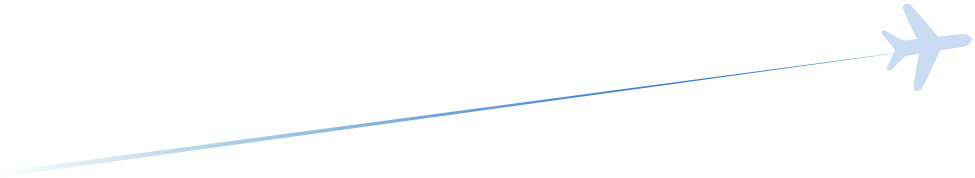

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EARTH

EARTH - ENHANCED RUNWAY THROUGHPUT

This TS/IRS is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 731781 under European Union's Horizon 2020 research and innovation programme.

Abstract

The is the Technical Specification produced for the Solution 02-05 and it includes all technical aspects (e.g. technical requirements, etc.) related to Independent Rotorcraft operations in airport environment.

The purpose of this document is to provide the technical specification and interface requirements (TS/IRS) for Rotorcraft operation (SNI concept) in airport environment applying SBAS, GBAS and SVS new technologies functions, with regard, the New SESAR Operating Method options and associated use cases (NSV.1, NSV-2 and NSV-4s).

The OI step addressed in this solution is:

- **AO-0316** *Increased Airport Performance through Independent (parallel or convergent) IFR Rotorcraft Operations*

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1 Executive summary

The aim of this document is to detail the Technical System Requirements (functional and non-functional) and the Interface(s) Related Requirements (IRS) specifying the development and the implementation of the Solution PJ.02-05 “Independent Rotorcraft Operations at the Airport”, included in the SESAR Project PJ.02 "**EARTH** - **E**nh**A**nced **R**unway **TH**roughput".

Solution PJ.02-05 addresses concepts and systems which allow the implementation of the operational concept of the Simultaneous-non-Interfering (SNI) Operations for rotorcraft aimed to increase the Airport Performance through the use of independent IFR rotorcraft procedures to/from FATO (Advanced Point-In-Space procedures). Besides, the Solution 02-05 addresses additionally the applicability of Advanced PinS designing criteria to specific rotorcraft operations SBAS/GBAS technologies based. Combined SBAS (CAT I) procedures with Radius to Fix legs (RF) and Synthetic Vision System (SVS) for qualitative evaluation of the pilot HMI flying the procedure, increasing pilot situational awareness and safety meanwhile reducing ATCOs’ and Pilot’s workload.

This TS/IRS document identifies several technical specifications that were analysed in the concerned operational scenarios for V3 phase in order to address Operational Improvement AO-0316. It should also be noted that PJ.02-05 work might also contribute to mature the OI AOM-0104-B which is led by PJ.01-06.

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2 Introduction

The Solution 02-05 addresses concepts and systems which allow the implementation of the operational concept of the Simultaneous-non-Interfering (SNI) Operations for rotorcraft aimed to increase the Airport Performance through the use of independent IFR rotorcraft procedures to/from FATO (Advanced Point In Space procedures). In addition, Solution 02-05 analyses and formulate a best proposal for a possible Regulatory provision for the SNI IFR rotorcraft operations (using Advanced PinS).

The purpose of this Solution is to develop Advanced PinS approach and departure procedures with vertical guidance (APV) which enable SNI operations at the airport.

The basic building block is the APV SBAS approach which has started to be published in Europe and is in operational use today. Moreover, other navigation and approach concepts have recently been highlighted in the context of reduced environmental and operational impact: GBAS operation, RF legs (Radius to fix), RNP 0.3 all phase of flight navigation specification; SVS technologies .etc .

The advanced operational concept developed in this Solution aims at combining all these components into one.

The Advanced PinS (e.g. curve segment on final) concept has been identified by compiling separate concept in operation today (standard PinS, e.g. straight segment on final) in compliance with the coming ICAO PBN Manual:

- **Initial and Intermediate approach segments:** considering RF paths terminator, and the possibilities to have curved final approach segment;
- RNP APCH (RNP value 0.3 all phases of flight) with RF legs for lateral navigation in preference to fly-by or fly-over, and, when suitable, with an RF leg joined directly with the start of the final approach segment;
- **Final approach segment, with the shortest appropriate length:** APV SBAS and GBAS (RNAV GNSS approach operation down to LPV minima) keeping the length of the segment as short as possible;
- **Missed Approach segment**: application of RNP navigation with value of 0.3 and RF leg(s) in the final phase of the missed approach as an option depending on its suitability for the particular scenario (e.g. obstacle rich area);
- Qualitative assessment of the advantages of the use of SVS technology for a better pilot situation awareness during Rotorcraft flight operations;

With this scope, the TS/IRS is key Project documentation, which should collate any **Technical Requirement** identified as necessary to carry out this kind of operations.

With the scope of detailing the flows of information that are needed between different tools and actors involved in these operations, reference to the European ATM Architecture will be done along the document. This TS mainly encompasses the following Systems and FB:

- TWR (Runway Control)
    - Runway Arrival/Departure Management
    - FATO Arrival /Departure Management

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- APP ATC / ACC
    - TMA-ACC Arrivals/departures Management
- Rotorcraft Flight Deck
    - Rotorcraft flight crew and on-board systems

The initial technical maturity level of the solution is TRL4 (V2). The V2 validation cycle was successfully completed within SESAR 1 (Project 04.10 General Aviation and Rotorcraft Operations) and on this based it was launched, in S2020 Wave 1\ PJ.02-05, the V3 validation cycle, which is expected to provide specific inputs to completion of the Pre-Industrial development & Integration step.

Final expected Maturity level of this document is TRL6 (V3) which will result as fully aligned with the expectations in reported in the MAWP.

2.1 Purpose of the document

The final objective of the implementation of the TS/IRS document is to complete the V3 SESAR Solution Data Pack in order to increase the SESAR Solution maturity level. The SESAR solutions are divided in three groups: ATM Solution Projects, Enabling Projects and VLD´s, this TS document is part of the ATM Solution Projects group.

Specifically, the purpose of this document is to provide the technical specification and interface requirements (TS/IRS) for Rotorcraft operation (SNI concept) in airport environment applying SBAS/GBAS and SVS new technologies enablers. The Rotorcraft community within SESAR expresses the specific intentions of Airspace Users to better develop what already achieved in SESAR 1 Project 04.10, and further analysed the utilisation of new technologies available on modern rotorcraft to faster the introduction in the new ATM operation system. This document describes the adaptation and developments of technical means supporting the design of SNI Advanced PinS in airport environment, from airborne platform objectives to systems requirements, fully compliant with the SESAR performance target, but is also responsible to ensure that the design of FPDO (Flight Procedures Design Organisation) and rotorcraft manufacture systems meets the operative needs and that system elements are developed accordingly.

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 Technical specifications (TS/IRS) represent one of the key parts of this SESAR Solution Data-Pack.

The Technical Specifications address the “what” and not the “how”, therefore they do not aim at specifying the physical design of the functional block (which remains under each industry decision), but the **functional description** and the necessary logical interfaces with other functional blocks. The TS/IRS documents are intended to form **the basis for the development of industry standards** for the systems or sub-systems in standardisation development organisations, for example EUROCAE. The target architecture will be made up of a set of domain level “systems” that will be further broken down into functional blocks based on performance requirements.

This document describes the translation of the operational requirements into system requirements and it includes consequently the translation of the technical requirements for SBAS/GBAS and SVS operated on PinS approach/departure procedures into system requirements and specifications for the FPDO with regards the concept of the SNI Advanced PinS – IFR procedures.

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All requirements, scenarios and use cases in this document are in accordance with the operational scenarios and requirements described in the PJ.02-05 SPR-INTEROPS/OSEDV V3 Part I and taking into account the description of the Technical Architecture done in SESAR 1 P04.10 Project. The requirements presented herein have been developed to support the integration on flying rotorcraft platform prototypes that allowed the validation of the operational concepts and requirements defined hereafter.

TS/IRS should provide sufficient information so as to allow the functional block (or parts of it in which the project is working) to be designed and implemented either as separate functional block or as part of an integrated system, depending upon the design choice, for V&V activity within the programme and ultimately for industrialization, standardization and deployment.

These requirements here identified have supported the validation activities conducted by ENAV and LEONARDO (V2 FTS, V3 RTS and V3 Flight Trials).

Most up-to-date information regarding the architecture is the EATMA 12 based on the Data Set 19. It should be taken into account that it is not a frozen version, but a working version and several Change Requests will be implemented in Wave 2 for Dataset 20.

2.2 Scope

This is the FINAL edition of TS/IRS for SESAR Solution 02-05, for the TRL-6 maturity level for the systems used in the validation activities. The TS/IRS development is an iterative process, and so, the final TS/IRS document was updated after the validation results of the last Flight Trials performed in the Quarter 2 of 2019. This Technical Specification document constitutes the technical reference for the V3 Data Pack of the solution.

The Technical Modelling and the consequent allocation of Requirements to Technical Functions has been done trying to mirror as much as possible the approach followed on the OSED for the Solution.

So, the Requirements inside this Technical Specification include, improvements on the Rotorcraft RNP trajectory compliance, addressing particularly the departures/arrivals phases of the operations, where the TWR Capability Configuration (Runway) and the Functional Blocks of the Approach/Departure Control System will be supposed as key factors in this process, being impacted by the new Requirements appearing in this TS/IRS allocated to the Rotorcraft Independent Operations at the airports.

Finally, the other impacted element would be the interactions between the aforementioned Capability Configuration and its contained systems, where some modification might be necessary.

2.3 Intended readership

The intended audience for this TS / IRS is represented by the main Solutions and Projects related to the Solution PJ02-05.

This document is also intended for people interested in the new GBAS and Vision Systems technologies, wanting to understand an innovative use of Ground Augumentation System (GLS technique) and an imaging on-board sensor to incorporate a new source of rotorcraft position into the current SVS design.

The target audience of this Updated Technical Specification includes operational experts, human factors experts and engineers interested in precision guidance in the last segment of approach phase.

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This document is intended for use by operational SESAR project's coordinating and consolidating of operational concept definition and validation and project PJ.19 (Content Integration) responsible for managing the content integration process to ensure the needed coherency (in terms of operational concept, architecture) between the different SESAR 2020 projects coordinating the avionics developments thus being engaged in interoperability across different airborne platform types.

Additional audience of this document can be also project SESAR PJ.01-06 which is operational project including advanced rotorcraft functions in TMA operations to support flight crew in the en-route movements and operations in adverse weather conditions.

2.4 Background

This section provides information on previous activities relevant for SESAR Solution PJ02-05 including the work performed both internal and external to SESAR 1 Programme

Research activities in SESAR 1 have built the foundation for the activities in PJ.02-05. During SESAR 1, the only project within the scope of 'Rotorcraft Operations" focused on the definition and validation of potential solutions (RNP-1) routes for Rotorcraft in the TMA environment, Low Level IFR routes RNP1.0 / 0.3, PinS (Point in Space) procedures, SNI Simultaneous-Non-Interfering operations (in a busy airports). P.4.10 complementary activities was performed in support of SESAR 2020 Project.01 (Solution PJ.01.06 for PinS and LLR) and Project.02 (Solution PJ.02.05 for SNI operations) with V3 validation successfully achieved through Live Trials within Milan TMA (Malpensa, Linate and Lugano involved airports) with AW189 and AW139 AgustaWestland helicopters.

More detailed information has been reported in the following deliverables:

- 04.10 D10 FINAL - SESAR Solution Guidance XX (PinS) – GEN (ed. 00.01.01)
- 04.10 D23 FINAL - SESAR Solution Guidance ZZ (SNI) – GEN (ed. 00.01.00)

Based on that foundation and on the forecast that up to 70 % of medium to large airports across Europe are currently facing challenges to grow and/or capacity constraints for Air Traffic management reasons; further technical and operational evaluation has been conducted in SESAR2020-solution Pj-02-05. An even higher number anticipate difficulties in securing planning approval to grow as a direct result of environmental concerns. Tailored Rotorcraft arrival and departures procedures (PinS) are defined to Initial Approach Fix (IAF) or to FATOs landing location taking in account the other fixed wing procedures and constraints, to optimize the paths and the descent, trough curved segments.

The requirements and needs identified in SESAR 1, specifically considering solution PJ.02-05 remain unchanged and were evaluated focusing on other technological enablers:

- The need for more runway capacity, better resilience and improved runway utilisation
- The need for environmental improvements at and around airports in order to decrease noise exposure and to reduce emissions
- Increase Airport Capacity and Accessibility in SNI concept of operations

The new technological enablers identified in solution 02.05 are applicable to different main airports needs drive development of the Enhanced Arrival Procedures in SNI environment enabled by SBAS and where applicable by optional GBAS and SVS concepts.

In SESAR 1 was proposed a dedicated method of operation at busy airports, with regards SNI concept applicable to Rotorcrafts operations:

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- Mode 5, Simultaneous non-interfering (SNI) operations: simultaneous independent approaches and departures of fixed-wing and rotorcraft where radar separation minima between them is not prescribed the limited SNI evaluation in congested airport
- designing and testing a Point-In-Space "Convergent/Parallel Approaches (RNP 0.3 all phases of flight)" to evaluate the benefits deriving by the possibility to manage the runway traffic (fixed-wing) and rotorcraft traffic to/from heliports in a simultaneous and independent way
- Evaluating of positive impact on the runway throughput (freer slot for SIDs and STARs).

This assumption (available to date) has been investigated in the light of different new technological enablers applicable to advanced approach and departure procedures (Advanced PinS) that may need to be harmonized with advanced arrival management methods.

2.5 Structure of the document

- **Section 1** – Executive summary: It describes the scope and purpose of the Solution PJ02-05 as well as a summary of results, conclusions and recommendations.
- **Section 2** – Introduction: It details the purpose and the scope of the document. This section is also intended to provide an overview of previous activities relevant for SESAR Solution PJ02-05 and all the Solutions and Projects that could be interested in reading this document.
- **Section 3** – SESAR Solution Impacts on Architecture: It describes the Functional Blocks included in the Solution as well as the Capability Configurations and the changes from the architecture in EATMA if needed.
- **Section 4** – Technical Specifications: It describes the Functions needed to realise the Solution and provides a functional view of how the technical systems, functional blocks, system ports and roles participate in realising the operational needs.
- **Section 5** – Implementation Options: It describes the available options that can be chosen when implementing the solution using capability configurations and sub-operating environments.
- **Section 6** – Assumptions: It covers any assumption made about impacts on the technical specifications described in Section
- **Section 7** – References and Applicable Documents: It references the documents mentioned throughout this document.]

2.6 Glossary of terms

Term	Definition	Source of the definition
Area navigation (RNAV)	Method of navigation which permits aircraft operation on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these.	ICAO Doc 9613 PBN Manual

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	Note.— Area navigation includes performance-based navigation as well as other RNAV operations that do not meet the definition of performance-based navigation	
Approach procedure with vertical guidance (APV)	An instrument procedure which utilizes lateral and vertical guidance but does not meet the requirements established for precision approach and landing operations. These procedures are enabled by GNSS and Baro VNAV or by SBAS. (PBN).	ICAO Doc 9613 PBN Manual
APV Baro-VNAV	RNP APCH down to LNAV/VNAV minima.	ICAO Doc 9613 PBN Manual
APV SBAS	RNP APCH down to LPV minima.	ICAO Doc 9613 PBN Manual
Baro-VNAV	Barometric vertical navigation (Baro-VNAV) is a navigation system that presents to the pilot computed vertical guidance referenced to a specified vertical path angle (VPA), nominally 3°. The computer-resolved vertical guidance is based on barometric altitude and is specified as a VPA from reference datum height (RDH). (PANS OPS).	ICAO Doc 9613 PBN Manual
Final Approach Point/Fix (FAP/FAF)	In PANS-OPS ICAO Doc 8168 VOL I, FAF is described as the beginning of the final approach segment of an Non-Precision Approach, and FAP is described as the beginning of the final approach segment of a Precision Approach. Moreover, PANS-OPS ICAO Doc 8168 VOL II states that the APV segment of an APV SBAS procedure starts at the Final Approach Point. So, within this document, since only APV SBAS procedures are considered, the beginning of the final approach segment is called the FAP	PANS-OPS ICAO Doc 8168 VOL I
Final Approach Segment (FAS) Data Block	The APV database for SBAS includes a FAS Data Block. The FAS Data Block information is protected with high integrity using a cyclic redundancy check (CRC).	PANS OPS
GNSS – Global Navigation Satellite System	A worldwide position and time determination system that includes one or more satellite constellations, aircraft receivers and system integrity monitoring, augmented as necessary to support the required navigation performance for the intended operation.	ICAO Annex 10

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GBAS – Ground Based Augmentation System	Augmentation of a global navigation satellite system (GNSS) is a method of improving – "augmenting"– the navigation system's performances, such as integrity, continuity, accuracy or availability thanks to the use of external information to the GNSS into the user position solution.	ICAO Documentation
LNAV, LNAV/VNAV, LPV	Are different levels of approach service and are used to distinguish the various minima lines on the RNAV (GNSS) chart. The minima line to be used depends on the aircraft capability and approval.	EUR RNP APCH Guidance Material
LNAV/VNAV	The minima line based on Baro-VNAV system performances that can be used by aircraft approved according to AMC 20-27 or equivalent. LNAV/VNAV minima can also be used by SBAS capable aircraft.	EUR RNP APCH Guidance Material
LPV (Localiser Performance with Vertical Guidance)	The minima-line based on SBAS performances that can be used by aircraft approved according to AMC 20-28 or equivalent	EUR RNP APCH Guidance Material
MAPt	Missed Approach Point	ICAO Doc 9613
MAWP	Multi-annual Work Programme	
Navigation specification	A navigation specification is a set of aircraft and aircrew requirements needed to support a navigation application within a defined airspace concept. The navigation specification: • defines the performance required by the navigation system, • prescribes the performance requirements in terms of accuracy, integrity, continuity and availability for proposed operations in a particular Airspace, • also describes how these performance requirements are to be achieved i.e. which navigation functionalities are required to achieve the prescribed performance and associated requirements related to pilot knowledge and training and operational approval. A Performance-Based Navigation Specification is either a RNAV specification or a RNP specification.	ICAO Doc 9613 and WP B04.02 CONOPS Step 1

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	RNAV specifies a required accuracy whilst RNP specifies, in addition to a required accuracy, an aircraft system alert in case of deviation, with the pilot responsible to remain the aircraft within the RNP accuracy; it allows reducing ATC buffer with the controller still responsible for the separation against traffic.	
Performance-Based Navigation (PBN)	Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace. *Note.— Performance requirements are expressed in navigation specifications in terms of accuracy, integrity,* *continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept*	ICAO DOC 9613 PBN Manual
PinS	Point in Space is an approach procedure designed for helicopters only that includes both a visual and an instrument segment	ICAO PANS OPS 8168
Point-in-Space (PinS) Departures	Point-in-space departure is a departure procedure designed for helicopters only that includes both a visual and an instrument segment.	ICAO PANS OPS 8168
Point-in-Space (PinS) Approach	Point-in-space approach is an approach procedure designed for helicopters only that includes both a visual and an instrument segment.	ICAO PANS OPS 8168
RNAV specification	See Navigation specification	ICAO PBN Manual 9613
RNP specification	See Navigation specification	ICAO PBN Manual 9613
RNP operations	Aircraft operations using an RNP system for RNP navigation applications	ICAO PBN Manual 9613
RNP route	An ATS route established for the use of aircraft adhering to a prescribed RNP navigation specification	ICAO PBN Manual 9613
RF – Radius to Fix path terminator	– An ARINC 424 specification that defines a specific fixed-radius curved path in a terminal procedure. An RF leg is defined by the arc centre fix, the arc initial fix, the arc ending fix and the turn direction.	ICAO PBN Manual 9613

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RNAV Approach	This is a generic name for any kind of approach that is designed to be flown using the on-board area navigation system. It uses waypoints to describe the path to be flown instead of headings and radials to/from ground-based navigation aids. RNP APCH navigation specification is synonym of the RNAV approach.	ICAO PBN Manual 9613
RNP APCH – RNP approach	The RNP navigation specification that applies to approach applications based on GNSS. As illustrated in figure 2 below, there are four types of RNP APCH that are flown to different minima lines published on the same RNAV(GNSS) approach chart.	ICAO PBN Manual 9613
SBAS – Satellite-Based Augmentation System	A wide coverage augmentation system in which the user receives augmentation information from a satellite-based transmitter. (ICAO Annex 10). The European SBAS is called EGNOS, the US version is called WAAS and there are also other SBASs in different regions of the World such as GAGAN in India and MSAS in Japan	ICAO Documentation
SNI- Simultaneous Non Interfering	The SNI is a concept describing the way simultaneous non interfering procedures have to be defined and executed to ensure the different traffic streams do not interfere with each other. This concept is mainly specified for fixed wing traffic. In this document, the focus of this concept is set on separating fixed-wing traffic from rotary-wing traffic, namely the SNI concept specific for Rotorcraft/ATCO operation. The simultaneous non interfering procedure for rotorcraft ensures, throughout the whole procedure and especially with regard to the final approach segment as well as the missed approach segment, it does not cause interference in terms of observing and (re)scheduling and separating fixed-wing traffic from rotary-wing traffic by the Air Traffic Controller (ATCO)	ICAO Documentation
SVS -Synthetic Vision Guidance System	SVS uses the basic elements of synthetic vision—a 3-D representation of terrain, obstacles and runways	EUROCAE WG-79

Table 1: Glossary

2.7 Acronyms and Terminology

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Acronym	Definition
AC	Advisory Circular
ADD	Architecture Definition Document
ADS-C	Automatic Dependent Surveillance - Contract
AMSL	Above Mean Sea Level
AMC	Acceptable Means of Compliance
ANSP	Air Navigation Service Provider
APCH	Approach
APV	Approach Procedure with Vertical guidance
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATM	Air Traffic Management
AU	Airspace User
BADA	Base of Aircraft Data
CAA	Civil Aeronautics Authority
CDA	Continuous Descent Approach
CDFA	Continuous Descent Final Approach
CDO	Continuous Descent Operation
CDTI	Cockpit Display of Traffic Information
CNS	Communications, navigation and surveillance
CM	Context Management
COORD	Coordinator
CPDL-C	Controller Pilot Data Link Communications
CRC	Cyclic Redundancy Check
CTR	Control Zone
DA/H	Decision Altitude/ Height
DA	Decision Altitude
DB	Database
DOD	Detailed Operational Description
DRA	Direct Route Airspace
DSS	Desk System Suite Hardware
E-ATMS	European Air Traffic Management System

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EGNOS	European Geostationary Navigation Overlay Service
ENB	Enabler
E-OCVM	European Operational Concept Validation Methodology
ETSO	European Technical Standard Order
EU-OPS	This refers to European Union (EU) regulations specifying minimum safety and related procedures for commercial passenger and cargo fixed-wing aviation
EXE	Executive
FAF	Final Approach Fix
FAP	Final Approach Point
FAS	Final Approach Segment
FAS DB	Final Approach Segment Data Base
FATO	Final Approach & Take-Off areas
FCS	Flight Control System
FMS	Flight Management System
FNHD	Finmeccanica Helicopters Division
FPDO	Flight Procedures Design Organization
FTA	Fix Tolerance Area
GPA	Glide Path Angle
GPS	Global Positioning System
GNSS	Global Navigation Satellite System
HMI	Human Machine Interface
HP	Human Performance
HRP	Heliport Reference Point
ICAO	International Civil Aviation Organization
ICP	Initial Climb Procedure
IDF	Initial Departure Fix
IFR	Instrument Flight Rule
ILS	Instrument Landing System
INTEROP	Interoperability Requirements
I/O	Input/Output

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IRS	Interface Requirements Specification
JRE	Java Runtime Environment
LLR	Low Level IFR Routes
LPV	Localizer Performance with Vertical Guidance
LNAV	Lateral Navigation
MAHF	Missed Approach Holding Fix
MAP	Missed Approach
MAPt	Missed Approach Point
MAWP	Multi-annual Work Programme
MCA	Minimum Crossing Altitude
MCDU	Multipurpose Control & Display Unit
MET	Meteorological
MLS	Microwave Landing System
MOC	Minimum Obstacle Clearance
M/M	Medium complexity / Medium density
NOTAM	Notice To AirMen
OCA	Obstacle Clearance Altitude
OCA/H	Obstacle Clearance Altitude/Height
OFA	Operational Focus Areas
OIS	Visual Identification Surface
OSED	Operational Service and Environment Definition
PANS-OPS	Procedures for Air Navigation Services – Aircraft Operations
PBN	Performance Based Navigation
PC	Personal Computer
PDG	Procedure Design Gradient
PDG	Procedure Design Gradient
PFD	Primary Flight Display
PI	Performance Indicator
PinS	Point-in-Space
PRE	Predictability
QFU	Aviation Q-code for magnetic heading of a runway

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R&D	Research & Development
R/C	Rotorcraft
RAIM	Receiver Autonomous Integrity Monitoring
RF	Radius to Fix
RHP	Runway Holding Point
RNAV	Area Navigation
RNP	Required Navigation Performance
RTS	Real Time Simulator
RWY	Runway
SBAS	Satellite-Based Augmentation System
SESAR	Single European Sky ATM Research Programme
SID	Standard Instrument Departure
SJU	SESAR Joint Undertaking
SME	Subject Matter Expert
SNI	Simultaneous non-interfering
SPR	Safety and Performance Requirements
SPR	Safety and Performance Requirements
SPV	Supervisor
SSR	Secondary Surveillance Radar
STAR	Standard Instrument Arrival
SUT	System Under Test
TAD	Technical Architecture Description
TIA	Turn Initiation Area
TMA	Terminal Manoeuvring Area
TS	Technical Specification
TSO	Technical Standard Order
UC	Use Case
VALP	Validation Plan
VALR	Validation Report
VALS	Validation Strategy
VNAV	Vertical Navigation

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VP	Verification Plan
VR	Verification Report
VS	Verification Strategy
WIMS	Weather Information Management System
WL	Workload
WP	Waypoint
WPT	Waypoint
WP	Waypoint
XTK	Cross Track

Table 2: Acronyms and terminology

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3 SESAR Solution Impacts on Architecture

3.1 Target Solution Architecture

3.1.1 SESAR Solution(s) Overview

The Table 3 below details the solution under validation and relevant operational improvements and enablers ("Optional" ENs are highlighted in amber and in light blue the ENs specifically developed within PJ.02-05, either if their nature are purely operational and they have little to do with a TS/IRS).

Additionally, some these ENs were already validated within SESAR 1 Projects and based on this, the Solutions 02-05 considered them (as assumption) as "fully matured" and integrable in the operations concerned, given that they do not need further evaluation to be matured (fully V3 matured as reported in the EATMA Architecture).

SESAR Solution ID	SESAR Solution Description	OI Master or Contributing (M or C)	Contribution to the SESAR Solution short description	OI Steps ref. (from EATMA)	Enablers ref. (from EATMA)
PJ.02-05	Independent rotorcraft operations at a busy airport	M	Contribution to Capacity, Predictability, Environmental sustainability and fuel efficiency, Security, Human Performance and Safety	**AO-0316** - Increased Airport Performance through Independent (parallel or convergent) IFR Rotorcraft Operations	**A/C-01** Enhanced positioning for LPV/RNP based on Single Frequency SBAS
					A/C-02a Enhanced positioning using GBAS single frequency
					A/C-04 Flight management and guidance for improved lateral navigation in approach via RNP

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SESAR Solution ID	SESAR Solution Description	OI Master or Contributing (M or C)	Contribution to the SESAR Solution short description	OI Steps ref. (from EATMA)	Enablers ref. (from EATMA)
					A/C-04b Flight management and guidance for RNP 0.3 (Category H(rotorcraft)) in all phases of flight, except final approach and initial missed approach
					A/C-06 Flight management and guidance for LPV approach based on SBAS
					A/C-07 Flight management and guidance for RNP transition to ILS/GLS/LPV
					A/C-23a Synthetic vision in low visibility conditions
					BTNAV-0502 Update of Minimum Performance Standard for Enhanced Vision (EV)
					BTNAV-0503 New ARP standard for Transport Category Airplane HUD/SVS systems
					BTNAV-0504 Update of Minimum Performance Standard for

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SESAR Solution ID	SESAR Solution Description	OI Master or Contributing (M or C)	Contribution to the SESAR Solution short description	OI Steps ref. (from EATMA)	Enablers ref. (from EATMA)
					Airborne Synthetic Vision (SV)
					CTE-N07a GBAS Cat I based on Single-Constellation / Single-Frequency GNSS (GPS L1)
					PRO-251 ATC Procedure to handle SNI IFR rotorcraft operations using PinS
					REG-0521 Regulatory provisions for SNI IFR rotorcraft operations using PinS
					REG-0009 AMC for Curved Approaches
					STD-025 Harmonisation Specifications on Ground Based Augmentation System Ground Equipment to Support Category I Operations
					STD-043 EN 303 084, Ground Based Augmentation System (GBAS) VHF ground-air Data Broadcast (VDB)
					STD-067 DO-253D 'GBAS MOPS' & DO-246E 'GBAS ICD'

Table 3: SESAR Solution(s) addressed in the Validation Report

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Independent Rotorcraft (RC) operations at the airport refer to RC specific approach procedures and SBAS-based point-in-space (PinS), which aim to improve access to secondary airports in Low Visibility Conditions (LVC).

OI Step		OI description	Open CR
AO-0316		Increased Airport Performance through Independent (parallel or convergent) IFR Rotorcraft Operations	CR 03260 Update AO-0316 list of EN (PJ02-05)
	EN code	EN description	Open CR
	A/C-01	Enhanced positioning for LPV/RNP based on Single Frequency SBAS	No changes
	A/C-02a	Enhanced positioning using GBAS single frequency	No changes
	A/C-04a	Flight management and guidance for Advanced RNP	Unlinked by AO-0316
	A/C-04b	Flight management and guidance for RNP 0.3 (Category H(rotorcraft)) in all phases of flight, except final approach and initial missed approach	No changes
	A/C-04	Flight management and guidance for improved lateral navigation in approach via RNP	No changes
	A/C-06	Flight management and guidance for LPV approach based on SBAS	No changes
	A/C-07	Flight management and guidance for RNP transition to ILS/GLS/LPV	No changes
	A/C-23a	Synthetic vision in low visibility conditions	No changes
	AIMS-23	Enhanced digital data chain to ensure Aeronautical Information data provision to meet full 4D trajectory management requirements	Unlinked by AO-0316. No i4D operations were considered within PJ.02-05 work
	BTNAV-0502	Update of Minimum Performance Standard for Enhanced Vision (EV)	No changes
	BTNAV-0503	New ARP standard for Transport Category Airplane HUD/SVS systems	No changes
	BTNAV-0504	Update of Minimum Performance Standard for Airborne Synthetic Vision (SV)	No changes

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	CTE-N07a	GBAS Cat I based on Single-Constellation / Single-Frequency GNSS (GPS L1)	No changes
	METEO-03c	Provision and monitoring of real-time airport weather information for time-based separation and curved approaches	Unlinked by AO-0316. Solution 02-05 is focused on the airport operations (last phases of approaches or initial phases of departures)
	METEO-04c	Generate and provide MET information relevant for Airport and approach related operations at short notice ('time to decision' between 3 minutes and 7days) including rotorcraft and RPAS	Unlinked by AO-0316. Solution 02-05 is focused on the airport operations (last phases of approaches or initial phases of departures)
	METEO-05c	Generate and provide MET information relevant for TMA and En-route related operations at short notice ('time to decision' between 3 minutes and 7days), including for low-level IFR operations.	Unlinked by AO-0316. Solution 02-05 is focused on the airport operations (last phases of approaches or initial phases of departures)
	REG-0009	AMC for Curved Approaches	No changes
	STD-025	Harmonisation Specifications on Ground Based Augmentation System Ground Equipment to Support Category I Operations	No changes
	STD-043	EN 303 084, Ground Based Augmentation System (GBAS) VHF ground-air Data Broadcast (VDB)	No changes
	STD-067	DO-253D 'GBAS MOPS' & DO-246E 'GBAS ICD'	No changes
	EN code	EN description	Open CR
	PRO-251	ATC Procedure to handle SNI IFR rotorcraft operations using PinS	CR 03299 Update PRO-251 (AO-0316 - PJ02-05)

Table 4: SESAR Solution PJ02-05 Scope and related Functional Blocks/roles & Enablers

Type	Element	EN Code	EN/CR Title	Coverage
		PRO-251	CR 03299 Update PRO-251 (AO-0316 - PJ02-05)	

Table 5: EATMA CR linked to the enablers attached to the concerned OI step (AO-0316; PJ02-05 Scope)

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

There are no deviation between the enablers in the applicable version of EATMA and the ones listed in Section §3.1.1.

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Enabler	Opt/Req	Deviation
A/C-01_Enhanced positioning for LPV/RNP based on Single Frequency SBAS	Required	No Deviation
A/C-02a_Enhanced positioning using GBAS single frequency	Optional	No Deviation
~~A/C-04a_Flight management and guidance for Advanced RNP~~	~~Required~~	~~No Deviation~~
A/C-04b_Flight management and guidance for RNP 0.3 (Category H(rotorcraft)) in all phases of flight, except final approach and initial missed approach	Required	No Deviation
A/C-04_Flight management and guidance for improved lateral navigation in approach via RNP	Required	No Deviation
A/C-06_Flight management and guidance for LPV approach based on SBAS	Required	No Deviation
A/C-07_Flight management and guidance for RNP transition to ILS/GLS/LPV	Required	No Deviation
A/C-23a_Synthetic vision in low visibility conditions	Optional	No Deviation
~~AIMS-23_Enhanced digital data chain to ensure Aeronautical Information data provision to meet full 4D trajectory management requirements~~	~~Optional~~	~~No Deviation~~
BTNAV-0502_Update of Minimum Performance Standard for Enhanced Vision (EV)	Optional	No Deviation
BTNAV-0503_New ARP standard for Transport Category Airplane HUD/SVS systems	Optional	No Deviation
BTNAV-0504_Update of Minimum Performance Standard for Airborne Synthetic Vision (SV)	Optional	No Deviation
CTE-N07a_GBAS Cat I based on Single-Constellation / Single-Frequency GNSS (GPS L1)	Optional	No Deviation
~~METEO-03c_Provision and monitoring of real-time airport weather information for time-based separation and curved approaches~~	~~Optional~~	~~No Deviation~~
~~METEO-04c_Generate and provide MET information relevant for Airport and approach related operations at short notice ('time to decision' between 3 minutes and~~	~~Optional~~	~~No Deviation~~
~~METEO-05c_Generate and provide MET information relevant for TMA and En-route related operations at short notice ('time to decision' between 3 minutes and 7da~~	~~Optional~~	~~No Deviation~~
REG-0009_AMC for Curved Approaches	Optional	No Deviation
STD-025_Harmonisation Specifications on Ground Based Augmentation System Ground Equipment to Support Category I Operations	Optional	No Deviation
STD-043_EN 303 084, Ground Based Augmentation System (GBAS) VHF ground-air Data Broadcast (VDB)	Optional	No Deviation
STD-067_DO-253D 'GBAS MOPS' & DO-246E 'GBAS ICD'	Optional	No Deviation
PRO-251_ATC Procedure to handle SNI IFR rotorcraft operations using PinS	Required	No Deviation

Table 6: Deviations for enabler attached to the concerned OI step (PJ.02-05 scope)

3.1.1.2 Relevant Use Cases

The relevant use case has been described in Solution PJ02-05 Use Cases in Section 3.3.2.5 of the SPR-INTEROP/OSED and reported in the Table 7 below.

Operational Use Case	Description
[NOV-5][SNI-01] SNI approach with PinS (rotorcraft)	Simultaneous non-interfering operations (SNI) are instrument flight procedures designed to enable rotorcraft to operate to / from airports without conflicting with fixed-wing traffic or requiring runway slots. These procedures based on satellite guidance technology (SBAS) to fly low-level corridors, often parallel or

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Operational Use Case	Description
	convergent to the direction of the duty runway, down to a given point-in-space (Mapt) in the close vicinity of the FATO in airport environment than followed by a final visual segment to landing site. This use case describes particular occurrence, in Airport environment where a SNI PinS approach procedure (Straight-in and/or curved Parallel/Convergent approach with LPV minima) to FATO is developed. The unmatched rotorcraft capabilities to fly at very low flight level with low flight speed allow to design procedure with a steep approach (more than conventional 3° used by fixed-wing). In this way, these procedures result as capable to minimising the noise nuisance and also, where possible, they can be flown simultaneously and independently (SNI) of the fixed-wing traffic (to/from the runway) provided that all SNI criteria are respected. The description of the procedure to be followed by the rotorcraft is the following[1]: • The helicopter approach to an airport following a standard ATS route or a Low Level IFR route (RNP 1 / RNP 0.3) requesting the clearance to approach to the FATO via a specific PinS procedure (e.g. request for clearance to proceed to IAF); • After crossing the IAF, the procedure design provides RNP 0.30 for all procedure segments until the PinS point, where the Pilot can decide if continue to the landing location or to proceed to Missed Approach procedure. Anyhow, the Pilot at the PinS/MaPt must report to the Tower Runway Controller the “FATO in sight” to receive the clearance for Landing to the FATO otherwise the ATCO instructs the Pilot to perform the Missed Approach procedure as described in the PinS map; • If the Pilot can report “FATO is in sight” he/she can proceed to the landing location through the visual segment (VS) which might be either “Proceed Visually” or “Proceed VFR” (Remark: In the context of PJ.023-05 only “Proceed Visually” is considered”). A “Proceed VFR” VS should not be implemented unless it is not possible to design a “Proceed Visually” VS. In case of “Proceed VFR” VS the following assumptions should be considered: • there is no protection from the PinS/MaPt to landing location and the pilot shall comply with VFR minima (visibility and cloud ceiling) in this part of flight to see and avoid obstacles; and

[1] The information presented below has to be considered as the final edition and thus most probably doesn’t need to be further improved

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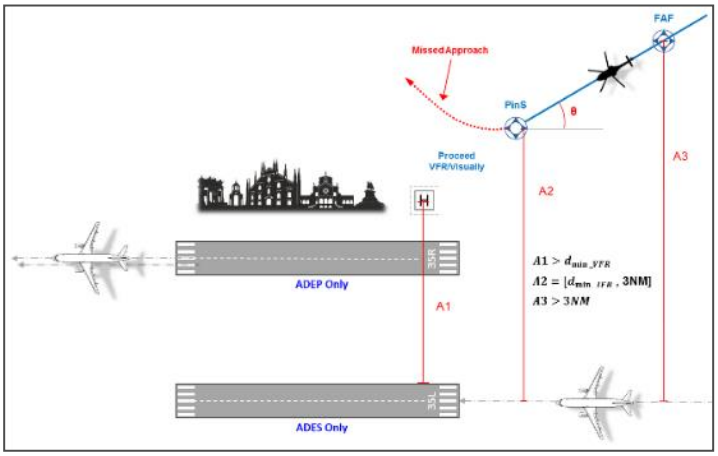
Operational Use Case	Description
	• after the PinS/MaPt, the protection of the instrument segment is the same as for a PinS "proceed visually" departure. On the other hand, a "Proceed Visually" VS implies that pilots can navigate by visual reference and see and avoid obstacles with visibility sufficient to reach the heliport (or to return on the procedure and perform the Missed Approach Procedures) if they cannot continue visually. The "Proceed Visually" VS may be conducted below minima required for VFR. **1/ General Conditions** **Assumption for designing and testing the PinS**: *the operative airport CONF should allow to manage mixed arrival traffic (rotorcraft and CAT Commercial Aviation "fixed-wing") in a fully independent way, being the procedures compliant with the SNI requirements.* - **Procedure design:** *the approach should consist of a PinS approach procedure in accordance with ICAO PANS-OPS vol. II, Part IV. It's mandatory that the LPV PinS procedure is SBAS guided.* - **Final Approach Segment:** *the final approach segment may be parallel or convergent to the runway edge (extension of the runway centre line).* - **Layout:** *the distance between FATO edge and runway edge should be compliant with the following parameters:*  **Figure 1: Case Study focused on Milano Malpensa Airport configuration (operative assumption)** where: - **A1** is the distance between FATO and Runway edges; - **A2** is the lateral distance between the DA/H point and the runway centreline or its extension. It is a key distance used in order to discern which options are compliant with current separation standards applicable for the "Independent parallel approaches"; - **A3** is the distance between the FAF of the rotorcraft approach and the extension of the fixed-wing runway centreline. This parameter is used in order to assess the actual need of radar vectoring and radar monitoring. In case of parallel approach, it takes the same value of A2;

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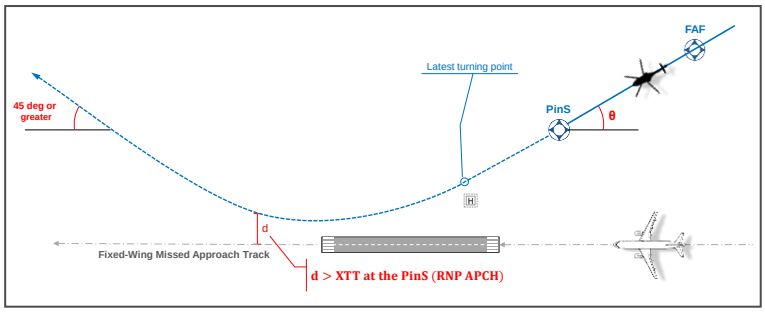
Operational Use Case	Description
	- **θ** is the convergence angle between the final segment of the rotorcraft procedure and the extension of the fixed-wing runway centreline. - **d_{min}_VFR** is a reference parameter which takes the value of the minimum distance between FATO and runway edges (**Error! Reference source not found.**); - **d_{min}_IFR** is a reference parameter which takes the value of the minimum distance between parallel runways for independent parallel approaches (**Error! Reference source not found.**);  **Figure 2: Missed Approach path. PinS convergent approach** The RNP APCH navigation specification requires to fly the Initial, Intermediate and Missed Approach (MA) segments according to RNP1 criteria. In the context of the PJ.02-05, the Airspace Designer, responsible to design the PinS SNI IFR procedures to/from Malpensa Airport, considered the entire procedure as **RNP0.3** (Initial/Intermediate/Final Segments and Missed approach) in order to better integrate the procedures in an existing operational environment and evaluate also the coexistence of these kind of operations with the surrounding departure traffic flows from another runway (e.g. RWY 35 R). *Precondition* Aircraft (including Rotorcraft) have to be complying with clearance. *Post Condition* - **Arrival**: Aircraft/Rotorcraft reaches runway/FATO threshold (or a suitable point on the final approach leg/FATO) and is coordinated with the Aerodrome Air controller and is flying according to its clearance and relevant ATC coordination. - **Departure**: Depending on space design and flight profile – Aircraft/Rotorcraft reaches TMA exit point, or top of climb and/or integrates into FRA – Free Route Airspace. *Additional Assumptions* - Before rotorcraft traffic reach the FAF, a vertical separation of 1000 ft with respect to fixed-wing traffic must be assured; In this approach the designed type of visual segment was “proceed visually” with the related manoeuvring area, but both types are admitted.

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Operational Use Case	Description
[NOV-5][SNI-02] SNI departure with PinS (rotorcraft)	The SNI PinS departure is a procedure only applicable to rotorcraft. It consists of a visual segment and subsequent instrument segment. In the past, the PANS-OPS version did not include provisions for design PinS departure procedures, but ICAO working groups have been worked in the development of the relative criteria. The information presented below has to be considered as the final available editionbased on the latest updates coming from ICAO WG and specific DOC 8168 design criteria standards. This doesn't not preclude any further improvement, not known at that stage. The description of the procedure to be followed by the rotorcraft is the following: • The helicopter departs and is flown visually to cross the IDF at or above the IDF minimum crossing altitude (MCA) and join a route originating from the IDF; • After crossing the IDF at or above MCA, the procedure design provides RNP 0.3 protection on the route, which is retrievable from the receiver's navigation database, provided that each of the waypoints in the departure procedure is crossed at or above its MCA; • The first initial segment, the visual segment (VS), might be either "Proceed Visually" or "Proceed VFR", as it actually happens with PinS approach procedures. A "Proceed VFR" VS (Visual Segment) should not be implemented unless it is not possible to design a "Proceed Visually" VS. In case of "Proceed VFR" VS the following assumptions should be considered: • there is no protection from the landing location to the IDF and the pilot shall comply with VFR minima (visibility and cloud ceiling) in this part of flight to see and avoid obstacles; and • after the IDF, the protection of the instrument segment is the same as for a PinS "proceed visually" departure. On the other hand, a "Proceed Visually" VS implies that pilots can navigate by visual reference and see and avoid obstacles with visibility sufficient to return to the heliport if they cannot continue visually to cross the IDF at or above the IDF MCA. Visual flight may be conducted below minima required for VFR.

Table 7: Relevant PJ.02-05 Use Cases (UCs)

System Process	Description
[NSV-4][SNI-01a] SNI approach with PinS (rotorcraft) [Ground]	The system describes the bi-univocal interaction between Ground ATCOs, performing PinS approaches in SNI environment
[NSV-4][SNI-01b] SNI approach with PinS (rotorcraft) [Airborne]	The system describes the high level bi-univocal interaction/actions between Airborne Crew/pilots and the avionic on board architectures performing PinS approaches in SNI environment

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[NSV-4][SNI-02a] SNI departure with PinS (rotorcraft) [Ground]	The system describes the bi-univocal interaction between Ground ATCOs, performing PinS departures in SNI environment
[NSV-4][SNI-02b] SNI departure with PinS (rotorcraft) [Airborne]	The system describes the high level bi-univocal interaction/actions between Airborne Crew/pilots and the on board avionic architectures performing PinS departures in SNI environment

Table 8: Description of the System Processes involved within PJ.02-05 Use Cases (UCs)

3.1.1.3 Applicable standards and regulations

This section identifies the list of standards and regulations that are applicable to the services included in the SESAR Solution PJ02-05.

Institutional Enabler	Standard
BTNAV-0504_Update of Minimum Performance Standard for Airborne Synthetic Vision (SV)	EUROCAE ED-180
BTNAV-0504_Update of Minimum Performance Standard for Airborne Synthetic Vision (SV)STD-004_Review of ATN B2 standards in WG-78/SC-214 for US/EUR convergence	EUROCAE ED-231
STD-043_EN 303 084, Ground Based Augmentation System (GBAS) VHF ground-air Data Broadcast (VDB)	EN 303 084

Table 9: Standards & Regulation considered within PJ.02-05 Use Cases (UCs)

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3.1.2 Capability Configurations required for the SESAR Solution

SNI operations (rotorcraft)		Airport; Terminal Airspace		
CC	**Op Env**	**Capability**	**Node**	**Stakeholder**
APP ACC (Step 2)	Very HC TMA/ENR; HC TMA/ENR; MC TMA/ENR	Air Traffic Complexity Management; Air Traffic Flow Management; Airspace Configuration Management; Airspace Infringement Avoidance; Airspace Reservation Management; Arrival Sequencing; Arrival/Departure Routes Management; Clearance/Instruction Management; Coordination and Transfer; Crisis Management; CTA/CTO Management; Integrated Arrival/Departure Sequencing; Interval Management (IM); Mid-Air Collision Avoidance; Minimum Pair Separation Provision; Separation Provision (airspace); Separation Technique Management; Trajectory Conformance Monitoring; Trajectory Information Synchronisation; Trajectory Management; Trajectory Revision in Execution; Wake Turbulence Separation Provision; Weather-Dependent Separation Provision;	Air Traffic Flow and Capacity Management; Airspace Management; Airspace Organisation; En-Route/Approach ATS;	
Communication Infrastructure	Very HC TMA/ENR; HC TMA/ENR; MC TMA/ENR	Airport Operations Management;	Flight Deck;	Air Navigation Service Provider;

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SNI operations (rotorcraft)		Airport; Terminal Airspace		
CC	**Op Env**	**Capability**	**Node**	**Stakeholder**
Navigation Infrastructure Ground Based	Very HC TMA/ENR; HC TMA/ENR; MC TMA/ENR		En-Route/Approach ATS;	Air Navigation Service Provider;
Navigation Infrastructure Satellite Based	Very HC TMA/ENR; HC TMA/ENR; MC TMA/ENR			
Civil Aircraft (Step 2)	Very HC TMA/ENR; HC TMA/ENR; MC TMA/ENR	Adverse Condition Operations Provision; ATSAW-Spacing Monitoring Execution; Clearance/Instruction Management; CTA/CTO Management; Ground Collision Avoidance; Interval Management (IM); Meteorological Observation and Forecasting Provision; Mid-Air Collision Avoidance; Optimised Climb Execution; Optimised Descent Execution; Optimised Take-Off / Landing Execution; PinS Operations Execution; RNP based Operations Execution; Separation Technique Management; Surface Route Management; Trajectory Information Synchronisation; Trajectory Revision in Execution; Wake Turbulence Separation Provision;	Airspace User Operations; Flight Deck;	
TWR (Step 2)	Very Large Airport; Large Airport, Small Airport	Adverse Condition Operations Provision; Air Traffic Flow Management; Airspace Infringement Avoidance; Airspace Reservation Management; Arrival Sequencing;	Network Operations;	Air Navigation Service Provider;

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SNI operations (rotorcraft)		Airport; Terminal Airspace		
CC	**Op Env**	**Capability**	**Node**	**Stakeholder**
		Arrival/Departure Routes Management; Crisis Management; Departure Sequencing; Dynamic Runway Allocation; Ground Collision Avoidance; Integrated Arrival/Departure Sequencing; Interval Management (IM); Remote Tower Operations Provision; Separation Provision (airspace); Separation Technique Management; Surface Guidance Provision; Surface Route Management; Wake Turbulence Separation Provision; Weather-Dependent Separation Provision;		

Table 10: List of Capability Configuration required for the SESAR Solution

3.2 Changes imposed by the SESAR Solution on the baseline Architecture

N/A[2]

[2] It was widely discussed with SJU that PJ.02-05 does not need to produce anything else on top of what already exists in EATMA- for the TS/IRS. Actually, it seems that PJ.02-05 had not need to develop Technical Specifications, considering that all the required/mandatory technical Enablers and attached to OI AO-0316, were already matured in SESAR 1 phase. Nevertheless, we invested a lot of effort to the EATMA modelling activity in order to improve the quality of the Solution Data Pack V3 and finally capture the needed technical aspects for the rotorcraft operations never considered in the Programme so far.

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4 Technical Specifications

4.1 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.*

Role	Functional Block	Function
[NSV-4][SNI-01a] SNI approach with PinS (rotorcraft) [Ground]		
ATC Executive Controller (PJ.02-05)		Control and sequence the arrival traffics; Separation Provision, Sequencing, Space Aircraft, Management of mixed operations (fixed wing and Rotorcraft); Transfer Flight to Tower Control;
Tower Runway Controller (PJ.02-05)		Provide Landing Clearance; Surveillance (Monitoring) until PinS\MAPt;
[NSV-4][SNI-01b] SNI approach with PinS (rotorcraft) [Airborne]		
	Databases	Databases;
	Displays and Controls	Displays and Controls;
Flight Crew (PJ.02-05)		Acknowledge Landing Clearance; Change Frequency and Contact Tower Controller; Comply to approach clearance and instructions; Fly Rotorcraft Initial Approach Route; Landing or Missed Approach (Pilot Discretion); Monitor Trajectory until PinS/MAPt; Perform Missed Approach;
	Flight Plan Management	Flight Plan Management;
	Lateral and Vertical Guidance	Lateral and Vertical Guidance;
	Lateral Positioning	Lateral Positioning;
	Sensors and Antennas	Sensors and Antennas;
	Vertical Positioning	Vertical Positioning;
[NSV-4][SNI-02a] SNI departure with PinS (rotorcraft) [Ground]		
ATC Executive Controller (PJ.02-05)		IFR Clearance to proceed Enroute phase;
Tower Runway Controller (PJ.02-05)		Control Departure Traffics (Rotorcraft and fixed-wing); Provide Departure Clearance; Transfer Flight to TMA (Departures) Controller;

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Role	Functional Block	Function
[NSV-4][SNI-02b] SNI departure with PinS (rotorcraft) [Airborne]		
	Databases	Databases;
	Displays and Controls	Displays and Controls;
Flight Crew (PJ.02-05)		Change Frequency and Contact TMA (Departures) Control; Comply to IFR clearance (Standard or Low Level IFR routes); Fly according IFR Clearance (Rotorcraft); Proceed Visually or VFR until the IDF point; Request Departure Clearance (SNI PinS Procedure);
	Flight Plan Management	Flight Plan Management;
	Lateral and Vertical Guidance	Lateral and Vertical Guidance;
	Lateral Positioning	Lateral Positioning;
	Sensors and Antennas	Sensors and Antennas;
	Vertical Positioning	Vertical Positioning;

Table 11: List of Functions required to perform needed Operational Activities

4.1.1 Resource Connectivity Model

The system describes the high-level architecture of operation performing PinS approach and departure procedure in airport environment, where the SNI concept is applicable. In this architecture the main "actors" represented are from the ground and airborne side, considering the enabler technologies applied to the concept.

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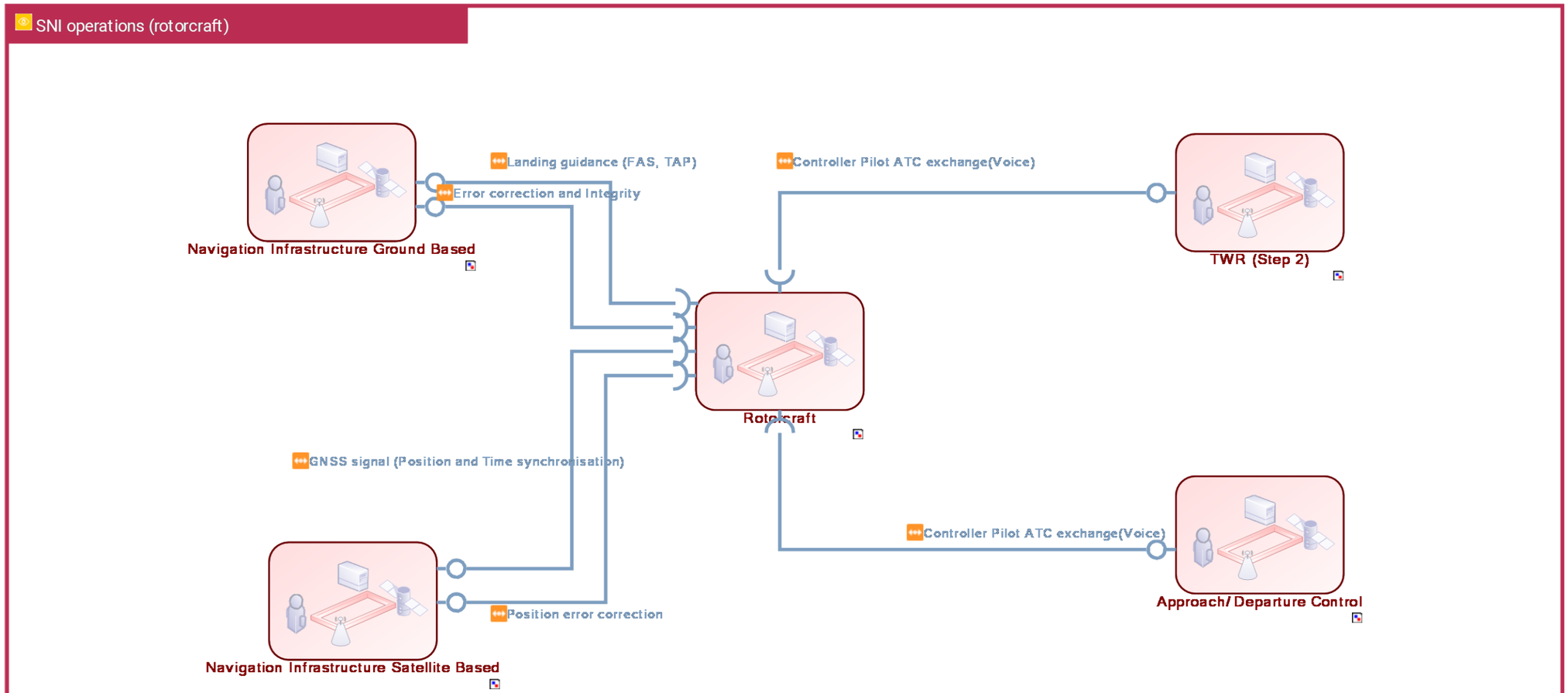

[NSV-4][SNI-01a] SNI approach with PinS (rotorcraft) [Ground] [A/G Voice Communication, A/G Voice Communication, ATC Executive Controller (PJ.02-05), Controller Human Machine Interaction Management Aerodrome ATC, Controller Human Machine Interaction Management ER/APP, Rotorcraft, Tower Runway Controller (PJ.02-05)]

[NSV-4][SNI-01b] SNI approach with PinS (rotorcraft) [Airborne] [Approach/Departure Control, Databases, Displays and Controls, Flight Crew (PJ.02-05), Flight Plan Management, Lateral and Vertical Guidance, Lateral Positioning, Navigation Infrastructure Ground Based, Navigation Infrastructure Satellite Based, Sensors and Antennas, TWR (Step 2), Vertical Positioning, Voice]

[NSV-4][SNI-02a] SNI departure with PinS (rotorcraft) [Ground] [A/G Voice Communication, A/G Voice Communication, ATC Executive Controller (PJ.02-05), Controller Human Machine Interaction Management Aerodrome ATC, Controller Human Machine Interaction Management ER/APP, Rotorcraft, Tower Runway Controller (PJ.02-05)]

[NSV-4][SNI-02b] SNI departure with PinS (rotorcraft) [Airborne] [Approach/Departure Control, Databases, Displays and Controls, Flight Crew (PJ.02-05), Flight Plan Management, Lateral and Vertical Guidance, Lateral Positioning, Navigation Infrastructure Satellite Based, Sensors and Antennas, TWR (Step 2), Vertical Positioning, Voice]

Figure 3: NSV 1 Soluton 02-05

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4.1.2 Resource Orchestration view

4.1.2.1 [NSV-4][SNI-01a] SNI approach with PinS (rotorcraft) [Ground]

The system describes the bi-univocal interaction between Ground ATCOs, performing PinS approaches in SNI environment

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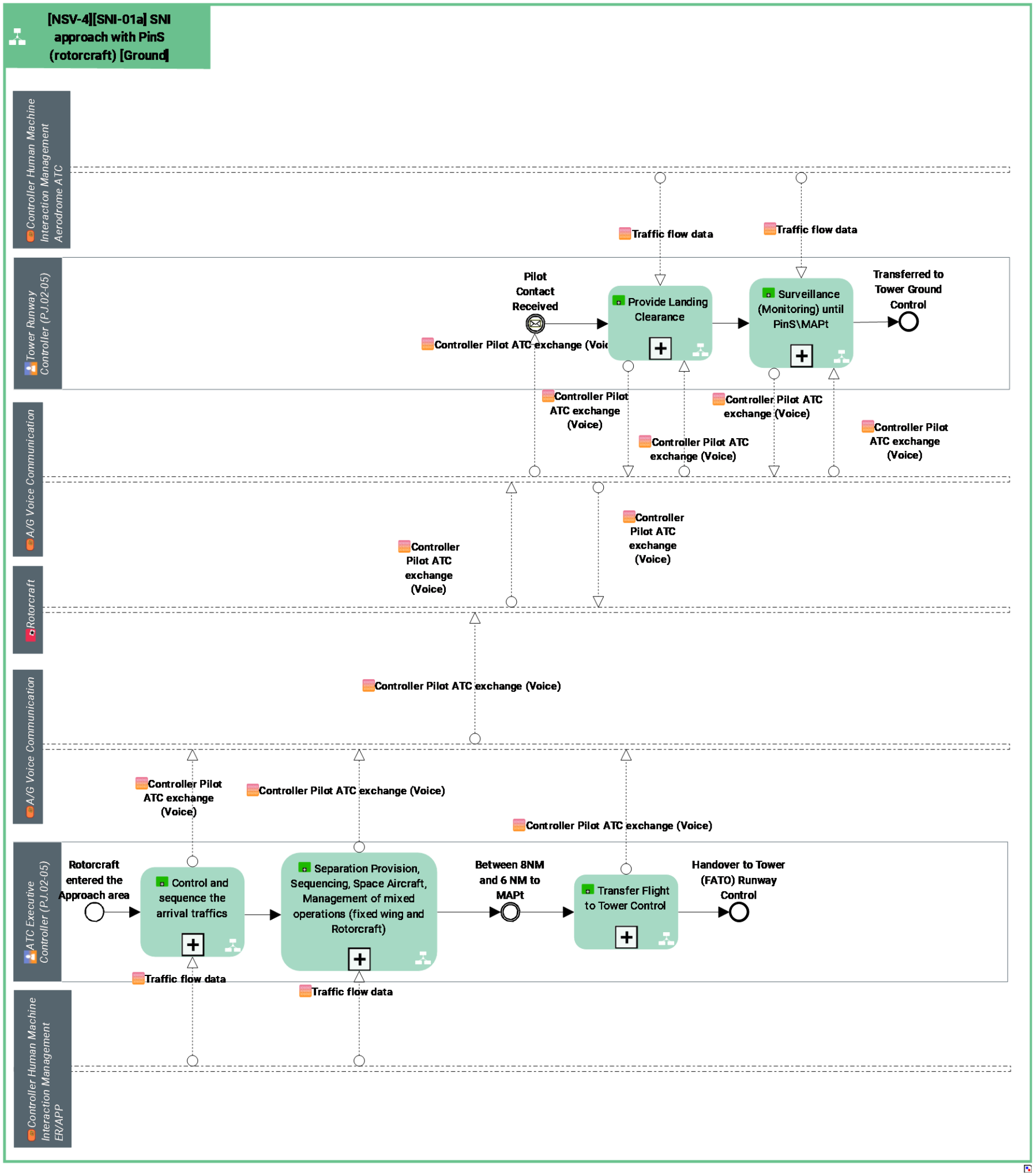

Figure 4: [NSV-4][SNI 01a]

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Function	Description
Control and sequence the arrival traffics	ATC executive controller in the en-route phases. Comply to IFR flight plan, sequencing and separation clearance provided until IAF.
Provide Landing Clearance	ATC (services provided by ACC/APP, under radar coverage) provides IFR landing Clearance
Separation Provision, Sequencing, Space Aircraft, Management of mixed operations (fixed wing and Rotorcraft)	ATC (services provided by ACC/APP, under radar coverage) maintains safely flight flow, providing separation of mixed traffic under its responsibility.
Surveillance (Monitoring) until PinS\MAPt	ATC (services provided by ACC/APP, under radar coverage), maintains surveillance and situational awareness of its flights (under its responsibility) until reaching the final point of PinS approach procedures, identified as the MAPt.
Transfer Flight to Tower Control	The last ATCO, who have the considered flight under its responsibility, leave the aircraft for the final stage of the flight to the services provided by the Tower control. In that phases the final segment is flown visually and the responsibility it''s transferred to the pilot in command.

Table 12: Description of Functions in the [NSV-4][SNI 01a]

4.1.2.2 [NSV-4][SNI-01b] SNI approach with PinS (rotorcraft) [Airborne]

The system describes the high level bi-univocal interaction/actions between Airborne Crew/pilots and the avionic on-board architectures performing PinS approaches in SNI environment

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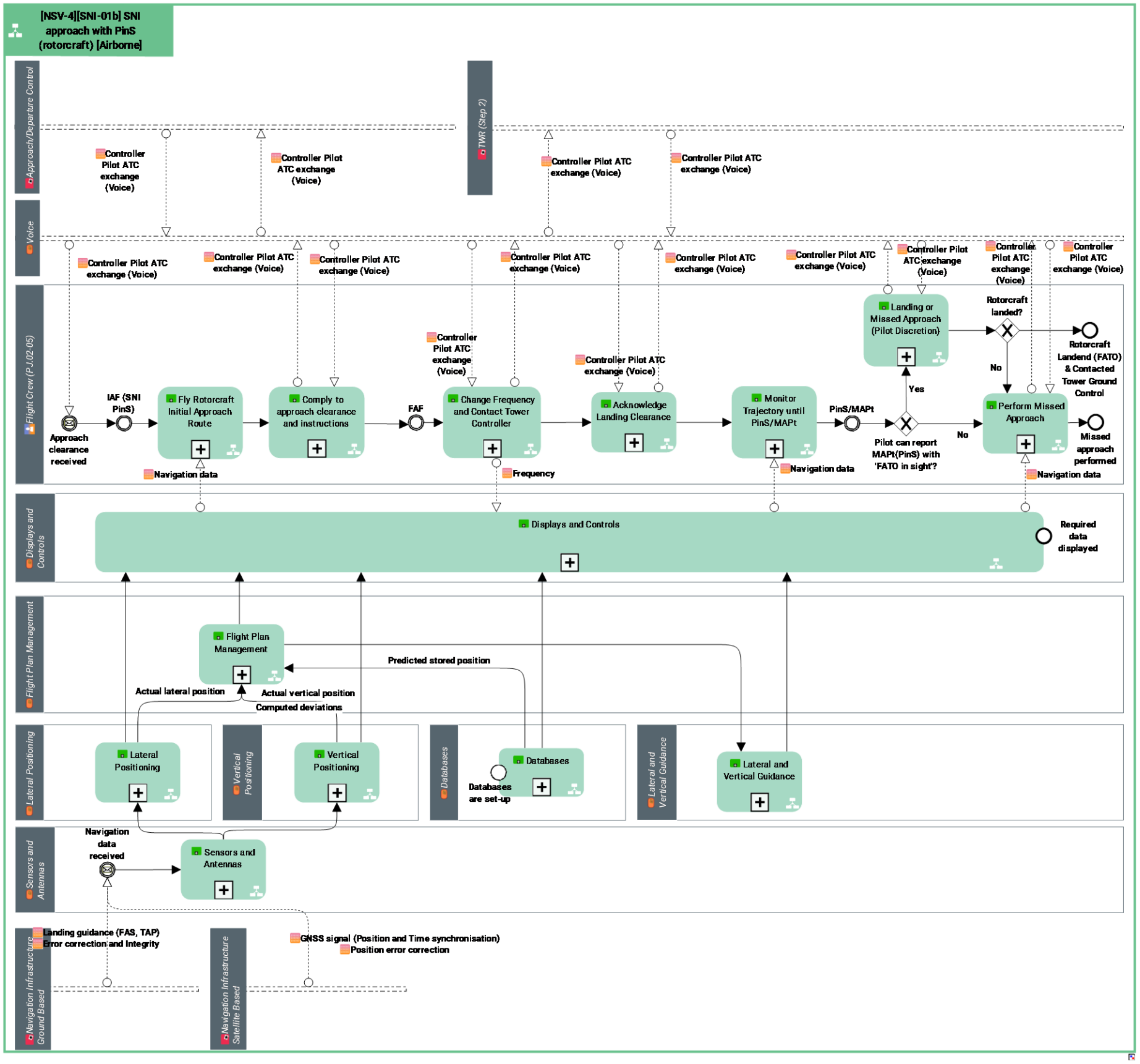

Figure 5: [NSV-4][SNI 01b]

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Function	Description
Acknowledge Landing Clearance	The on board flight crew, responsible for the flight, acknowledge and comply with it, in accordance to ATCO instructions
Change Frequency and Contact Tower Controller	The ATCO (APP/APP) responsible so far for the considered flight, transfers the air/ground/air voice communication to the next ground controller (airport Tower controller).
Comply to approach clearance and instructions	The flight deck complies with the last clearance received, in accordance with the controller instructions.
Databases	Onboard A/C databases (e.g. airport, navigation and terrain data bases). Some may require periodic updates based on AIRAC cycle
Displays and Controls	The function centralising HMI related functions for avionics including graphic user interface.
Flight Plan Management	Management of FMS 4D Trajectory (e.g. activ/secondary/alternate flight play waypoints, turn/holding patterns, etc)
Fly Rotorcraft Initial Approach Route	The rotorcrafts flies the acknowledge and cleared IFR segment approach route, established and retrieved from NAV DB.
Landing or Missed Approach (Pilot Discretion)	In accordance to pilot operational evaluation/discretion if the visual landing location is not achieved or some safety issue might occur, a Missed approach is performed. In the opposite scenario, leaving the MAPt, if the landing location is in sight and no safety issue are evaluated; at pilot discretion the landing phase can be accomplished
Lateral and Vertical Guidance	Flight Control i.e. the control of the aircraft on its lateral and vertical axis (e.g. Autopilot, Flight Director, Head up display)
Lateral Positioning	Elaboration of A/C latitude and longitude based on external means (GNSS, Radio Navigation, TACAN for Mil A/C) or autonomous means (Inertial Reference System).
Monitor Trajectory until PinS/MAPt	ATC (services provided by ACC/APP, under radar coverage), maintains surveillance and situational awareness of its flights (under its responsibility) until reaching the final point of PinS approach procedures, identified as the MAPt.
Perform Missed Approach	In accordance to pilot operational evaluation/discretion if the visual landing location is not achieved or some safety issue might occur at MAPt, a Missed approach is performed
Sensors and Antennas	The function related Sensors and Antennas capabilities.

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Vertical Positioning	Elaboration of A/C vertical position (altitude, height) based on external means (GNSS) or autonomous means (Baro-Altitude, Radio-Altitude measurements)

Table 13: Description of Functions in the [NSV-4][SNI 01b]

4.1.2.3 [NSV-4][SNI-02a] SNI departure with PinS (rotorcraft) [Ground]

The system describes the bi-univocal interaction between Ground ATCOs, performing PinS departures in SNI environment.

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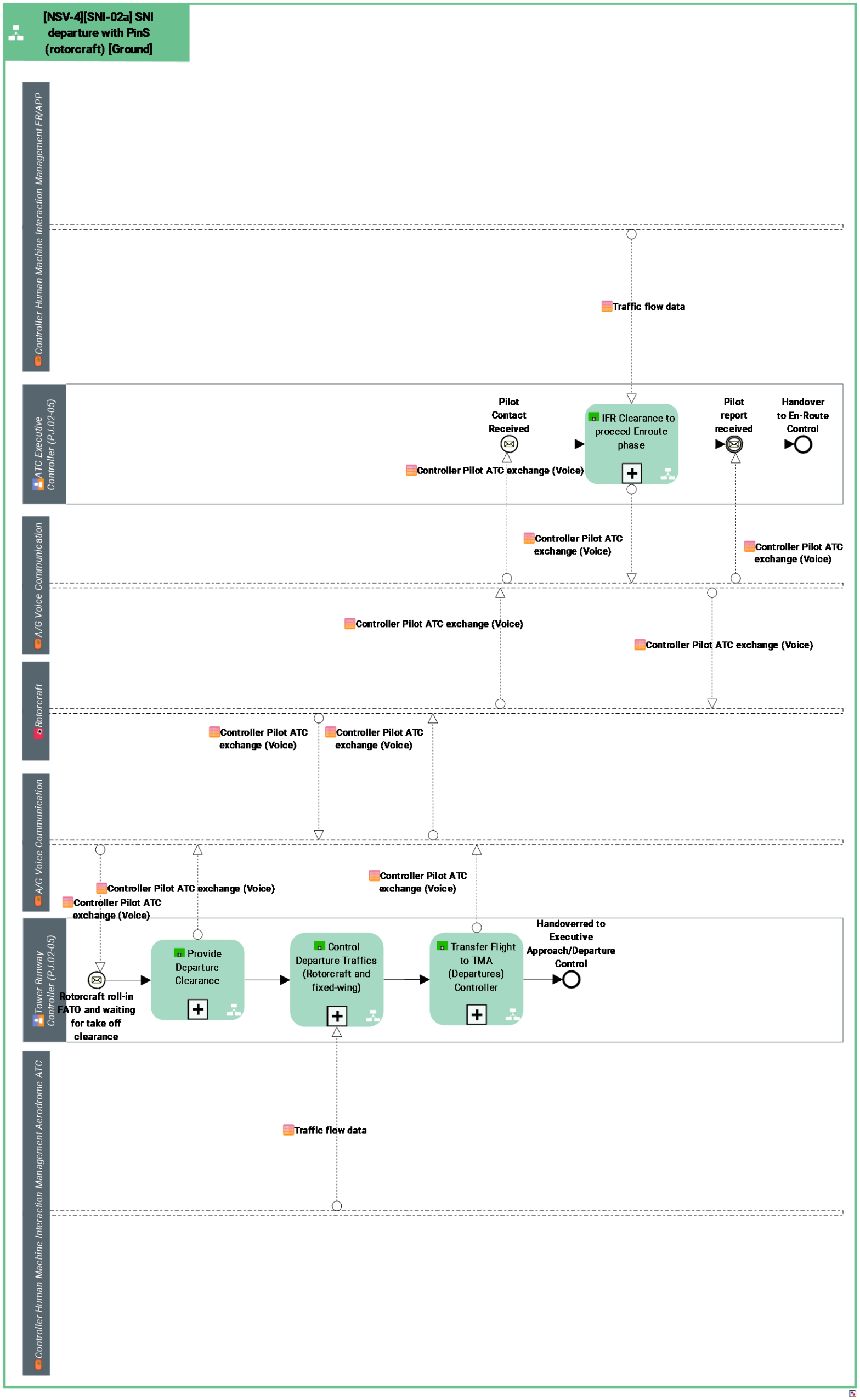

Figure 6: [NSV-4][SNI 02a]

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Function	Description
Control Departure Traffics (Rotorcraft and fixed-wing)	The ATCO (APP/ACC) will take care of the departing traffic in accordance to the Planned IFR flight plan. In this context particular attention will be devoted to the management of mixed traffic.
IFR Clearance to proceed Enroute phase	The ATCO, will provide to departing rotorcraft reaching the first IFR procedure point (IDF) the relative en-route clearance to proceed according to the selected departure procedure
Provide Departure Clearance	The ATCO, will provide to departing rotorcraft the relative departure clearance to take off.
Transfer Flight to TMA (Departures) Controller	The ATCO (Tower controller) responsible so far for the considered flight, transfers the air/ground/air voice communication and responsibility to the next TMA controller (ACC/APP controller)

Table 14: Description of Functions in the [NSV-4][SNI 02a]

4.1.2.4 [NSV-4][SNI-02b] SNI departure with PinS (rotorcraft) [Airborne]

The system describes the high level bi-univocal interaction/actions between Airborne Crew/pilots and the on board avionic architectures performing PinS departures in SNI environment

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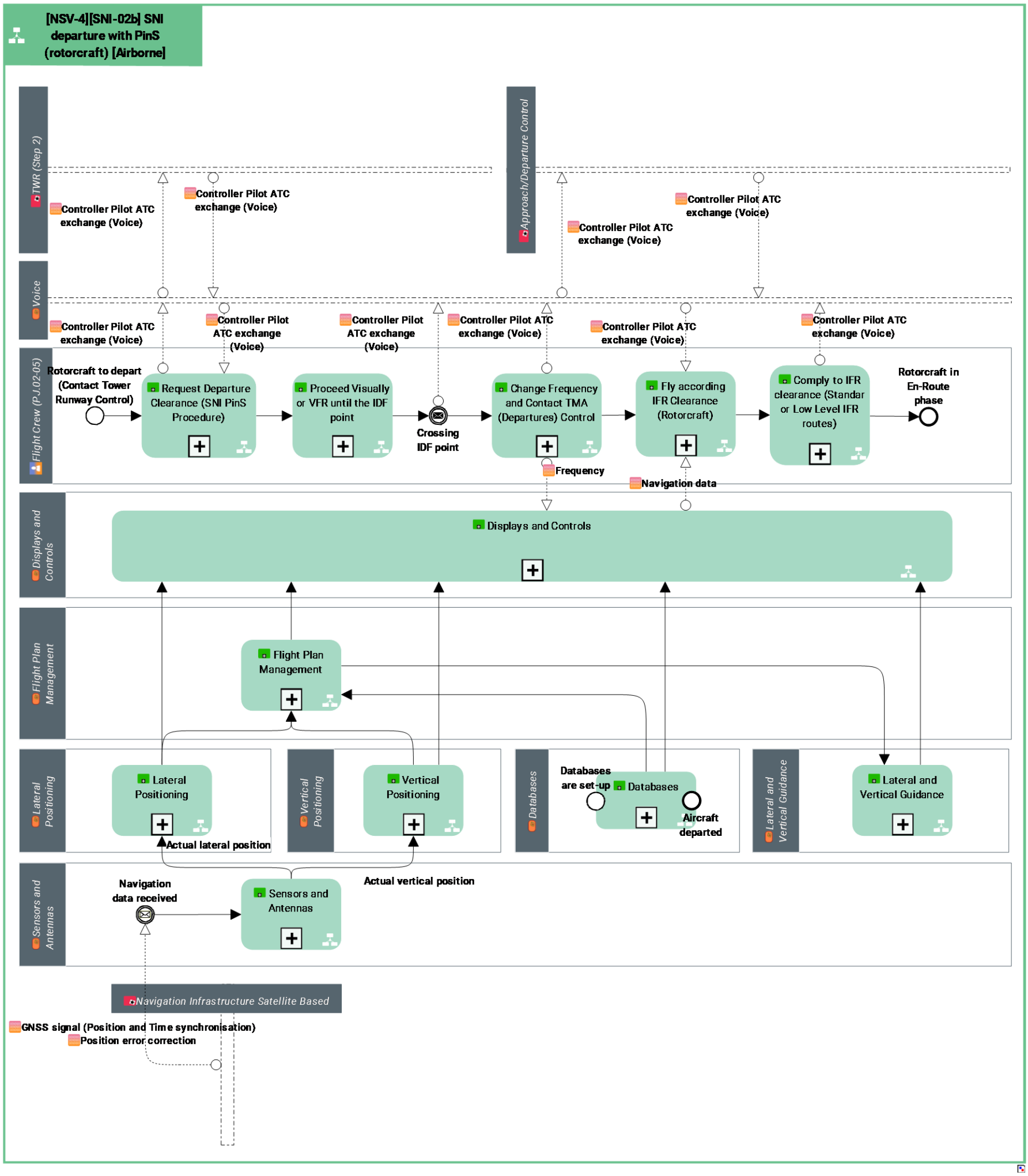

Figure 7: [NSV-4][SNI 02b]

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Function	Description
Change Frequency and Contact TMA (Departures) Control	The actual ATCO responsible so far for the considered flight, instructs the pilots to change air/ground/air voice communication and responsibility to the next TMA controller (ACC/APP controller)
Comply to IFR clearance (Standar or Low Level IFR routes)	In accordance to the acknowledge IFR clearance, the flight is performed according to the selected IFR procedure
Databases	Onboard A/C databases (e.g. airport, navigation and terrain data bases). Some may require periodic updates based on AIRAC cycle
Displays and Controls	The function centralising HMI related functions for avionics including graphic user interface.
Flight Plan Management	Management of FMS 4D Trajectory (e.g. activ/secondary/alternate flight play waypoints, turn/holding patterns, etc)
Fly according IFR Clearance (Rotorcraft)	The flight is performed according to the cleared and selected IFR procedure
Lateral and Vertical Guidance	Flight Control i.e. the control of the aircraft on its lateral and vertical axis (e.g. Autopilot, Flight Director, Head up display)
Lateral Positioning	Elaboration of A/C latitude and longitude based on external means (GNSS, Radio Navigation, TACAN for Mil A/C) or autonomous means (Inertial Reference System).
Proceed Visually or VFR until the IDF point	Flight crew performing the initial segment of PinS departure procedures, will fly in accordance to ““VFR rules”” or the instruction to ““proceed visually”” until IDF point.
Request Departure Clearance (SNI PinS Procedure)	Flight crew performing the initial segment of PinS departure procedures, after having reached the IDF will fly in accordance to the requested and acknowledge departure clearance, joining IFR departure procedure
Sensors and Antennas	The function related Sensors and Antennas capabilities.
Vertical Positioning	Elaboration of A/C vertical position (altitude, height) based on external means (GNSS) or autonomous means (Baro-Altitude, Radio-Altitude measurements)

Table 15: Description of Functions in the [NSV-4][SNI 02b]

4.1.3 Infrastructure connectivity model

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The following diagram describes the high-level Infrastructure connectivity model in support of operations performing PinS approach/departure procedure in airport environment, where the SNI concept is applicable. This infrastructure mainly supports the operations from the ground viewpoint with Navigation Infrastructure Ground based, Approach/Departure Control and Tower, and from airborne viewpoint with Navigation Infrastructure Satellite Based, considering the enabler technologies applied to the concept. Overall the infrastructure centre is represented by the block "Communication Infrastructure" which seems to be a sort of hub where each information related to the services pass through.

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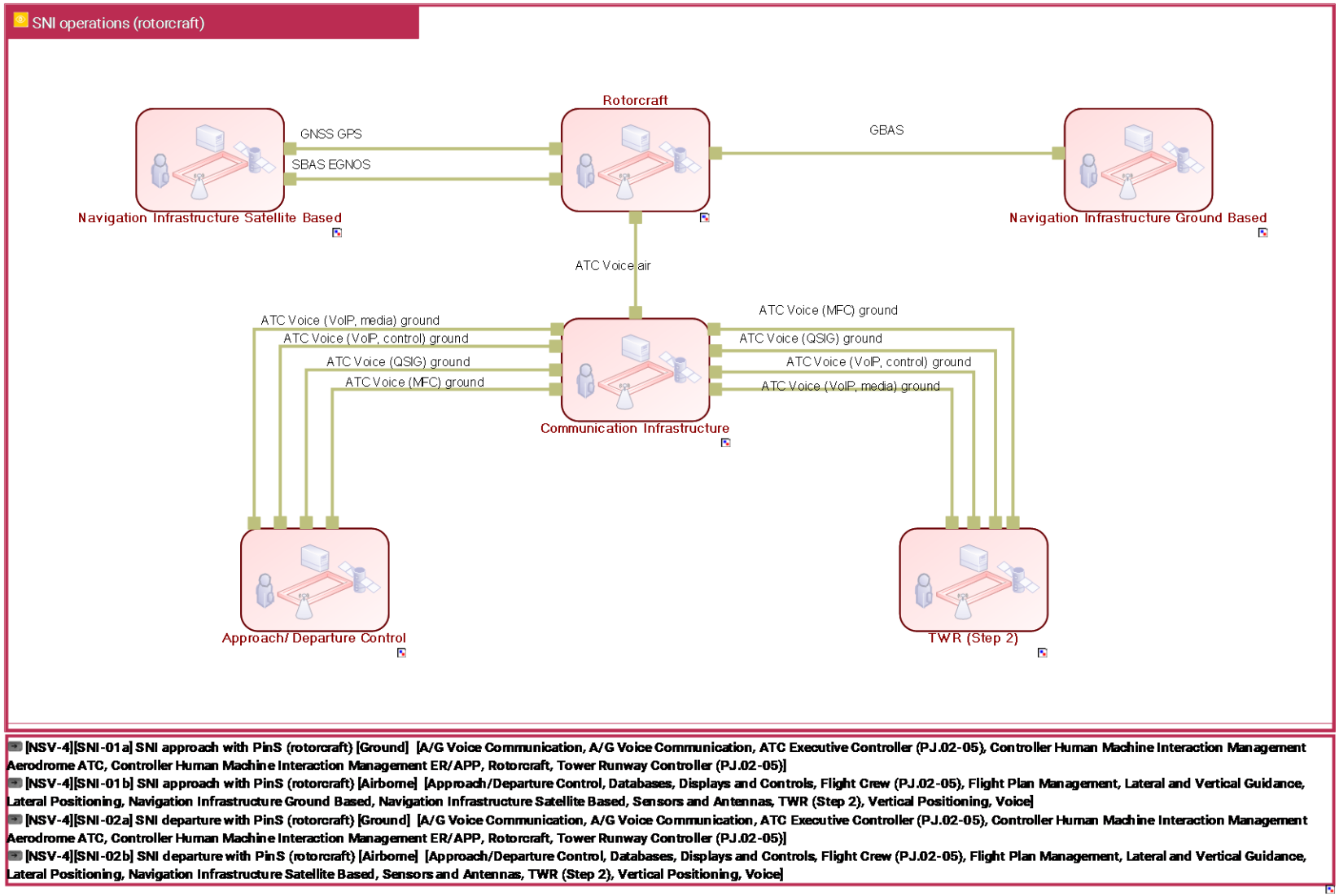

Figure 8: Infrastructure connectivity model for Solution 02-05

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4.1.4 Service view

N/A

4.1.4.1 Service description

4.1.4.2 Service Provisioning

Interaction	Consumer CC	Consumer System	Provider CC	Provider System
Landing guidance (FAS, TAP).Rotorcraft_CC and Navigation Infrastructure Ground Based_CC	Rotorcraft	Aircraft;	Navigation Infrastructure Ground Based	GBAS Ground station;
Error correction and Integrity.Rotorcraft_CC and Navigation Infrastructure Ground Based_CC	Rotorcraft	Aircraft;	Navigation Infrastructure Ground Based	GBAS Ground station;
Controller Pilot ATC exchange(Voice).Rotorcraft_CC and TWR (Step 2)_CC	Rotorcraft	Aircraft;	TWR (Step 2)	Voice;
GNSS signal (Position and Time synchronisation).Rotorcraft_CC and Navigation Infrastructure Satellite Based_CC	Rotorcraft	Aircraft;	Navigation Infrastructure Satellite Based	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External);
Controller Pilot ATC exchange(Voice).Rotorcraft_CC and Approach/Departure Control_CC	Rotorcraft	Aircraft;	Approach/Departure Control	Voice;
Position error correction.Rotorcraft_CC and Navigation Infrastructure Satellite Based_CC	Rotorcraft	Aircraft;	Navigation Infrastructure Satellite Based	SBAS;

Table 16: Service Interaction between Provide and Consumer

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4.1.4.3 Service Realization

4.1.4.3.1 Interaction Controller Pilot ATC exchange (Voice).Rotorcraft_CC and Approach/Departure Control_CC

System Port: VOICE_RADIO_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP
OPC (Operational) Voice ground	

System Port: ATC_VOICE_GND at APP ACC (Step 2)_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP

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Protocol Stack	Protocol
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP

System Port: VOICE_RADIO_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP
OPC (Operational) Voice ground	

System Port: ATC_VOICE_GND at APP ACC (Step 2)_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP

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	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP

System Port: VOICE_RADIO_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP
OPC (Operational) Voice ground	

System Port: ATC_VOICE_GND at APP ACC (Step 2)_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG

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ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP

System Port: VOICE_RADIO_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP
OPC (Operational) Voice ground	

System Port: ATC_VOICE_GND at APP ACC (Step 2)_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG

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ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP

System Port: ATC_VOICE at Civil Aircraft (Step 2)_CC

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

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)

4.1.4.3.2 Interaction Controller Pilot ATC exchange (Voice).Rotorcraft_CC and TWR (Step 2)_CC

System Port: VOICE_RADIO_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG

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ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP
OPC (Operational) Voice ground	

System Port: ATC_VOICE_GND at TWR (Step 2)_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP

System Port: VOICE_RADIO_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	

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	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP
OPC (Operational) Voice ground	

System Port: ATC_VOICE_GND at TWR (Step 2)_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP

System Port: VOICE_RADIO_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2

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ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP
OPC (Operational) Voice ground	

System Port: ATC_VOICE_GND at TWR (Step 2)_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP

System Port: VOICE_RADIO_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	

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	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP
OPC (Operational) Voice ground	

System Port: ATC_VOICE_GND at TWR (Step 2)_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP

System Port: ATC_VOICE at Civil Aircraft (Step 2)_CC

Protocol Stack	Protocol

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

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)

4.1.4.3.3 Interaction Error correction and Integrity. Rotorcraft_CC and Navigation Infrastructure Ground Based_CC

System Port: GBAS_VDB at Civil Aircraft (Step 2)_CC

Protocol Stack	Protocol
GBAS	
	VDB Link VHF 108 - 117.95 MHz

System Port: NAV_GBAS_AIR at Navigation Infrastructure Ground Based_CC

Protocol Stack	Protocol
GBAS	
	VDB Link VHF 108 - 117.95 MHz

4.1.4.3.4 Interaction GNSS signal (Position and Time synchronisation). Rotorcraft_CC and Navigation Infrastructure Satellite Based_CC

System Port: SAT_GNSS at Civil Aircraft (Step 2)_CC

Protocol Stack	Protocol
GNSS GPS	
	L1 1575.42MHz

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	L2 1227.6 MHz
	L5 1176.45 MHz
SBAS EGNOS	
	L1 1572.42MHz

System Port: NAV_SAT_GNSS at Navigation Infrastructure Satellite Based_CC

Protocol Stack	Protocol
GNSS BEIDOU	
	B1 1561.098 MHz
	B2 1207.147 MHz
	B3 1268.52 MHz
GNSS GALILEO	
	E1 1575.42 MHz
	E5a 1176.45 MHz
	E5b 1207.14 MHz
	E6 1278.75 MHz
GNSS GLONASS	
	L1 1598.0625 - 1605.375 MHz
	L2 1242.9375 - 1248.625 MHz
	L3 1201 MHz
GNSS GPS	
	L1 1575.42MHz
	L2 1227.6 MHz
	L5 1176.45 MHz
SBAS EGNOS	
	L1 1572.42MHz

4.1.4.3.5 Interaction Landing guidance (FAS, TAP). Rotorcraft_CC and Navigation Infrastructure Ground Based_CC

System Port: GBAS_VDB at Civil Aircraft (Step 2)_CC

Protocol Stack	Protocol
GBAS	

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	VDB Link VHF 108 - 117.95 MHz

System Port: NAV_GBAS_AIR at Navigation Infrastructure Ground Based_CC

Protocol Stack	Protocol
GBAS	
	VDB Link VHF 108 - 117.95 MHz

4.1.4.3.6 Interaction Position error correction. Rotorcraft_CC and Navigation Infrastructure Satellite Based_CC

System Port: SAT_GNSS at Civil Aircraft (Step 2)_CC

Protocol Stack	Protocol
GNSS GPS	
	L1 1575.42MHz
	L2 1227.6 MHz
	L5 1176.45 MHz
SBAS EGNOS	
	L1 1572.42MHz

System Port: NAV_SAT_GNSS at Navigation Infrastructure Satellite Based_CC

Protocol Stack	Protocol
GNSS BEIDOU	
	B1 1561.098 MHz
	B2 1207.147 MHz
	B3 1268.52 MHz
GNSS GALILEO	
	E1 1575.42 MHz
	E5a 1176.45 MHz
	E5b 1207.14 MHz
	E6 1278.75 MHz
GNSS GLONASS	
	L1 1598.0625 - 1605.375 MHz
	L2 1242.9375 - 1248.625 MHz
	L3 1201 MHz

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GNSS GPS	
	L1 1575.42MHz
	L2 1227.6 MHz
	L5 1176.45 MHz
SBAS EGNOS	
	L1 1572.42MHz

4.2 Functional and non-Functional Requirements

This section contains all developed technical requirements that are based on the operational requirements included in the SPR-INTEROP/OSED [38].

An assessment of the requirements in the OSED was performed to determine whether specific performance requirements were required to complete the necessary traceability between the OSED operational requirements, INTEROP requirements, TS functional requirements and Validation Objectives, as per the following guidance in the required Templates and Toolbox User Manual: DMF/MEGA.

4.2.1 Performance Requirements

As the PinS Advanced APV concept is an airborne-based procedure, many of the TS/IRS requirements inherently relate to required performance to fulfil a specific operational requirement. Thus, rather than create superfluous performance requirements already identified as the outcomes of SESAR 1 – P04.10, an analysis was performed to determine whether any OSED requirements justified the creation of new explicit [SPR] performance requirements. All the previously requirements already identified in P4.10 project considering rotorcraft performances and avionics capabilities to perform standard PinS procedures has been taken mature and reliable enough; therefore, they have been implicitly considered as a starting point.

The following performance requirements for the Advanced APV concept described in V3 OSED [38], along with their associated traceability, are described

[REQ]

Identifier	REQ-02.05-TS-PSNI.0010
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft shall be capable of allowing the Flight Crew to conduct a PinS APCH procedure compliant with the applicable Navigation Specification (RNP APCH 0.3 all phases of flight), sufficient to perform approach operations to LNAV/LPV minima with initial and intermediate segments with: 1. RNP values of RNP 0.3 NM; 2. RF legs ending at the FAP, and; 3. Evaluation of CDA technique.

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Status	<validated>
Rationale	The flight execution shall respect the RNP requirements of the RNP APCH operations down to LANV/LPV minima with segments with RNP values of 0.3 NM with RF legs ending at the FAP together with the CDA technique.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0020
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0030
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0040
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0050
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0060
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0070
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	Lateral and Vertical Guidance
<ALLOCATED_TO>	<Role>	Flight Crew
<ALLOCATED_TO>	<Function>	Comply to approach clearance and instructions
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-PSNI.0020
Title	Design of the airspace concept
Requirement	For the identified VFR FATOs approach operations, the final approach segment shall be an RNP-APCH (LNAV/LPV) segment: A. allowance of RNP straight in FAS and RF legs, future to consider that also in the missed approach intermediate and final phase;

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	B. an 0.3 all phases of flight
Status	<validated>
Rationale	Avoidance of obstacles/terrain, reduce flight path lengths, optimisation in accordance to Rotorcraft performances and through increased precision paths.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0020
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0030
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0040
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0050
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0060
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0070
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	Primary Flight DIsplay
<ALLOCATED_TO>	<Role>	Flight Crew
<ALLOCATED_TO>	<Function>	Comply to approach clearance and instructions Landing or Missed Approach (Pilot Discretion)
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-PSNI.0030
Title	Compliance with applicable Navigation Specifications (Missed Approach)

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Requirement	The rotorcraft shall be capable of allowing the Flight Crew to conduct a PinS APCH procedure compliant with the applicable Navigation Specification (RNP APCH) sufficient to perform the coded RNP Missed Approach with RNP values of 1NM and 0.3, including the RF legs flown in LNAV and LPV mode.
Status	<validated>
Rationale	The Missed Approach RNP requirements shall be respected when flying the coded missed approach, including the RF legs flown in LNAV and LPV mode.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0600
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	N/A
<ALLOCATED_TO>	<Role>	Flight Crew
<ALLOCATED_TO>	<Function>	Fly Rotorcraft Initial Approach Route Comply to approach clearance and instructions Landing or Missed Approach (Pilot Discretion)
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-PSNI.0050
Title	Compliance with applicable Navigation Specifications (Missed Approach)
Requirement	The rotorcraft shall be capable to perform a PinS APCH approach procedure compliant with the applicable Navigation Specification (RNP APCH) in order to perform the coded RNP Missed Approach with RNP 0.3 values, including a coded RF-Legs.

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Status	<validated>
Rationale	The Missed Approach RNP requirements shall be respected when flying the coded missed approach.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0600
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	
<ALLOCATED_TO>	<Role>	Flight Crew
<ALLOCATED_TO>	<Function>	Fly Rotorcraft Initial Approach Route Comply to approach clearance and instructions Landing or Missed Approach (Pilot Discretion)
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-PSNI.0100
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft shall be capable to execute RNP 0.3 terminal procedures extracted from the on board navigation database, including the capability to execute fly-over and fly-by turns.
Status	<validated>
Rationale	Navigation data and performance, must be displayed on PFD
Category	<Performance>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0570
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0580
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0590
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0610
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	
<ALLOCATED_TO>	<Role>	Flight Crew
<ALLOCATED_TO>	<Function>	Fly Rotorcraft Initial Approach Route Comply to approach clearance and instructions Landing or Missed Approach (Pilot Discretion) Monitor Trajectory until PinS/MAPt
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-PSNI.0190
Title	Database performance
Requirement	FATO and Runway database accuracy and integrity shall be per ICAO Annex 15, Aeronautical Information Services, Tables A7-1, and A7-2 and RTCA DO-201A. The database used also by SVS for FATOs, runway and airport information shall be consistent with that used by other systems in the rotorcraft (e.g., FATO, runway data from a state approved Flight Management System navigation database or state approved GPS approach database.).
Status	<Validated>
Rationale	The consistency of databases eliminates a discrepancy between information depicted to pilot from different avionics.
Category	<Performance>

[REQ Trace]

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Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0590
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0620
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	Database
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

4.2.2 Related Interoperability requirements

[REQ]

Identifier	REQ-02.05-TS-PINT.0030
Title	Rotorcraft FMS Capabilities
Requirement	The functions and capabilities to execute path terminator transition (mainly RF legs) shall be implemented in the helicopter navigation systems
Status	<Validated>
Rationale	This is an rotorcraft required functionality to support APV operations (departure and approach).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0050
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0110
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0120
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0140
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0150
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0170
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0180

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<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0190
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0200
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0210
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0210
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0220
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0240
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0250
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0280
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0310
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0350
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0360
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0370
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0380
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0390
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	Primary Flight Display
<ALLOCATED_TO>	<Role>	Flight Plan Management
<ALLOCATED_TO>	<Function>	Flight Plan Management
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05- TS-PINT.0070
Title	Rotorcraft SBAS Capabilities
Requirement	The Avionics shall be able to elaborate an absolute rotorcraft position based either on SBAS system
Status	<Validated>
Rationale	This is an rotorcraft required functionality to support APV operations (departure and approach).

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Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0090
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0230
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0320
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0360
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0370
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0380
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0410
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0570
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	Primary Flight Display GNSS Sensors and Antennas (Navigation Data reception)
<ALLOCATED_TO>	<Role>	Lateral Positioning Display and Controls Sensors and Antennas
<ALLOCATED_TO>	<Function>	Lateral Positioning Vertical Positioning Database Lateral and Vertical guidance Display and Controls
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

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Identifier	REQ-02.05- TS-PINT.0100
Title	Rotorcraft Navigation Database Capabilities
Requirement	The system shall store the precision RNAV-GNSS now 'RNAV' approach charts renamed 'RNP approach procedure (with LNAV or LPV minima) definitions, in the standard navigation database.
Status	<Validated>
Rationale	This is an rotorcraft required functionality to support APV operations (departure and approach).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0040
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0060
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0120
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0130
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0140
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0160
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0180
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0390
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0400
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0420
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	Database Primary Flight Display
<ALLOCATED_TO>	<Role>	Flight Plan Management (role)
<ALLOCATED_TO>	<Function>	Flight Plan Management (Function)
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

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[REQ]

Identifier	REQ-02.05-TS-PINT.0150
Title	Rotorcraft FMS Capabilities
Requirement	The FMS database will follow the RTCA/DO 200A (LOA Type 2) process to format the ARINC 424 database, supplied by the provider, into the FMS proprietary Format, which shall include the FAS DB. Path terminators are defined in ARINC Specification 424, and their application is described in more detail in RTCA documents DO-236B and DO-201A. For GBAS operation the system shall retrieve the selected GBAS APCH procedure from NAV DB, while FAS DB is received from GS on VHF frequencies.
Status	<Validated>
Rationale	This is an rotorcraft required functionality to support APV operations (departure and approach procedure).either for SBAS either for GBAS operation
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0050
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0110
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0120
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0140
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0150
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0170
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0180
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0190
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0200
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0210
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0210
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0220
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0240
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0250
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0280
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0310
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0350

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<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0360
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0370
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0380
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0390
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	Database
<ALLOCATED_TO>	<Role>	Database Primary Flight Display
<ALLOCATED_TO>	<Function>	Flight Plan Management
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-PINT.0180
Title	Rotorcraft FMS Capabilities
Requirement	The functions and capabilities to execute path terminators transition shall be implemented in the helicopter navigation systems
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0050
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0110
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0120

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<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0140
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0150
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0170
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0180
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0190
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0200
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0210
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0210
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0220
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0240
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0250
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0280
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0310
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0350
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0360
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0370
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0380
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0390
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	
<ALLOCATED_TO>	<Role>	Flight Plan Management
<ALLOCATED_TO>	<Function>	Flight Plan Management
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

4.2.3 Requirements for Safety

The safety requirements and assumptions developed in this paragraph and evaluated during the PJ02-05 timeframe are directly compatible with those in the previous phase and are therefore achievable for the same reasons. In particular, it is noted that the level of performance strictly connected with safety is stated in line with existing standards.

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It is under light that safety requirements have been determined/derived and evaluated only for elements under the managerial control of airborne side (Flight crew, Pilots and flying platform) and in conjunctions with specific technologies (GBAS and SVS) applied to Advanced PinS APCH procedures.

Some safety requirements should be easily satisfied because they are not different from those applicable and already evaluated in P4.10 project. and to the operative scenario existing standards which are well known by the aeronautical community (e.g. GNSS/SBAS/GBAS, LNAV/LPV..etc).

The assurance of validation and verification of the safety requirements is an on-going activity. A qualitative safety assessment has been performed from airborne side on the basis of the Use Cases, described in the SPR_INTEROP_OSED and validated through the exercises described in the VALP and recorded in the synthesis of validation results VALR. A specific activity (questionnaires, pilot and flight crew feedback, post analysis and de-briefing activities) was performed to map the safety objectives and requirements generated here to the validation objectives and results, to ensure that all requirements were fully assessed. For that reasons some safety requirements are evaluated together and the outcomes will be complementary.

[REQ]

Identifier	REQ-02.05-TS-PSAF.0020
Title	APV Display capable in case of GNSS failures
Requirement	The function shall inform the crew in case of GNSS and GBAS/SBAS signal integrity loss through PFD.
Status	<Validated>
Rationale	This requirement is derived from the SPR level model of the APV system.
Category	<Safety>; <HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0320
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0330
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0340
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0350
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0360
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0370
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0380
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0390
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<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0400
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0410

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<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0420
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0430
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0440
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0450
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0460
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0470
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0480
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0490
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0500
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0510
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0520
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0530
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0540
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	Primary Flight Display
<ALLOCATED_TO>	<Role>	Flight Crew Display and Controls
<ALLOCATED_TO>	<Function>	Display and Controls
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-PSAF.0040
Title	APV FMS capability in case of GNSS/SBAS failures
Requirement	The system shall provide indication of loss of navigation capability to the pilot in less than 0.6 seconds (so called time to alert) in case of SBAS/GBAS level of service unavailability
Status	<Validated>
Rationale	This requirement is derived from the SPR level model of the APV system. This is judged as validated as it requires the concept to conform to applicable standards

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Category	<Safety>; <HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0360
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0370
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0380
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	Primary Flight Display
<ALLOCATED_TO>	<Role>	Flight Crew Display and Controls
<ALLOCATED_TO>	<Function>	Display and Controls
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-PSAF.0050
Title	Navigation System FMS go –around capability in case of GNSS/SBAS failures
Requirement	In case of an initiation of a go-around due to a loss of GNSS/GBAS/SBAS, the FMS shall enable the use of other navigation means to comply with the performance requirements.
Status	<Validated>
Rationale	This requirement is derived from the SPR level model of the APV system. This is judged as validated as it requires the concept to conform to applicable standards
Category	<Safety>; <HMI>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0360
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0370
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0380
< ALLOCATED_TO >	<Enabler>	A/C -01 A/C -04 A/C-04b A/C-06 A/C-07
<ALLOCATED_TO>	<Functional block>	Primary Flight Display
<ALLOCATED_TO>	<Role>	Flight Crew Display and Controls
<ALLOCATED_TO>	<Function>	Display and Controls
<ALLOCATED_TO>	<Service>	GPS (External); GALILEO (External); GLONASS (External); BEIDOU (External); SBAS
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

4.2.4 Optional Requirements outside SBAS coverage

4.2.4.1 Optional Performances requirements:

[REQ]

Identifier	REQ-02.05-TS-POPT.0130
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft GBAS avionic receiver shall be capable to assure hazardous failure condition (2 x10^{-7})
Status	<Validated>
Rationale	GBAS Navigation receiver integrity
Category	<Performance>

[REQ Trace]

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Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.080
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.100
< ALLOCATED_TO >	<Enabler>	A/C-02a CTE-N07a
<ALLOCATED_TO>	<Functional block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-POPT.0140
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft FMS shall be capable to assure navigation lock for GBAS pseudo LOC and GS at final Approach Fix, performances of +/- 0.125 nm left and right on the horizontal plane and +/-75 ft accuracy in vertical ones, as per ICAO RNP APCH minima LNAV/VNAV document.
Status	<Validated>
Rationale	GBAS Navigation receiver performances
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.080
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.100
< ALLOCATED_TO >	<Enabler>	A/C-02a CTE-N07a
<ALLOCATED_TO>	<Functional block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

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[REQ]

Identifier	REQ-02.05-TS-POPT.0150
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft FMS shall be capable to assure navigation accuracy from FAF to MAPt equivalent to ILS look like, based on deviation calculated from FMS, on GBAS receiver inputs.
Status	<Validated>
Rationale	GBAS Navigation receiver performances
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.080
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.100
< ALLOCATED_TO >	<Enabler>	A/C-02a CTE-N07a
<ALLOCATED_TO>	<Functional block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-POPT.0160
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft GBAS receiver shall be certified according to: CMA-6024 SBAS/GBAS GNSS sensor unit (compliant with RTCA/DO-229E class 3, TSOC145e Class Beta-3 and TSO-C146e Class Delta-4 and with RTCA/DO-253C, TSP-C161a and TSO-C162a VHF Data Broadcast (VDB) receiver).
Status	<Validated>
Rationale	GBAS Navigation receiver performances
Category	<Performance>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.080
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.100
< ALLOCATED_TO >	<Enabler>	A/C-02a CTE-N07a
<ALLOCATED_TO>	<Functional block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-POPT.0170
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft GBAS receiver frequencies and channels shall be comprises in the range of: • Possible Channel from 20000 to 39999 • VDB GS station frequencies from 107 MHz to 118 MHz with a channel spacing of 25KHz
Status	<Validated>
Rationale	GBAS Navigation receiver performances
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.080
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.100
< ALLOCATED_TO >	<Enabler>	A/C-02a CTE-N07a
<ALLOCATED_TO>	<Functional block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A

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<ALLOCATED_TO>	<Service>	N/A
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-POPT.0180
Title	Conformal SVS display
Requirement	The SVS display shall be conformal with the outside view. The SVS depictions shall be conformal with each other as required according to the intended function.
Status	<In Progress>
Rationale	The pilot shall be able to look for the outside visual references in the same location as they appear in the SVS image and readily see them as soon as visibility conditions permit, without delays or distraction due to multiple head up and head down transitions.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.080
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.100
< ALLOCATED_TO >	<Enabler>	A/C-23a
<ALLOCATED_TO>	<Functional block>	Primary Flight Display
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

4.2.4.2 Optional Interoperability Requirements

[REQ]

Identifier	REQ-02.05-TS-IOPT.0130
Title	Rotorcraft Navigation Database Capabilities
Requirement	The system shall store the FAS Datablock received from GS with its relevant CRC for each GBAS-GLS APCH procedure

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Status	<In Progress>
Rationale	This is a rotorcraft required functionality to support APV operations (approach). based on GLS approach under GBAS signal.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0040
< ALLOCATED_TO >	<Enabler>	A/C-02a CTE-N07a
<ALLOCATED_TO>	<Functional block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05-TS-IOPT.0190
Title	Rotorcraft SVS system Capabilities
Requirement	The Primary Flight Display (PFD) are cockpit displays that shall be used to provide information needed to guide and control the rotorcraft and provide the Rc altitude, attitude, and airspeed indications. SVS can be implemented on the primary Head Down Display (HDD) in 14 CFR part 23 and 25 aircraft. Refer to AC 27-1B and AC 29-2C for guidance on installation on rotorcraft. The following requirements apply to SVS implemented on PFD.
Status	<In Progress>
Rationale	This is a rotorcraft required functionality to support SVS operations
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PINS.0100

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< ALLOCATED_TO >	<Enabler>	A/C-23a
<ALLOCATED_TO>	<Functional block>	Primary Flight Display
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

4.2.4.3 Optional Safety Requirements

[REQ]

Identifier	REQ-02.05-TS-OSAF.0070
Title	Stabilized approach for ADV-LPV
Requirement	The probability of not being able to perform a stabilized approach shall not increase for GBAS and SVS applicability's to ADV-LPV compared to standard SBAS LPV
Status	<In Progress>
Rationale	The argument is that using RF-turn and removing the level segment before FAF, there will be a need for assuring that the rotorcraft will be stabilized during the final approach segment.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	REQ-02.05-SPRINTEROP-PSNI.0430
<SATISFIES>	<ATMS Requirement>	N/A
< ALLOCATED_TO >	<Enabler>	N/A
<ALLOCATED_TO>	<Functional block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05- TS-OSAF.0080

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Title	Navigation and Image Positioning Sources integrity
Requirement	The system architecture must provide adequate accuracy and integrity of the SVS depiction so that the risk of displaying a misleading image is compatible with the safety analysis.
Status	<In Progress>
Rationale	The accuracy, integrity and continuity of the system needs to be evaluated at least equivalent level as is required for CAT I standard operation.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	N/A
<SATISFIES>	<ATMS Requirement>	N/A
< ALLOCATED_TO >	<Enabler>	N/A
<ALLOCATED_TO>	<Functional block>	Primary Flight Display
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

[REQ]

Identifier	REQ-02.05- TS-OSAF.0090
Title	Rotorcraft SVS system Capabilities
Requirement	Synthetic Vision Systems require a terrain and obstacle database, a precision navigation position, display, and height, attitude, and heading/track inputs. The design and installation safety levels shall be appropriate for the system's intended function. AC 25-11A and AC 23.1311-1 provide additional general display guidance
Status	<In Progress>
Rationale	This is a rotorcraft required functionality to support SVS operations
Category	<Safety>

[REQ Trace]

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Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<ATMS Requirement>	N/A
<SATISFIES>	<ATMS Requirement>	N/A
< ALLOCATED_TO >	<Enabler>	N/A
<ALLOCATED_TO>	<Functional block>	Primary Flight Display
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Function>	N/A
<ALLOCATED_TO>	<Service>	N/A
<ALLOCATED_TO>	<Resource Interaction>	Resource Interaction Identifier

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5 Implementation Options

N/A

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6 Assumptions

Given that, the proposed IFR SNI PinS procedures can be flown by available technology and systems (e.g. available advanced rotorcraft on-board avionics system) and taken into consideration that they do not require anything more, this section lists all those requirements whom were considered as assumptions for this kind of operations.

6.1 Performances Requirements:

Identifier	REQ-02.05-TS-ASSM.0040
Title	Stabilised final approach
Requirement	The rotorcraft shall be capable of allowing the Flight Crew to perform a stabilised final approach, where the PinS APCH procedures includes RF-legs in the intermediate segment ending at the FAP.
Status	<In Progress>
Rationale	The final approach shall be stabilised even where the PinS APCH procedure includes an RF-turn direct to the FAP.
Category	<Performance>

Identifier	REQ-02.05-TS-ASSM.0060
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft shall be capable to handle navigation data, including a failure indicator, must be displayed on a lateral deviation display (CDI, (E)HSI) and/or a navigation map display. These must be used as primary flight instruments for the navigation of the aircraft, for manoeuvre anticipation and for failure/status/integrity indication.
Status	<Validated>
Rationale	The capability to continuously display to the pilot flying, on the primary flight instruments for navigation of the aircraft (primary navigation display), the computed path and aircraft position relative to the path....
Category	<Performance>

Identifier	REQ-02.05-TS-ASSM.0070
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft shall be capable to retrieve and display data stored in the navigation database relating to individual waypoints and navigation aids, to enable the pilot to verify the ATS route to be flown.
Status	<Validated>
Rationale	Capacity to load from the database into the RNP system the entire Instrument Flight Procedure and the ATS route to be flown.....
Category	<Performance>

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Identifier	REQ-02.05-TS-ASSM.0080
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft shall be capable to display scaling automatically by default logic: automatically to a value obtained from a navigation database, or manually by pilot procedures. The full-scale deflection value must be known or must be available for display to the pilot commensurate with the required track keeping accuracy.
Status	<Validated>
Rationale	Navigation data, including a failure indicator, must be displayed on a lateral deviation display (CDI, (E)HSI) and/or a navigation map display
Category	<Performance>

Identifier	REQ-02.05-TS-ASSM.0090
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft shall be capable to display the following items: • The active navigation sensor type • The identification of the active (To) waypoint • The ground speed or time to the active (To) waypoint • The distance and bearing to the active (To) waypoint
Status	<Validated>
Rationale	Navigation data, must be displayed on PFD
Category	<Performance>

Identifier	REQ-02.05-TS-ASSM.0110
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft shall be capable to automatically execute leg transitions consistent with VA, VM and VI ARINC 424 path terminators, or must be able to be manually flown on a heading to intercept a course or to go direct to another fix after reaching a procedure-specified altitude.
Status	<Validated>
Rationale	Navigation data and performance, must be displayed on PFD
Category	<Performance>

Identifier	REQ-02.05-TS-ASSM.0120
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft shall be capable to loading numeric values for courses and tracks from the on board navigation database
Status	<Validated>
Rationale	Navigation data and performance, must be displayed on PFD
Category	<Performance>

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6.2 Interoperability Requirements:

Identifier	REQ-02.05-TS-ASSM.0010
Title	Rotorcraft Display Capability
Requirement	A continuous navigation data display shall be used as primary flight indicator in order to provide indication to pilots with possible failure, actual status, integrity, lateral deviation (cross track deviation), helicopter position relative to the desired approach path
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach).
Category	<Operational>

Identifier	REQ-02.05-TS-ASSM.0020
Title	Rotorcraft Navigation Database Capabilities
Requirement	The functions and capabilities to execute desired RNP considering terminal procedure shall be implemented in the navigation data base stored on the helicopter navigation systems
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach).
Category	<Operational>

Identifier	REQ-02.05-TS-ASSM.0040
Title	Rotorcraft Navigation Database Capabilities
Requirement	The functions and capabilities to select from the Navigation database shall be available to pilots in order to comply with the desired PinS APCH procedure
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach).
Category	<Operational>

Identifier	REQ-02.05-TS-ASSM.0050
Title	Rotorcraft Navigation monitoring Capabilities
Requirement	The capabilities to display navigations systems accuracy, integrity, availability and continuity including helicopter performance monitoring shall be available to pilots during approach phase
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach).
Category	<Operational>

Identifier	REQ-02.05-TS-ASSM.0080
Title	Rotorcraft FMS Capabilities

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Requirement	To perform an RNAV-GNSS approach (with LPV minima), the system shall compute angular deviations (ILS-Look-Alike).
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach).
Category	<Operational>

Identifier	REQ-02.05-TS-ASSM.0090
Title	Rotorcraft FMS Capabilities
Requirement	When flying an RNAV-GNSS approach now 'RNAV' approach charts renamed 'RNP' (with LNAV or LPV minima) associated to a missed approach procedure coded in the Navigation Database, at the engagement of the missed approach the system shall revert from angular deviations scales to linear scales with deviations from the flight plan
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach).
Category	<Operational>

Identifier	REQ-02.05-TS-ASSM.0110
Title	Rotorcraft FMS Capabilities
Requirement	The Navigation function shall allow the crew to select the RNAV-GNSS now 'RNAV' approach charts renamed 'RNP approach procedure (with LNAV or LNAV/VNAV or LPV minima).
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach).
Category	<Operational>

Identifier	REQ-02.05-TS-ASSM.0120
Title	Rotorcraft Navigation Database Capabilities
Requirement	The system shall store the FAS Datablock with its relevant CRC for each RNAV GPS Approach procedure (now 'RNAV' approach charts renamed 'RNP) with LNAV/LPV minima based on SBAS signal.
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach).
Category	<Operational>

Identifier	REQ-02.05-TS-ASSM.0140
Title	Rotorcraft FMS Capabilities
Requirement	The Navigation function shall update the flight plan after inserting the selected RNAV-GNSS approach procedure (now 'RNAV' approach charts renamed 'RNP)

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Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach).
Category	<Operational>

Identifier	REQ-02.05-TS-ASSM.0160
Title	Rotorcraft FMS Capabilities
Requirement	The Navigation function shall validate the FAS data block integrity through the use of its CRC check function.
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach).
Category	<Operational>

Identifier	REQ-02.05-TS-ASSM.0170
Title	Rotorcraft FMS requirements Capabilities
Requirement	When flying RNAV procedure with LPV minima, vertical guidance shall be based on vertical deviations computed by the GNSS receiver
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach).
Category	<Operational>

6.3 Safety Requirements

Identifier	REQ-02.05-TS-ASSM.0010
Title	APV Display the capable RNP
Requirement	The capabilities to display the followed RNP shall be available to pilots in order to verify and control any possible RNP system failure
Status	<Validated>
Rationale	This requirement is derived from the SPR level model of the APV system. This is judged as validated as it requires the concept to conform to applicable standards
Category	<Functional>

Identifier	REQ-02.05-TS-ASSM.0030
Title	APV FMS capability in case of GNSS/GBAS/SBAS Signal failures
Requirement	In case of loss of signal integrity, the Navigation function shall allow the crew to load the selected missed approach procedure at the airport or activate an FPL to alternate destination.
Status	<Validated>
Rationale	This requirement is derived from the SPR level model of the APV system.
Category	<Functional>

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Identifier	REQ-02.05-TS-ASSM.0060
Title	LoA integrity coding process
Requirement	The probability of an LoA Type 1 or Type 2 error shall be no greater than $1x10^{-5}$ per flight.
Status	<Validated>
Rationale	This requirement is in-line with industry standards which apply to such processes, and it is therefore already tried and tested within the industry.
Category	<Safety>

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7 References and Applicable Documents

7.1 Applicable Documents

Content Integration

[1] B.04.01 D138 EATMA Guidance Material

[2] EATMA Community pages

[3] SESAR ATM Lexicon

Content Development

[4] B4.2 D106 Transition Concept of Operations SESAR 2020

System and Service Development

[5] 08.01.01 D52: SWIM Foundation v2

[6] 08.01.01 D49: SWIM Compliance Criteria

[7] 08.01.03 D47: AIRM v4.1.0

[8] 08.03.10 D45: ISRM Foundation v00.08.00

[9] B.04.03 D102 SESAR Working Method on Services

[10]B.04.03 D128 ADD SESAR1

[11]B.04.05 Common Service Foundation Method

Performance Management

[12]B.04.01 D108 SESAR 2020 Transition Performance Framework

[13]B.04.01 D42 SESAR2020 Transition Validation

[14]B.05 D86 Guidance on KPIs and Data Collection support to SESAR 2020 transition.

[15]16.06.06-D68 Part 1 –SESAR Cost Benefit Analysis – Integrated Model

[16]16.06.06-D51-SESAR_1 Business Case Consolidated_Deliverable-00.01.00 and CBA

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

[18]ATM Cost Breakdown Structure_ed02_2014

[19]Standard Inputs for EUROCONTROL Cost Benefit Analyses

[20]16.06.06_D26-08 ATM CBA Quality Checklist

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[21]16.06.06_D26_04_Guidelines_for_Producing_Benefit_and_Impact_Mechanisms

Validation

[22]03.00 D16 WP3 Engineering methodology

[23]Transition VALS SESAR 2020 - Consolidated deliverable with contribution from Operational Federating Projects

[24]European Operational Concept Validation Methodology (E-OCVM) - 3.0 [February 2010]

System Engineering

[25] SESAR 2020 Requirements and Validation Guidelines

Safety

[26]SESAR, Safety Reference Material, Edition 4.0, April 2016

[27]SESAR, Guidance to Apply the Safety Reference Material, Edition 3.0, April 2016

[28]SESAR, Final Guidance Material to Execute Proof of Concept, Ed00.04.00, August 2015

[29]SESAR, Resilience Engineering Guidance, May 2016

Human Performance

[30]16.06.05 D 27 HP Reference Material D27

[31]16.04.02 D04 e-HP Repository - Release note

Environment Assessment

[32]SESAR, Environment Reference Material, alias, “Environmental impact assessment as part of the global SESAR validation”, Project 16.06.03, Deliverable D26, 2014.

[33]ICAO CAEP – “Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes” document, Doc 10031.

Security

[34]16.06.02 D103 SESAR Security Ref Material Level

[35]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[36]16.06.02 D131 Security Database Application (CTRL_S)

7.2 Reference Documents

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[37]ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.[3]

[38]SESAR Solution 02-05 SPR-INTEROP/OSED Part I V3 (D4.1.012-1)

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Appendix A Service Description Document (SDD)

N/A

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Appendix B Service Technical Design Document (STDD)

SESAR Technical
Service Contract Ter

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END OF DOCUMENT-

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