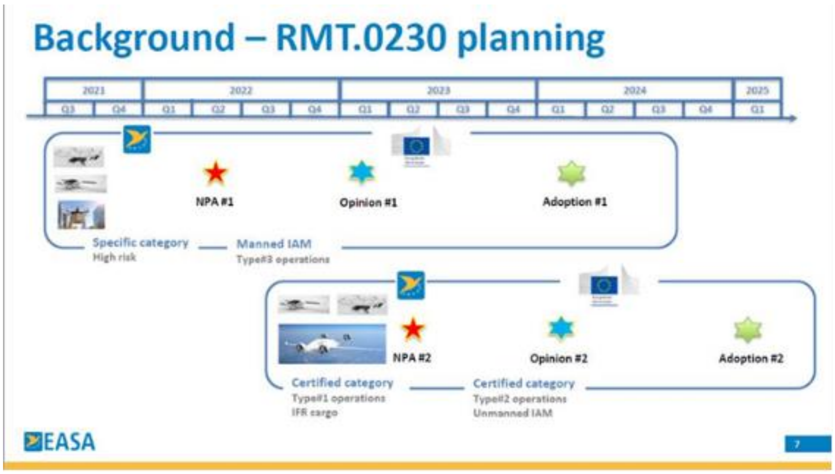
Conclusion 2:
All RPAS, due to their 'pilotless' nature (pilotless here means without a pilot ONBOARD, however, there remains a pilot in charge), their RPS-RPA architecture, their associated automation when in C2 LL and their C-N-S features, require accommodation (if flying short and medium term in mixed traffic non segregated) and also if flying in the longer term in the same accommodation operational conditions.

2. Rulemaking derived to future civil RPAS

Accommodated transit flight operating in class A to C controlled airspace as IFR GAT, will require authorisation, (or exemption or derogation by the nature of their operations for state RPAS) and in all for all RPAS, including future civil ones. The authorisations fall under the responsibility of each state.

Initial RPAS may not, always and in full, comply with ICAO and existing regulations.

No EU civil regulation yet exists, at current time of this paper, for certified category RPAS in controlled airspace. A rulemaking action (RMT.0230[24]) is due to start for this category of RPAS (NPA #2, Type #1 assuming this encompasses large MALE RPAS). The EASA Opinion is planned 2024 and the adoption by the EC planned 2025:



- **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.**
- **Recommendation is that the future civil RPAS airworthiness regulation (with similar size, weight, performance) is CS-23 Amendment 4.**

[24] Futher detail in Terms of reference for rulemaking task RMT.0230

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The objective of this SESAR solution 115 is to benefit from the existing knowhow and operational experience obtained through external coordination[25], in order to disseminate practices for wider European deployment in the accommodation operating environment.

- All state aircraft, using the European airspace are subject to the “safe to fly” and “fly safely” principles. MIL platforms, meet recognized airworthiness requirements in NATO STANAG 4671, parts of which are relevant to IFR operations as GAT.. Military/STATE RPAS fly under certification provided by specific state military authorities or certification equivalence or statistical/empirical evidence that are subject to acceptance of the national certification authority. These requirements are equivalent to civil airworthiness standards Certification Specification CS-23 Amendment 4 and operations comply with ICAO.

  For example in France, such initial RPAS fly under a certificate of airworthiness following a Type Certificate Data Sheet itself based on Type Certificate of General Atomics Aeronautical Systems and certification basis Tailored Airworthiness Certification Criteria (TACC). With these documents, the State military certification authority, DSAé (Direction de la Sécurité Aéronautique d’Etat), was able to establish a certificate of Airworthiness for the French and Space Force for each aircraft.

Conclusion 3:

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). Their airworthiness will be derived from CS-23 Amendment 4.

The RPAS Accommodation solution S115 industrialisation/deployment phase (V4) and its associated concept, safety assessment should be coordinated with RMT.0230 activities.

Complementary Information:

This SESAR work on an accommodation solution, only had one single national candidate for validation.

The work performed in this solution is a proposed harmonised deployment across EU states for the accommodation context described here. Wide deployment, in this context, may not be always fully possible through the classical European deployment process[26] – as it will most likely depend on individual State positions.

Provision for elements related to State special authorisation (cf. ICAO Cir 328 AN/190 and Annex 2, Appendix 4 -section 3) exist, considering future civil RPAS. Per this section, the obligation is to provide information on the RPAS performances and capabilities amongst other information.

[25] French Air Force & French DSAé & DGA-DGAC, in EDA RPAS Reaper trails in IFR-GAT class A-C controlled airspace.

[26] See https://www.eurocontrol.int/publication/european-operational-concept-validation-methodology-eocvm

In the case of initial State/MIL RPAS, a specific process is needed such as the one that allowed EMAAR 21, for it to be adopted by as many European nations as possible.

The following is an existing list of standards, related to manned aviation and where certain elements are relevant to RPAS Accommodation:

(1) **Chicago Convention (1944)**;
(2) **ICAO Standards And Recommended Practices (SARPs) contained in the 19 Annexes** and additional complementary materiel from ongoing RPAS Panel on amendments to SARPs for RPAS;
(3) **ICAO Manual on RPAS** (Doc 10019);
(4) **ICAO Procedures for Air Navigation Services Air Traffic Management (PANS-ATM)** (Doc 4444);
(5) Special conditions for RPAS : EASA **SC RPAS.1309.03 [25]/ AMC RPAS.1309 Issue 2** Nov. 2015 (JARUS-16 WG6) [61] if applicable to existing RPAS;
(6) **EASA CS-ACNS issue 2** Airborne Communications, Navigation and Surveillance [26];
(7) **STANAG** relevant for State/MIL certification:
    - <u>**Public Standards:**</u>
        - **STANAG 4671 [69]** UAS Airworthiness Requirements (USAR) Edition 3 (AEP-4671);
        - **STANAG 4586 [66]** UAS Standard Interfaces of UA Control Systems for Interoperability Edition 4 (AEP-84) Guidelines / Validation / Conformance / Configuration / Type IDs;
        - **STANAG 4670 [68]** UAS Minimum Training Requirements Operators and Pilots Edition 5 (ATP-3.3.8.1)
    - <u>**NATO Classified Standards:**</u>
        - **STANAG 4660 [67]** UAS Command and Control Data Link Edition 1 (IC2DL) (AEP-77)

D.1.2 DAA Discussion

ICAO defines DAA as the capability to see, sense or detect conflicting traffic or other hazards and take the appropriate action.

DAA concerns **two specific areas**:

- Pilot's role in **airspace classes where pilots have an explicit separation responsibility role in using see / sense and avoid conflicting traffic**.
- **Last resort collision** avoidance, which for certain aircraft categories, in the current civil airspace, supported by the ACAS system.

1. ICAO rules of the air case:

ICAO Annex 2 (rules of the air):

- A high-level principle is that the pilot can see other aircraft and thereby avoid collisions, maintain sufficient distance from other aircraft so as not to create a collision hazard, and follow the right-of- way rules.

  This principle must be considered in the specific scope of the accommodation environment, where the **RPAS remote pilot, like any other IFR manned aircraft pilot, cannot be assumed to be in visual meteorological conditions**, and will be **under separation responsibility IFR flights with separation services from ATC**.

  In addition, in the general scope of IFR flights in Class A-C airspace, all pilots, including the RPAS pilot have a level of traffic awareness through the "party-line" radio-communications.

- Annex 2 also implies **last resort collision avoidance through aircraft safety nets (ACAS systems) supporting the pilot**. It is worth noting that ACAS is **only installed on certain aircraft (>5.7 T / 19 passengers)** and may even be absent on those certain aircraft under MEL dispatch conditions.

This section further discusses the RPAS environment, during the accommodation period, and appropriate provisions to ensure and maintain safety barriers to a level equivalent to IFR manned aviation and assuming worst case IMC conditions.

2. See and Avoid:

As discussed in the previous section, States may allow flight of RPAS over their territory through multilateral agreement as it is the case for State aircraft.

The main concern for acceptance and thus agreement is safety of operations.

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3. S115 ATCO feedback form evaluation EXE:

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**[27]. It was also clearly stated during exercise by controllers that RPA has sufficiently low speed[28] in both nominal and C2LL situation in order to manage it without any increased workload, ATCo can interact with other traffic relying on RPA maintaining its FL in particular on C2LL cleared trajectory and never relying on RP to perform a visual manoeuvre.

Conclusion 4:
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.

Pilot last resort collision avoidance resolution is discussed below.

4. S115 Safety assessment:

The risk of encounter of the RPAS with an intruder aircraft not known by ATC within the accommodation operating environment is extremely low. It is estimated in the S115 SAR: Safety Assessment Report (i.e. low RPAS numbers (principally one) per sector, intruders, highest majority, being recreational light aircraft are excluded by setting the floor of the operating environment to FL100; all other a/c in the accommodation operating environment are on ATC surveillance means, are in contact and being separated by ATC)[29]. Moreover a single RPAS operates per control sector and with other low-medium density traffic[30].

5. Last resort Pilot Collision Avoidance safety net / ACAS:

Considering International flight of civilian RPAS flying IFR in controlled areas and more largely UAS operations, there is no current ACAS requirement on UAS:
. The current COMMISSION IMPLEMENTING REGULATION (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft specifies in Article 7 (item 3) that:

[27] For IFR visual is needed in low-level airspace for final approach runway in view but this outside S115 scope.

[28] ATCO exercises feedback indicated that they were reassured by RPAS "low" speed (150 to 200 knots which corresponds to initial state RPAS demand) allowing them sufficient time margins.

[29] RPAS is not flying within higher altitude high speed jet aircraft (it is below those), and not within and in approaches and departure close proximity aircraft manoeuvres (it is above those).

[30] RPAS is also not flying within higher altitude high speed jet aircraft (it is below those), and not flying within risk encounter traffic in approaches and departures with close proximity aircraft manoeuvres (outside accommodation scope)

3. UAS operations in the 'certified' category shall be subject to the applicable operational requirements laid down in Implementing Regulation (EU) No 923/2012 and Commission Regulations (EU) No 965/2012 and (EU) No 1332/2011.
(*Note that Regulation No 2016/583 amends Regulation No 1332/2011*).

When considering the referred Commission Regulation (EU) No 2016/583of 15 April 2016 laying down common airspace usage requirements and operating procedures for airborne collision avoidance (still in application):

ANNEX I, the part considering ACAS II specifies:

> Airborne collision avoidance systems (ACAS) II
> (Part-ACAS)
> Section I — ACAS II equipment
> AUR.ACAS.1005 Performance requirement
> (1) The following turbine-powered aeroplanes shall be equipped with collision avoidance logic version 7.1 of ACAS II:
> (a) Aeroplanes **with a maximum certificated take-off mass exceeding 5 700 kg**; or
> (b) Aeroplanes authorised to carry more than 19 passengers.
> (2) Aircraft not referred to in point (1) but which will be equipped on a voluntary basis with ACAS II, shall have collision avoidance logic version 7.1.
> **(3) Point (1) shall not apply to unmanned aircraft systems.**

In the case of State a/c of all types, they can have special provisions or derogation.

Conclusion 5: **With current EU regulations, current initial RPAS are already excluded[31] regarding UAS collision avoidance (ACAS) requirements.** - as specified, in (3) above, no current applicable regulation exists requiring collision avoidance (ACAS) on UAS.

6. Complementary information:

In the nominal flight situation, even though the pilot "see" arguments have been discussed, it may be noted that additional awareness means are available:

- the existing MIL/state RPAS are equipped with highly performant Visual and Infrared camera vision means camera, which are used to support the remote pilot in flight information situations
- IFR flights in Class A-C airspace, all pilots, including the RPAS pilot have a level of traffic awareness through the "party-line" radio-communications

[31] Should another situation become concerned in the future, and flying outside the accommodation environment, collision avoidance may become necessary – this is a future situation, and a next step to the accommodation scope.

- RPS, being located on ground, have the possibility of traffic feed into their ground stations, and MIL could even feed the primary radar (PSR) tracks;
- It is reminded (see specific use case) that for the principal RPAS abnormal situation (C2link loss where RPA is on a pre-programmed trajectory):
  - ATC has information on the RPAS C2LL route and FL (with full details during post C2LL event through the ground telephone link) that is provided by RP when contacting ATCo. Moreover, under the operational environment construction, there should be only a single RPAS present in one sector at any time. Therefore, ATC is in a position to maintain safety by reorganising or clearing the traffic on the RPAS C2LL route.
  - ATC, when relevant, has short –term conflict detection support tools (STCA)

D.2 C2LL Procedure Sharing Focus Team Output

D2.1 C2LL Workshop Summary

S115 Partners identified some uncertainties and open questions within concept around C2LL, which required focused discussion

- 2 (online) workshops held 22/11/21 and 13/01/2022
- Supplemented by active discussion via email
- Points agreed in workshop:
    - Phraseology (e.g. "remote" prefix; "diversion point");
    - C2LL contingency SSR code (7400 in line with ICAO RPAS Panel recommendation)
    - Detail of C2LL procedure (RP to initiate call to ATCO; information passed in initial call)
    - Promulgation of ATC phone numbers by AIP
    - Questions flagged for further discussion following validation exercise
    - Impact on ATCO? (workload, new terminology/phraseology)
    - What information ATCO needs to record or recall?
- Workshop output to be included in updates to final OSED

D2.2 C2LL Workshop Report

1. Background:

During development of the Solution 115 OSED it was determined that there were some outstanding concept questions to be answered. The project set up five working groups, to progress these issues. NATS volunteered to lead a working group to further address issues relating to the C2LL (Command and Control Lost Link).

2. Process:

An initial workshop was held on 22nd November 2021, which clarified some points of understanding and identified the key issues to be addressed. These key issues are included in **Appendix I Initial C2LL Workshop Output.**

A period of data gathering and discussions between partners via email followed, during which NATS for example held a workshop with internal subject matter experts to gather input.

The partners reconvened for a follow-up workshop on 13th January 2022 to discuss the issues in detail. The outcomes of this workshop were shared across the project partners, and were categorised into 3 types:

- Agreed;
- Revisit (to be considered after Validation Exercise), and
- Further Action to resolve

These are summarised in **Appendix II – Follow-Up C2LL Workshop Output**.

Further email exchanges and discussion of preliminary results from the Validation Exercise allowed the 'Further Action' items to be closed and provided the final input to this report, which has been circulated for review amongst partners.

3. Summary of Workshop Conclusions:

3.1 Agreed:

Points agreed will be reflected in the next iteration of deliverable documentation for the project.

The following points were agreed in the workshop (See **Appendix II – Follow-Up C2LL Workshop Output**).

- Add Assumption or Note for OSED alluding to expectation of "standard aviation practice" e.g., land clear and consideration of potential actions during emergency
- 'Diversion point' to be used rather than 'Exit Point'
- The RP will be the first to be aware of C2LL therefore the RP should contact ATC.

- In a C2LL scenario, control would not be transferred between ATCOs. This is regardless of whether GAT & OAT are distinct services or not (e.g., both are provided by the same provider in Germany but are separate in the UK).

- Safety Assessment to consider more than one RPAS in a sector.

The following points were agreed subsequently to the workshop (See **Appendix III – Email Discussion on final points**):

- All R/T should include prefix “remote” and initial contact should include the type.

- A military unit advising ATC of a change of mission/route via telephone rather than R/T would be highly unusual procedure but has been used in ON and NATS operations successfully. Publication of phone numbers (Action 8) will enable this.

- Agreed common transponder code should be 7400 in line with ICAO RPAS Panel. Noting that France has open question on how to resolve conflict with usage as interception code

- Each ANSP should endeavour to publish within their AIP a sector map and phone numbers to allow the RP to contact the ATM centre/ATCO in a C2LL contingency. This can relate to sector groups rather than individual sectors to allow for sector re-configuration and be to a supervisor position rather than direct to ATCO.

3.2 Revisit (to be considered after Validation Exercise):

The following issues remain open for consideration following the C2LL workshop and will be considered in line with results from the validation exercise.

- Consider data passed in initial call, including the addition of the Diversion Point and Alternate Airfield as C2LL contingency data. What information should be passed to inform ATCO without overloading R/T?

- Assess for the potential for terminology confusion in new R/T Phraseology specifically “Diversion point”.

- Consider feedback from ATCO from validation on proposed solution for C2LL during vectoring. There are concerns the solution is complex for ATCO to understand and certain scenarios may be difficult to execute solution e.g., could the RPAS fly past the exit point? Is mitigation of phone line sufficient?

- Assess impact on ATCO of multiple new considerations.

- Consider how ATCO will recall or record contingency information.

D2.3 Appendix

Appendix I: Initial C2LL Workshop Output

Clarified points on existing solution:

- The EXIT waypoint is a point on the route where, if the C2LL contingency occurs, the RPA will exit the planned route and either return to home or divert to a contingency airfield. Serge notified us that the current operational RPAs only have capability to return to home. Divert to an airfield may be a future capability, however.
- The EXIT waypoint could be within or beyond the current sector.
- Early assumption on project that the RPA will not perform a hold within CAS.
- ICAO recommendation in case of C2LL contingency (Still under discussion at ICAO): the 20 minute maintain current flight path is understood to be where there is no radar coverage. With radar it is 7 minutes.
- ICAO published new C2LL contingency procedures on Friday before meeting.

Suggestions for questions, which should be addressed within each organisation: (Including those proposed in the attached slides). These may not all be relevant to your organisation, and there may be other areas you wish to explore not listed here.

- How acceptable is current S115 concept to ATCOs? Break down into aspects: workload, communications, clarity etc.
- Does concept offer sufficient flexibility to operators of RPAS?
- Are there any suggestions for improvements?
- Who should initiate phone call in C2LL contingency? RP/ATCO/either?
- Should "UNMANNED or REMOTE (or whatever ICAO decides)“ be spoken on every transmission? Would it mitigate potential of step on by manned aircraft in sector?
- What is the contingency capability for the RPAs in your airspace? i.e., for UK the Protector.
- Will RPAs in each state operate from one or multiple bases? Can this allow us to simplify the contingency procedure?
- How does the ICAO recommendation to maintain flight path for 7 minutes impact the concept? If the exit waypoint be reached within the 7 minutes, could this lead to confusion?
- Will ATCO be able to recall the EXIT waypoint and contingency airfield after a duration when a C2LL occurs? Do we need procedures to note information on ATC systems somehow?

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Appendix II: Follow-Up C2LL Workshop Output

C2LL Notes and Discussion Consolidated Output from Workshop 12/1/22.

Note: there are 3 potential outcomes for each point:

1. Agreed position / consensus
2. Revisit after validation
3. Further action (not related to validation) to resolve (specify actions)

	Issue	Comments	Outcome	Outcome
Pre-Flight	Emergency flight plan	NATS – Reiterate that the RPAS Operator **is expected** have a plan for emergency situations and ensure standard rules like the need to "land clear" are maintained in planning flights over built up areas. Any alternative planned airfield is expected to be accessible via Controlled Airspace (CAS) or existing Danger Areas/Temporary Danger Areas (DA/TDAs)(restricted airspace) **TH-AVS** : … all RPAS operator used emergency airfields must be checked at pre-flight planning and must be accessible via CAS or existing DA/TDAs ; Can an emergency airfield/route be planned ? it would depend on where it happens For info: Potential diversion airfield will depend on multiple factors including capability and configuration of RPAS and equipment at airfield	**AGREED** Add Assumption or Note for OSED alluding to expectation of "standard aviation practice" e.g. land clear and consideration of potential actions during emergency.	1
Nominal Operations	Use of "unmanned" or "remote" on initial call and/or every call	**ENAIRE/DASSAULT/MUAC/NATS** Not necessary for ATCOs. **ON** prefer "remote" as easier to say and hear **ENAIRE** not for all transmissions, concern of R/T overload. **ECTRL**; Considered NOT necessary	**REVISIT AFTER VALIDATION & FURTHER ACTION** **Action 1 All ANSP :** Confirm that Callsign Name is sufficient to recognize that the	2 & 3

	Issue	Comments	Outcome	Outcome
		DSNA: Type of A/C already gives the information to ATCO that it is a RPAS. Usually, the phraseology shall avoid confusion if the part of the word is cut during the conversation. Hence, “remote” should be better than “unmanned”. **NATS** – For Info, ICAO propose “CREWED/UNCREWED” in documents? No requirement from ATC. If needed by other airspace users for awareness, then suggest “Remote”. Should have knowledge of aircraft callsigns. RPAS needs to be bought to attention of ATCO, not specified how. E.g. callsign, type in HMI/Strip Callsigns have specific meaning e.g. speedbird for British Airways. Reaper or Protector could be used.	aircraft is an RPAS (including for other pilots) **Feedback following validation, to ICAO.** **NOTE feedback from ICAO (via Airbus)** Phraseology "Unmanned is the current wording for RPA. If a point occurs where ICAO needs to go away with "unmanned", the plan is to revert to "pilotless" as is used in the Convention. Up to now there is no formal proposal yet for the change of the phraseology. Call sign prefix "The proposed radiotelephony for RPA is "remote" on initial contact e.g. "Reaper 01 remote". Same procedure as with "heavy".	
	Data passed in Initial Call	**DAV** – Add Speed, FL, direction of turn and heading **ENAIRE** – too much information to be passed. Expect to have a coordination document [**TH-AVS** : the contact exchange is as a manned a/c pilot who confirms current state vector & one dynamic element – such an element cannot be passed / documented before flight – only the procedure principle can be;	**REVISIT AFTER VALIDATION** Validation exercise includes the two new data elements (EXIT point and ALTERNATE airfield) will get feedback from ATCOs on method.	2

	Issue	Comments	Outcome	Outcome
		EXE_001 will be requesting feedback from ATCOs on the C2LL procedure, and feedback against multiple options] **NATS** – Military would not pass route info over R/T. [**TH-AVS** : Route is not provided, only one dynamic element the EXIT point – in any case also take into account that it is a GAT transit route] **ECTRL**: suggest to act as a manned pilot, additional information passed before flight [**TH-AVS** : the contact exchange is as a manned a/c pilot confirms current state vector & one dynamic element added which cannot be passed before flight, and is not contrary to existing phraseology practices; In any case, EXE_001 will be requesting feedback from ATCOs on the C2LL procedure, and feedback against multiple options] **AIRBUS DS**: support the view from above **DSNA**: Too much information. The ATCO does not need all this and can see part of them in real time on his display. Need to evolve situation from coordination document. Useful to validate passing exit point and alterative airfield. Other information (route, level etc.) not required by ATC Information passed is the standard initial contact information (e.g. callsign, altitude, reporting point) (TWR also more elements)… plus initial exit point and alternate airfield.		

	Issue	Comments	Outcome	Outcome
	Assumption of 1 aircraft per sector	**NATS** - Protector is likely to operate as 2 aircraft from the same base so there is a high likelihood that both may be in the same sector at same time [**TH-AVS** : to be reviewed against on-going SAR; To be confirmed by ongoing SAR, the main issue comes at last safety barriers, so TBC for more than 1 RPAS] **Airbus DS**: This can only be valid for the initial operation time. **[TH-AVS** : Yes, exactly scope of s115] In manned aviation, we do have multiple aircraft from same / different type in one sector and this can be handled well. The UAS should be considered as an "normal" aircraft and not different! **TH-AVS**: there are specificities of RPAS; due to that, the initial safety analysis on the led to this constraint. It is being thoroughly addressed in the on-going SAR workshops **DSNA**: Question: do you mean RPAS are operating in pair? **NATS response**: Not necessarily but in same geographical area is possible, providing 24/7 coverage of area would need to handover, or arriving/departing base at similar times. Can this scenario be added to validation to test assumption? Safety assessment found 2 RPAS with safety barrier loss would be concern. Suggest sufficient separation? NATS Formation flight including an RPAS in formation?	**FURTHER ACTION** **Action 2 NATS** : Provide input to SAR workshop on the 2 RPAS situation **Action 3 ALL ANSPs:** Do ANSPs have need for more than one RPAS per sector? [DNSA: yes but only in segregated areas or OAT. E.g. UAV refuelling tankers OAT] **Action 4 NATS** : check likely separation between RPAS operating from UK	3

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	Issue	Comments	Outcome	Outcome
	Phone Calls to ATC to pass operational changes	**NATS** – Phone calls from operator to ATC are frequently used during operation to advise of route changes or mission changes to avoid passing information over R/T. [Propose a map and list of phone numbers for "Group Supervisors" is published and shared between states – see C2LL situation]. *[TH-AVS : linked to ATCO or RP initiates call]* **AIRBUS DS**: By using the phone [**TH-AVS** : use of phone in s115 is only intended for post-C2LL coordination and never intended for normal flight communications] you are intentionally decreasing other "airspace users" situational awareness what is ongoing around them! In case of an emergency or Radio communication loss it might be a valid option, however during normal flight operation it could become an additional burden for the ATCO! Providing a list of phone numbers is helpful in case of unexpected situations e.g. Radio comm out. Is this a concern for other ANSPs? Can it be/Is it included in validation?	**FURTHER ACTION** **Action 5 ALL ANSPs:** to find out if each state military has a requirement to notify operation/mission changes to reroute an active GAT flight using phone to contact ATC. Also whether the ANSP could accept such notifications by phone from other military states e.g British RAF phone DSNA?	3
	Vectors	**NATS** – ATCO unlikely to give clearance limit in this scenario. Aircraft may pass beyond REJOIN or REJOIN point whilst on vectors. [**TH-AVS** : *Nota : this item is linked to Action of RPA on C2LL*. Assuming No clearance limit, current RPA (block-5 reaper) will "return "immediately" after 10 sec. or	**FURTHER ACTION** **Action 6 TH-AVS**: Laurent to provide draft of procedure as described now in OSED for information.	3

	Issue	Comments	Outcome	Outcome
		will revert to a pre/re-programmed trajectory which can be along the original FPLN, fully or partially] ATCOs feedback that they would be confused by change in clearance for vectors. Is this a concern for other ANSPs? Confirm part of validation? OSED now has updated definition, which may clarify. Validation: vector requested due to weather avoidance. C2LL following vector.		
2LL Contingency	7400 squawk	**DDA/DSNA** - Problematic for France as used as intercept code **NATS** - Query should it be 7700 emergency code to trigger warning to ATCO? 7400 won't highlight aircraft to ATCO, is this acceptable? **ECTRL**; to recheck if ICAO already decided to use 7400, still to differentiate between contingency and emergency, 7400 NOT emergency (so LL only) **Airbus DS**: Suggest to follow the guideline of the ICAO RPAS Panel for international UAS/RPAS operation. A common solution (like high jacking, loss of radio communication or emergency codes) should be the overall goal even if it includes that states have to change their already established codes **TH-AVS** - It may become an issue for cross border vs. individual state flights. Not suitable to use 7700 for C2LL?	**AGREE** - a squawk code should be used to indicate a C2LL situation to ATC and other airspace users. **REVIST AFTER VALIDATION** – to check whether the use of specific codes caused any issues. **ACTION 7 ALL ANSP** explore the need for a common code for cross-border operations. ANSP feedback on suitable codes for domestic and cross border use.	1,2,3

	Issue	Comments	Outcome	Outcome
		Use ICAO recommended code, whatever it is. Assume 7400 for validation purposes? **TH-AVS -** Considering 7400 as the "final", long-term option, for s115 suggest that ANSPs feedback suitable codes, which would be possible in the accommodation timeframe and to be documented.		
	"Exit point"	**ON** – term already used in ATC prefer diversion or decision point **ECTRL**: Why? Exit point already used as point aircraft leaves ATC current sector. Need for exit point (as information passed to ATCO) and also specific terminology will be tested in validation. ANSP feedback on what phraseology could be used. Diversion point?	**AGREE** – 'Diversion point' to be used rather than 'Exit Point'_ **REVIST AFTER VALIDATION** - to assess for the potential for terminology confusion, specifically in RT Phraseology.	1,2
	ATCO or RP initiates call	**DAV** - Pilot as first aware of C2LL **ON/ENAIRE** – RP as first aware of C2LL ATCO calls pilot if doesn't hear from RP after 2 (?) minutes. **NATS** – RP as first aware, however difficult to contact ATCO via land line, fixed lines ideal but not viable in timeframe. Propose a map and list of phone numbers for "Group Supervisors" is published and shared between states, to allow RP to call ATC. Look up of flight plan field 18 data would be too slow and too high workload, so also propose each state publish list of phone numbers for command	**AGREE**_– The RP will be the first to be aware of C2LL therefore the RP should contact ATC. **ACTION 8_– ANSPs** : Determine how to make the map and list of phone numbers available – including for cross border operations. **ACTION 9 NATS:** investigate	1,3

	Issue	Comments	Outcome	Outcome
		centres (should be a limited number, about 6?) so ATCOs can easily call RP when necessary **DSNA**: Must be adapted nationally to fit each country peculiarities **Frequentis:** The RCF flag at the UI is set (only) when we receive RCF via ASTERIX, i. e., we'd have to set the transponder code in the data stream to 7600 [**TH-AVS** : C2LL code 7x00, is automatically set by transponder at C2LL event by RPA system] by some means in order to exploit that. It may be interesting to consider for the C2LL procedure. [**TH-AVS** : discussion here is the following exchanges to be initiated over telephone] Would be ideal to standardise on this. No clear solution. Validation will inform further discussion. **TH-AVS - Action All ANSP :** Do you concur? => Each ANSP accommodating RPAS to publish map + list of phone numbers Control & Command Centres "Group Supervisors". => RP flight documentation must have that list and RP calls suitable number. ATC always has RP phone contact (from field 18?) as last resort.	how this occurs for today's Oceanic operation, where pilots are provided phone numbers to be called via SatCom (back up comms, in the event of VHF comms failure).	
	Action of RPA on C2LL	**DAV**: Reaper BLOCK-5 currently executes immediate return to home. Other aircraft have different capability. **NATS** – would prefer to follow proposal to maintain current flight path for 7 minutes if aircraft	**REVIST AFTER VALIDATION** - To invite feedback from ATCO on proposed solution. Scenario is RPAS leaves shared flight path on vector,	2,3

	Issue	Comments	Outcome	Outcome
		are capable. Also vertical profile is key so propose maintaining flight level until above diversion aerodrome, then spiral descent. **ON** - The "whichever comes first" rule may apply. If the time of occurrence of the C2LL is recorded by ATC and the RPAS system, and the EXIT point is still ahead, then the EXIT point is first option. [**TH-AVS** : the EXIT point is always ahead of the RPA ; the X minutes in the use case is a specific situation when the RPA is on a lateral vector]. Otherwise the deviation will occur at any point after 7 minutes. If ATC is aware of this, they will clear the traffic. Although in this case there are various possible outcomes. **ENAIRE** – Can be added to flight documentation **AIRBUS DS**: The aim should be to establish a standard C2LL procedure independently from the individual RPA capability. As in manned aviation the procedure should be designed that it can be executed by all RPAs. . [**TH-AVS** : the s115 intent is exactly to do that taking into account : • known RPAS in the accommodation timeframe flexibility for different RPAS and for external environment conditions] **DSNA**: ATC must know the future behaviour of the RPAS, whatever the procedure. But the procedure must also be common for every RPAS so that the ATCO does not have to remember several.	C2LL occurs, rejoins flight plan until exit point then returns direct to home. Same scenario for all ATCOs. **ACTION 10 DSNA**: Action Yannick to confirm validation scenario for C2LL is RPAS leaves shared flight path on vector, C2LL occurs, rejoins flight plan until exit point then returns direct to home.	

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	Issue	Comments	Outcome	Outcome
		As pilot/ATCO can communicate over phone, do we need to know action in advance? Wouldn't for crewed aircraft. If RPAS capability not standard, can ATC procedure proscribe any behaviour on RPAS? Standard procedure to use phone comms to get contingency flight plan (exit point and diversion airfield already known) from RP and clear that flight path. What is procedure(s) used in validation scenario? **TH-AVS Action NATS :** To confirm if possible whether Predator has this behaviour or more flexible C2LL trajectory options. **TH-AVS Action AIRBUS :** Please provide more precision on what you mean by a "standard C2LL procedure", taking into account the accommodation constraints **TH-AVS Action ENAIRE :** Please provide information of which documentation & how such information can be provided in documents		
	Transfer to OAT (if leaving CAS during contingency/emergency or ditching etc)	**NATS –** current EMERGENCY use case procedure is to keep an aircraft experiencing an emergency on frequency with the same ATCO to reduce workload on pilot and risk of comms loss. Therefore not recommended to transfer to OAT during emergency. [**TH-AVS** :	**AGREED**: In a C2LL scenario control would not be transferred between controllers regardless of whether GAT & OAT are distinct services or not (e.g. both are provided by	1

	Issue	Comments	Outcome	Outcome
		reminder : Use Case, worst case emergency is remotely pilotable/controlled flight to and emergency airfield/landing zone which can be chosen by remote pilot] **ECTRL**: Not clear what it should relate to? [TH-AVS : EMERGENCY use case] **TH-AVS - Action ALL ANSP :** Do you concur? => Emergency trajectory & descent to be maintained under GAT control Some states e.g. Germany do not differentiate between OAT and GAT. Revisit OSED use cases when next updated.	the same provider in Germany but are separate in the UK).	
	Situational awareness of other aircraft in sector	During C2LL due to use of telephone there would not be calls over R/T by ATCO to try to establish comms. Does this degrade situational awareness for other airspace users?	Not discussed	
ATCO Workload	Multiple new similar procedures	**ON** - the need to memorise simple but several similar procedures, i.e. C2LL and RCF, may have a negative impact on ATCO performance. We suggest monitoring this issue during the validation exercise and, if problems arise, suggesting in the conclusions that more research should be carried out on this specific issue. [**TH-AVS** : EXE_001 will be requesting feedback from ATCOs on the C2LL procedure, and feedback against multiple options collected] To this end, validation exercise scenarios should simulate cases where C2LL	REVISIT AFTER VALIDATION	2

	Issue	Comments	Outcome	Outcome
		and RCF occur simultaneously or with a small time difference. It should be monitored whether ATCOs transfer specific RCF skills to C2LL and vice versa, and what effect this generates. Of course, RCF/C2LL checklists can (almost) eliminate the problem. **DSNA** - Totally agree on the number of procedures. That's why we suggest that there is only one for RPAS and it is given at the first radio contact. Harmonization of the procedures could be part on the integration phase, when RPAS could integrate it. It is too late to play this scenario in S115 because the scenario is already defined **TH-AVS - Action ON :** Please provide to DSNA precise suggestions: EXE does not perform a RCF procedure, that is assumed already known to ATCOs		
	Recall of EXIT waypoint and alternate aerodrome	**ON/ENAIRE -** We think it would be inequitable to burden the ATCO with the responsibility of remembering very specific details of an individual aircraft (RPAS). If the RPAS behaviour in case of C2LL is to be indicated in one way or another in the FPL, I would ask for automated access to this information. E.g. via a dedicated label/strip section ("C2LL"), etc. [**TH-AVS** : this cannot be done in the accommodation concept as this information has to managed dynamically ; otherwise we are back to a fixed to route/fixed contingency trajectory which does not	REVISIT AFTER VALIDATION ACTION 11 DSNA: Can validation scenario have more than one aircraft in same sector?	**2**

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	Issue	Comments	Outcome	Outcome
		respond to the file & fly any IFR route] **NATS -** ATCO HMI may have notes function, need to confirm **DSNA** - It is very easy to remember the exit point for only one aircraft. The ATCO can write it on the strip. This would of course not be acceptable for several RPAS at the same time. **FREQUENTIS:** ATCO using Frequentis Prisma system screen can trigger displaying ICAO FPL dialog showing FPL fields. It shall be possible to configure showing also the field18 information (that could contain information about planned EXIT waypoints [**TH-AVS** : this cannot be done in the accommodation concept as the EXIT WPT has to be managed dynamically – typically if could be from 10 sec. ahead of the RPA to any other WPT of the FPLN ahead of the RPA – which is exactly why the concept is to provide that information to the ATCO] ; otherwise we are back to a fixed to route/fixed contingency trajectory which does not respond to the file & fly any IFR route] for contingency procedure, pilot contact and other RPAS relevant). **TH-AVS - Action ON/ENAIRE :** Please provide your suggested alternatives, taking into account the points noted here. **TH-AVS - Action FRQ :** Please provide information on : • Which ATCs use Prisma? • Is it used for Flight Planning		

	Issue	Comments	Outcome	Outcome
		• Does the current (or short-term system provide the feature display/configuration described?)		

Table 60: Appendix II- Focus Team C2LL Workshop Outputs

Appendix III: Email Discussion on final points

Action	Comments	Resolution
Action All ANSP: Confirm that Call sign Name is sufficient to recognize that the aircraft is an RPAS (including for other pilots). Note: validation results indicate it is necessary for RP to announce type over R/T. Do you concur?	**Airbus**: I do support that the RP announces the type as well over R/T. I as well would like to emphasize the view from ICAO RPAS Panel where:*"The proposed radiotelephony for RPA is "remote" on initial contact e.g. "Reaper 01 remote". Same procedure as with "heavy" in respect to manned aircraft.* **DSNA**: I confirm DSNA's RTS raised this need. As Maurice, I think that if we could stick to ICAO's proposal, it would be great. In addition, "remote" sounds better than "unmanned" which will probably add confusion with "manned". **EC**: YES	**Agreed that all R/T should include prefix "remote" and initial contact should include the type.**
Action 5 ALL ANSP: to find out if each state military has a requirement to notify operation/mission changes to reroute an active GAT flight using phone to contact ATC. Also whether the ANSP could accept such notifications by phone from other military states e.g. British RAF phone DSNA? Note: Requirement poorly understood so any input on if this practice is applicable to your operations is appreciated.	**Airbus**: In manned aviation aircrews are able to do an "en-route flight plan change" over the Radio. I would expect that any request for a flight plan change would as well be initiated by the RP itself and not by the military states. But maybe I understand this question / statement not correctly. **DSNA**: I also think this change could be done over R/T, like it is done today with civil operations. If the mission is as "secret" or "sensitive" as it requires a level of confidentiality, the military RPAS should fly in OAT, not in GAT. **EC**: Understood we are talking about a flight in the air, so tactical part! Yes via phone if of immediate concern, if for later (RPAS endurance up to >48 hours, than by established notification procedure (or as agreed in LoA or whatever memorandum). For action 5 the issue is time. It is very relevant for the means of communication if the aircraft is still on the ground or already in flight (tactical phase I was addressing, it has nothing to do with mission or OAT, it is the airborne phase). In flight there could be a tactical rerouting of the flight in direct comms between pilot and ATC or via telephone from e.g. WOC, although todays technologies prefers an associated flight plan message, so an automated message format to share a request for FPL revision, that could be initiated from cockpit or ground.	**Agreed this would be highly unusual situation but has been used in ON and NATS operations successfully. Publication of phone numbers (Action 8) will enable this.**

Action	Comments	Resolution
	Thales: The situation here is a standard IFR Transit flight under GAT, tactical appears out of scope … immediate concern / tactical would be a Mission situation, and under OAT wouldn't it ? Perhaps the transit route would have to change to go to another mission entry point or towards another aerodrome terminal area, but this part of change is a standard in-flight FPLN change is it not? As discussed/raised previously by Yannick, if the flight route is so sensitive that private exchange is needed it should not be in GAT Transit. **ON**: yes we have such practice, with foreign military RPAS and to the point with C2LL situation. Foreign military used phone call to resolve the issue. From our ATCOs perspective, it was helpful.	
ACTION 7 ALL ANSP feedback on suitable codes for domestic and cross border use for C2LL contingency situation. Note: ~~7600~~ [should be 7400] not available for DSNA, any further input or suggestion? Assuming a common code will be needed if the RPAS crosses international boundaries, otherwise each nations specific code would need to be programmed into RPAS, which is likely to be difficult. Do you concur?	**Airbus** There should be a common agreed transponder code (e.g. 7400) for this C2LL situation based on the recommendation of the ICAO RPAS Panel. There should be no different codes between domestic & international operations (e.g. in manned aviation we as well not distinguish between domestic and international operations when using the codes 7500, 7600 or 7700). AIRBUS DS is supporting the usage of the SQ 7400 for UAS C2 LL failure as it is recommended by the ICAO RPAS Panel! **DNSA** Correction: 7600 is available in France, this was the transponder code that France proposed for C2LL. But the majority voted for 7400, that is not available in France (used for interception). France has also voted in favour of 7400 for C2LL despite the use of this squawk for interception in France. France was probably alone in that case, that's why our representative(s) agreed on this proposal. So now the question is for France to know whether we keep 7400, which may create confusion for ATCO(for instance probably the label could be red in case of C2LL, it is blue for interception, so not	**Agreed common transponder code should be 7400 in line with ICAO RPAS Panel. Noting that France has open question on how to resolve conflict with usage as interception code.**

Action	Comments	Resolution
	adapted to the situation of C2LL), or if we set another code for interception. **EC**: Guess you mean 7400? My understanding is that ICAO will go for 7400, do n ot have latest update..sorry. EC supporting the use of that squawk [7400] in favour of the ICAO RPAS Panel. **ON** : no issues with future vision of ICAO RPAS Panel for usage of 7400 squawk	
ACTION 8 ALL ANSP :Determine how to make a sector map and list of phone numbers available – including for cross border operations. Note: NATS propose this could be published in each AIP. Do you concur?	**Airbus** These phone numbers should be published in an official, for everybody assessable document like the AIP. **DSNA**: I need to check how it works. I mean, if several sectors merge when the traffic is low, what will be the telephone number? I am pretty sure that that kind of situation is out of AIP publication delays. EC: This should be part of any LoA or whatever kind of memorandum made! all military operators are supposed to having LoAs or any other pertinent agreement available (with ANSPs) that builds the bases of their operational procedures in all regards. Having it in AIPs might not be wished by ANSPs, 1st because sectors are changing between active and inactive status and second those numbers should not being used often as they distract the 2 ATCOs in position form their work…adding workload away from the screen. Sector maps to my conviction should not be published in AIPs, as to the constant change of such sectors in size and volume, putting them together and distributing them to different positions in the Ops room of the ANSP. This would mean something like e.g. 10 to 20 changes per day for the AIP…a bureaucratic monster…J…if I do not get the idea wrong…???!!! Thales: My understanding is that this is a proposal to provide RPAS operator with a "published" list of ATC contact phone numbers … I don't believe (but not fully my domain) that a operator has access to LoA or other memorandums ON: In the Accommodation phase it would be very helpful for both sides to have such list. Taking into account, that number of operators in Accommodation phase would not be very wide,	**Agreed a list of phone numbers by sector groups should be published in each nations AIP to enable RP to contact ATC.**

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Action	Comments	Resolution
	they could be in very simple form Operator - Contact phone number. Also we would like to support Edgar position, that such maps and respective phone numbers should be part of respective LoAs.	

Table 61: Appendix III- Focus Team DAA Workshop Outputs

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D.3 COMM Latency Step On Focus Team Output

This section provides inputs collected on the latency of communications due to SATCOM relay. This overall conclusion is that SATCOM communication is feasible, as the induced latency is manageable.

D.3.1 ON Inputs

1. Latency:

After the revision of problem under consideration by ON ATCOs it was defined, that we fully agree with scheme provided by Cedric (below):

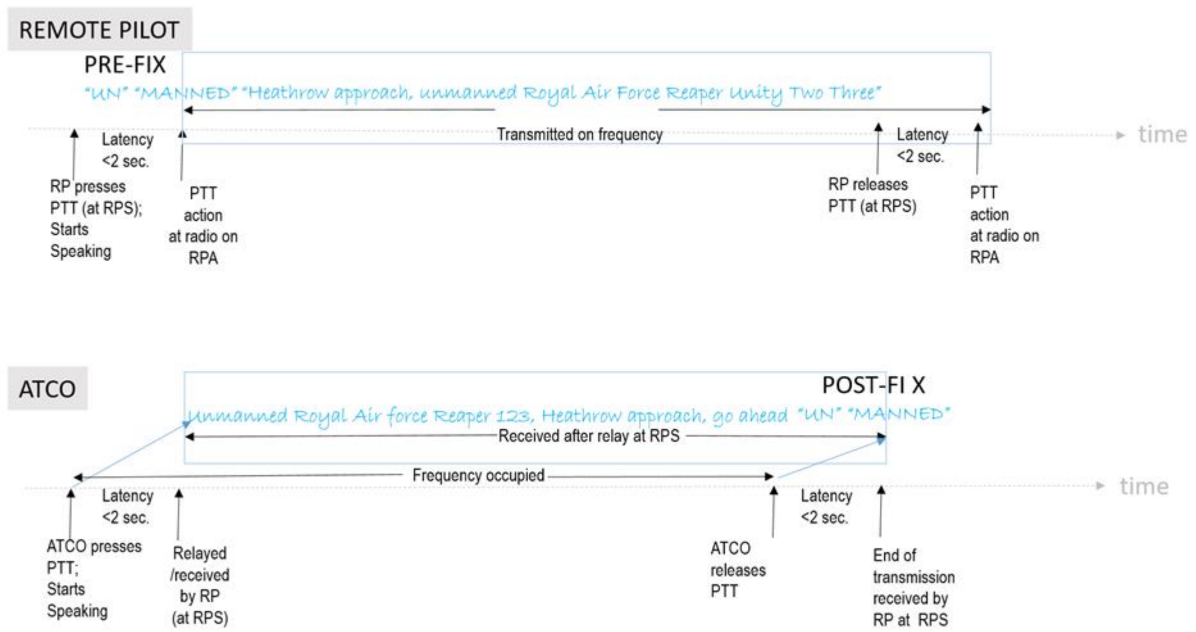

Figure 26 : Command & Control Link (C2L) Induced Latency

Also, from experience it was noted by ON ATCOs, that largest communication delay happened (using SATCOM over VHF) was 2 sec. Usually it was less than this figure (approx. 1 sec.).

2. Step on:

On ATCOs support DSNA's inputs and emphasize, notwithstanding minor experience, that quality of communication with HALE and MALE drones are on the level of manned aircraft or sometimes even better.

They mention a problem which is not linked to latency but more to individual communication, which is the pronunciation and phraseology from non- EU remote pilots. Sometimes it is difficult to understand their intentions, or answers, which impacts communication time.

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D3.2 DSNA Inputs

1. Latency:

ENAC is currently working on the latency part of the communications issue.

A study (based on existing documentation/data and research) encompassing two different items is performed on:

- Latency existing on satellite communication (FSS).
- What could impact latency in order to be able eventually to foresee additional latency (compared to the usual latency of 2 seconds) and provide some requirements in that case.

2. Step-on:

Two testimonies provided by Air Traffic Controllers one from ENAC in charge of ATCO training and one from CRNA south East:

- There could be a problem in dense traffic areas, but generally speaking, when an ATCO provides a clearance to a pilot, there is a natural trend to let the dialogue ATCO-pilot ends.
- There is no specific procedure in case of step on. If the ATCO detects that two or more pilots talk at the same time, he can manage to organize the conversation with appropriate phraseology (“aircraft call sign, go ahead”).

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D3.3 NATS Inputs

1. Latency:

Due to BRLOS satellite communication, a latency of approximately 2 seconds has been observed.

Gavin said, “I believe that the processing speed of the voice signal on the UA is unlikely to be a significant contributor to the overall latency figure. It is more likely to be down to the delay on the satellite constellation being used, and there are likely to be significant differences between different satellite constellations, and also between civil vs military satellite constellations. We know that neither the MOD nor General Atomics are prepared to divulge either the UA’s processing speed of voice signals, or the performance of the satellite link, so unfortunately a latency figure is not available.”

He adds “we received anecdotal reports from ATCOs involved of minor comms latency delays, but none were deemed significant (manageable, little to no impact).”

2. Step on:

Remote pilot and ATC are briefed to be aware of 'step on' and so it has not been an issue for these RT transmissions.
However, other aircrew are not aware of the (small) latency and are more likely to 'step on'. This is an education issue for all pilots and ATC - particularly for busy sectors.

D.4 WAKE Practices Focus Team Output

D4.1 DSNA Inputs

1. Input received from Air Traffic Controller Training Centre at ENAC:

RECAT-EU is applicable only in TMA for approach- arrivals and take-off – departures.

Above FL115, this is not applicable.

Leader/Follower	CAT A	CAT B	CAT C	CAT D	CAT E	CAT F
CAT A	3 NM	4 NM	5 NM	5 NM	6 NM	8 NM
CAT B		3 NM	4 NM	4 NM	5 NM	7 NM
CAT C			3 NM	3 NM	4 NM	6 NM
CAT D						5 NM
CAT E						4 NM
CAT F						3 NM

Leader/Follower	CAT A	CAT B	CAT C	CAT D	CAT E	CAT F
CAT A		100s	120s	140s	160s	180s
CAT B				100s	120s	140s
CAT C				80s	100s	120s
CAT D						120s
CAT E						100s
CAT F						80s

Figure 27 : Wake Practices Focus Team ENAC Outputs

Standard separation (5 NM/1000 feet) is applicable in the en-route phase.

There could be dedicated regulatory notes for managing traffic such as B777, A380, etc…

In that sense, RPAS, which considered as a light aircraft, should not be different to the other light aircraft.

2. Inputs received from en-route Air Traffic Controllers (CRNA East and South East):

A national regulation imposes a dedicated separation between light and heavy/super heavy aircraft of 6NM/1000 feet minimum.

In certain circumstances (meteorological conditions), ATCO confirm they receive requests from light aircraft pilot to change their trajectory to avoid wake turbulences when behind heavy/super heavy aircraft.

This occurs very rarely.

D.5 Flight Plan processing Practices Focus Team Output

D.5.1 RPAS ICAO FPL Workshop

This (artificial) FPL example demonstrates possible information to be included in RPAS flight plan for the initial FPL message. The next chapter demonstrates RPAS specific flight plan information using this FPL example. iOAT format specifics are studied in this paper, but not recommended to be used in context of PJ13 S115 – in the accommodation phase of RPAS. The last chapter gives final recommendations for PJ13 S115.

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Field nr.	ICAO FPL	Comments
Field 7,8 Field 9,10 Field 13 Field 15 Field 16 Field 18 Field 19	(FPL-REAP01-IM -FFLO/M-SIUYRGZ/S -LHNY1310 -N0090A045 RIGSA/N0090A035 KEKED STAY1/H/0027 KEKED ROMKA -LHNY0145 -RPA/MALE TYP/REAPER END/1400 PBN/A1B2C2D2L1O2S1 NAV/GBAS SBAS DOF/220107 EET/KEKED0049 KEKED0116 OPR/SZOLNOK RALT/LZKZ ALT/LKKV EXALT/KEKED-LZKZ ROMKA-LHMC STAYINFO1/TOUCH AND GO RMK/RTECOORATC PIC/PILOT NAME +420777854662 EUR/OAT -E/1400 P/000 R/VE A/WHITE WITH BLUE STRIPES C/PILOT NAME)	
	The field 18 of FPL is for providing other information about aircraft of flight, that is not contained in other FPL fields. FPL2012 defines standard/published indicators (such as DOF, PBN, NAV, COM, DAT … highlighted green in the example). Field18 indicator name and value is separated with a slash sign "/" (value field ends with next indicator name). The field18 allows using also unpublished indicators (highlighted blue in the example). Text followed after RMK/ indicator is a free text without syntax rules, interpretable only by a human. The field 19 (grey text) is supplementary information transmitted with via AFTN with a SPL message. Including it into FPL message makes the FPL non-ICAO. RQS is a request for supplementary, reply is SPL – the field19 content. It is not automatically distributed to ATS units and therefore shall not be used for RPAS information accommodation.	

Figure 28 : RPAS ICAO FPL Workshop

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D.5.2 RPAS Specific information in ICAO FPL

RPAS specific information	Mapping to FPL2012 format	Comments
RPA Type	**FPL field 8, 9** For RPAS, which is not capable of hover or vertical flight and needs to be in horizontal motion to sustain flight use the value **FFLO** (forward flight lift only) as specified by ICAO Doc 8643. For RPAS, which is capable of vertical flight and hover use the value **VFHC** (vertical flight and hover capability) as specified by ICAO Doc 8643. For aircraft types that are not published in ICAO Doc 8643, **ZZZZ** is inserted into the field 9 and specification of the type provided in field 18 **TYP**/ indicator (existing, published with FPL2012 format). **FPL field 18** Use **END**/ indicator in the field 18 followed by aircraft endurance (4 digits, not limited to 24h, part of iOAT). *Example of field 9 content:* `FFLO` (forward flight lift only) *Example of field 18 content:* `TYP/REAPER END/0014` Note: The field16 is Estimated Elapsed Time for the flight (IFPS can indicate specific profiles as extended EET/ information in the filed18). It shall always be smaller than END/ in th field18.	**THL**: Reaper flight flown on DOF/211213 from LFBG through Spain area and back contained 'AT' in the field8. **Action Frequentis:** find out, what values A, T means, these are not FPL2012 valid values. **FRQ**: iOAT suggest using 'P' in filed 8 2nd letter: iOAT standard says: *The new indicator "P" to be inserted in Item 8 is notifying that this particular IFR flight relates to the military RPAS operations and additional information will follow in Item 18.* Till iOAT is implemented by systems (will be implemented in NM during 2023) this letter cannot be used, because such FPL will be rejected. **FRQ**: Field19 contains E/ for endurance, iOAT is basically moving this information from field19 to field18. **ECTRL**: END/ is endurance (depending on fuel consumption and other conditions) it has nothing to do with fild16 EET, which is the Estimated Elapsed Time. END/ can be used by Alert services

RPAS specific information	Mapping to FPL2012 format	Comments

RPAS flight trajectory	Enter in the field 15 flight route as for a standard IFR flight.
	
	Use **STAY** indicator(s) integrated in field 15 for special activities during the flight. It can be associated with an ARES (reserved airspace), an Aerodrome or a Holding point. STAY is followed with a sequence number, 1-9 STAY parts can be included. After a slash sign is indicated which type of STAY association it is:
	
	• **A** – for ARES (reserved airspace),
	• **D** – for an Aerodrome,
	• **H** – for a Holding.
	
	After another slash sign follows the associated feature identifier. And finally after another slash sign is indicated the time of delay. For each STAY indicator in the field15 insert corresponding **STAYINFO/** indicator into the field18 providing more information for the stay reason.
	
	For STAY associated with **ARES**, the entry and exit point to STAY HOLDING indicator for aircraft holding or loitering activities is to be inserted in the route description.
	
	Example of field 15 content:
	`DCT EDTVAN0450F150 STAY1/A/EDTRA790/0040 EDTVAN0400F220 DCT`
	
	Example of field 18 content:
	`STAYINFO1/DETAILS OF STAYING IN ADTRA790`
		FRQ: More complex use of STAY indicators comes introduces iOAT, which allows distinguishing types of STAY (ARES, AD, Holding). This is generally good approach, but FPM systems as are now will need adaptations to understand this new syntax of iOAT encoded flight route.
		THL: For GAT transit flights (s115) STAY is not required? May be required for OAT portion, that is not s115's subject.
		ECTR: In ATC STAYx/D may not be possible to consume by ATC systems. Currently iOAT suspended implementation in NM of this feature.
		STAYx/D is important specifically for M flights, but also can be used for civil training flights etc.

RPAS specific information	Mapping to FPL2012 format	Comments
	For STAY associated with a **Holding**, the entry and exit points with related FL and speed parameters are integrated in the route description to the STAY ARES indicator. It should be noted that for ARES the entry and the exit point could be the same. *Field 15:* **KEKED STAY1/H/0049 KEDEK** *Field 18:* **STAYINFO1/ DETAILS OF STAYING IN KEDEK** For STAY associated with an Aerodrome (e.g. training at the aerodrome for multiple approaches), the Aerodrome designator is associated with the stay. *Field 15:* **KEKED STAY1/D/0049 LZKZ** *Field 18:* **STAYINFO1/TOUCH AND GO IN LZKZ** Use **EET** in field 18 to indicate significant points or FIR boundary designators followed with estimated elapsed times from take-off to such points or FIR boundaries. *Examples:* *Field 18:* **EET/KEKED0049 KEKED0116**	**ECTRL**: the route containing Aerodrome for STAY indication doesn't usually contain SID or STAR **TH**: The use of extended STAY indicators values followed with /A/, /D/, /H/ is not for discussion in s115 / not in scope of the project s115 is for GAT -> not to be used in accommodation, because existing system will not understand such field 15.
RPAS Equipment	Use in field 10 equipment codes published for FPL2012, or use 'Z' in field 10 for other equipment carried or other capabilities in combination with NAV/ COM/ DAT/ indicators of field 18 (existing, published with FPL2012 format).	**THL**: Reaper flight flown on DOF/211213 from LFBG through Spain area and back contained 'IUV/C' in field 10a and 'C' in 10b.

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RPAS specific information	Mapping to FPL2012 format	Comments
	For Unmanned aircraft types (when RPA/ indicator is used in the field 18), 'R' is mandatory in field 10 (PBN Approved). See details in Performance-based Navigation (PBN) Manual (Doc 9613). Use **NAV**/ to specify navigation equipment, other than specified in PBN/, as required by the appropriate ATS authority. Indicate GNSS augmentation under this indicator, with a space between two or more methods of augmentation. Use **COM**/ to indicate communications applications or capabilities no specified in Item 10a. Use **DAT**/ to indicate data applications or capabilities not specified in Item 10a. *Example of field 10:* `IUVC/S` *Example of field 18*: **`PBN/A1B2C2D2L1O2S1 NAV/GBAS SBAS`**	
Contingency procedures	Alternate aerodrome(s) to be used for landing in case of C2 link loss procedure activated in en-route the **RALT**/ indicator (existing, published with FPL2012 format) and in TMA the **ALTN**/ indicator (existing, published with FPL2012 format), when situation doesn't allow landing into the initial airport. *Example of field 18:* **`RALT/LZKZ ALT/LKKV`** Note: in the example above non-ICAO locations are used for en-route alternate aerodromes.	**FRQ**: The OSED 115 document states ALT instead of ALTN.. this is inconsistent **TH:** In 115 not to be used. EXIT / DIVERSION is a dynamic information. Adding

RPAS specific information	Mapping to FPL2012 format	Comments
	Use **EXALT/** (unpublished indicator in FPL2012 format) for each alternate aerodrome to specify the exit point on trajectory in field 18. The exit point identifiers must be contained in the Route information within the field 15. Note: EXIT term is to be replaced with DIVERSION *Example of fld 18 – waypoint based*: `EXALT/KEKED-LZKZ ROMKA-LHMC` (after KEDEK alternate to LZKZ, after ROMKA alternate to LHMC) *Example of field 18 – time based:* `EXALT/0015-LZKZ 0145-LHMC` (after 15m alternate to LKKZ, after 1h45m alternate to LHMC)	this information during planning phase would make the flight static. **FRQ**: ENAV suggested this format: OKL/ALT LK001 BEKVI/ALT LK002, but this approach is not compliant with field 18 syntax – indicator name shall be before the slash sign. This is why we would suggest inventing a **new** unpublished field18 indicator for RPAS exit points **NATS**: Field 18 is not available to ATCOs. Manual intervention from supervisor's desk is needed.
Remote Pilot contact and other information in field18	Remote pilot name and mobile phone number is provided in the field 18 PIC/ (unpublished indicator in FPL2012 format, part of iOAT format). *Example of field 18:* `PIC/PILOT NAME TEL.0042 777854662` Use EUR/OAT indicator for the flights operating in accordance with EUROAT and national rules or mixed rules combined with ICAO rules and provisions. EUR/OAT is a mandatory part of iOAT indicating this is an iOAT flight plan. *Example of field 18:* `EUR/OAT` Use **RTECOORATC** value within the **RMK**/ indicator for flights that are not compliant with constraints and restrictions and for which the flight route is coordinated prior with relevant ACC/UAC (RAD, AIP). *Example of field 18:* `RMK/RTECOORATC`	**THL**: in the scope of s115, the pilot will be usulaly initiating fist LL contact with ATC. When ATC needs to contact pilot through fld18 depending on ATC system -> extract phone number information (feedback from ACC expected) **NATS**: agree with above. Extract phone nuber from the field 18 PIC/ indicator would require adapt system with a lookup to a pre-defined list of phone numbers due to existing system design/checks. Phone numbers would need to be listed. Even adapting the lookup tables for fld18 indicators will not be possible for s115 scope. **SOPRA**: we have the same issue as NATS. **NATS/THL**: Also Existing DSNA Approach system supports only 8 characters for the the field indicator

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RPAS specific information	Mapping to FPL2012 format	Comments
		value – full number will not be this way reachable to ATCO. But information obtained later indicated that an Additions syeme in the APP does receive the full Field 18 information, and already in manned aviation the Pilot Phone Number is contained there for ATC to contact pilot (e.g. for Slot Changes). **ECTRL**: Phone contacts to unmanned aircraft pilots are published in a booklet as an official standard operational procedure (NATO) for any military MALE or HALE RPAS flights. **Action ACCs**: Please check, how your systems would deal with: PIC/PILOT NAME +420777854662 contained in FPL field 18. Please check with our ARO unit if there are other used ways of passing phone number information via FPL message. **THL**: Existing military capabilities can be considered, but not limted to in the s115. **ECTR**: Provide with FPL + booklet example of existing OAT (the booklet contains confidential information). The booklet is available (only) to the relevant ANSP. **THL**: Generating a TXT/Booklet document for every flight would not work for routine IFR GAT flights (i.e. coud be a different IFR route or a rapidly replanned, thus different IFR route, due to a weather condition).

Figure 29 : RPAS Specific Information in ICAO FPL

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D.5.3 Final recommendations on RPAS specific information accommodating in FPL

Recommendations	Comments
iOAT FPL format is not recommended to be used in the context of S115 during RPAS accommodation phase. Main obstacle is that existing system creating or processing FPL messages would need to be adapted for: • Field8 content ('P' letter is not today 'understood' by systems) • Field15 special activities indication with STAYx/D/A/H/tttt (currently FPL2012 follows only STAYx/tttt and systems may wrong interpret the route information) • Field18 unpublished indicators (such as PIC/ or END/) FPL2012 does allow using the unpublished indicators, not necessarily all systems implements this ICAO rule and may ignore unpublished indicators. The important recommendation of PJ13 S115 group about use of FPL2012 format for transmitting important information for RPAS flights is including RPAS pilots contact in the RMK/ indicator of the field 18. Example: `RMK/PILOT NAME TEL.0044 544544566` This information part of FPL shall be mandatory and RPAS pilot is required to be contactable by telephone during the entire flight. In case of lost R/T voice communication and no telephone back up, the 'lost comm' procedures from manned aviation shall apply.	**FRQ**: FPL2012 states: (44) An unpublished indicator i.e. one not listed above, shall be accepted by the system and included in output messages at the end of the field 18.

Figure 30 : Final Recommendations on RPAS Specific Information Accommodating in FPL