INDUSTRIAL RESEARCH

SESAR Solution 02-05 SPR-INTEROP/OSED for V3 - Part I

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Copyright Statement

EARTH

EARTH - ENHANCED RUNWAY THROUGHPUT

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Abstract

The PJ.02-05 OSED describes; the expected environment, the operational concept, the New SESAR Operating Method options and associated use cases. This document is used as the basis for assessing and establishing operational, safety, performance and interoperability requirements to deliver the following Operational Improvements:

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

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The SPR/INTEROP-OSED Template includes the following parts:

- ***SPR/INTEROP-OSED Template – Part I (this volume)***
- SPR/INTEROP-OSED Template – Part II Safety Assessment Report (SAR)
- SPR/INTEROP – OSED Template – Part III Security Assessment Report (SeAR)
- SPR/INTEROP – OSED Template – Part IV Human Performance Assessment Report (HPAR)
- SPR/INTEROP – OSED Template – Part V Performance Assessment Report (PAR)

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1 Executive Summary

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 a FATO (Standard/Advanced Point In Space procedures). Furthermore, the Solution 02-05 addresses *additionally* the applicability of **PinS *designing criteria*** to specific rotorcraft operations GBAS technologies based.

The Solution evaluates also the use of a combined SBAS (CAT I) procedures with Radius to Fix legs (RF) and Synthetic Vision System (SVS) for evaluating the possibility to reduce the approach minima value of the procedure, increasing pilot situational awareness and safety meanwhile reducing ATCOs' and Pilot's workload.

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).

This SPR-INTEROP/OSED, identifies several operating method options that have been analysed in the V3 phase 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.

2 Introduction

2.1 Purpose of the document

The Initial Operational Service and Environment Definition (OSED) describes the operational concept, the operational services, their environment, use cases and is used as the basis for assessing and establishing operational, safety, performance and interoperability requirements for the related systems detailed in the Safety and Performance Requirements (SPR) and INTEROP sections of this document. The OSED identifies the operational services supported by several entities within the ATM community and includes the operational expectations of the related systems. When at full V3 maturity, this SPR-INTEROP/OSED Part I document will provide the requirements specification, covering functional, non-functional and interface requirements related to SESAR Solution PJ.02-05.

2.2 Scope

This is the SPR-INTEROP/OSED for Solution PJ.02-05 for V3 phase, addressing Operational Improvement (OI step) AO-0316 - Increased Airport Performance through independent IFR rotorcraft operations.

The requirements contained herein will cover safety, performance, operational aspects as well as the interoperability aspects related to specific operational working methods and technologies to support the SESAR Solution PJ.02-05 Independent Rotorcraft IFR operations at the Airport.

2.3 Intended readership

The members of solutions within PJ.02 EARTH - EnhAnced Runway THroughput

The members of the following solutions within S2020:

PJ.01-06	Enhanced Rotorcraft and GA operations in the TMA
PJ.14-03-01	GBAS
EHA	European Helicopter Association
PJ22	Validation and Demonstration Engineering;
PJ19	Content Integration;

2.4 Background

Research activities in SESAR 1 have built the foundation for the activities in PJ.02-05. During SESAR 1, the P04.10 (WP4) was the only Project within the scope of 'Rotorcraft Operations" focused on the definition and validation of potential solutions as Low Level IFR routes RNP-1/RNP-0.3, PinS procedures (Point-In-Space), SNI operations (Simultaneous Non-Interfering) in a busy airports.

The SESAR 1 Project P04.10 complementary activities were performed in support of SESAR 2020 Project.01 (Solution PJ.01.06 - Enhanced Rotorcraft and GA operations in the TMA for PinS procedures) and Project.02 (Solution PJ.02.05 for SNI operations) with V2 and V3 validations successfully achieved through Fast /Real Time Simulations and Live Trials within Milan TMA and to/from two of busiest airports –in Milan ACC airspace- as Malpensa (LIMC), Linate (LIML) and Lugano (LSZA) airports, using prototype vehicles belonging to the AWxxx series (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) [39]
- 04.10 D23 FINAL - SESAR Solution Guidance ZZ (SNI) – GEN (ed. 00.01.00) [40]

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 will be 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 will be evaluated focusing on new 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 will be applicable to different main airports needs drive development of the Enhanced Arrival Procedures in SNI environment enabled by SBAS -GBAS and SVS concepts.

In SESAR 1 was proposed (on top of what is already included into ICAO document SOIR - Simultaneous Operations on Parallel or Near-Parallel Instrument Runways) a dedicated method of operation at busy airports, with regards SNI concept applicable to Rotorcrafts operations:

- 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*.

In this context the Solution PJ.02-05 will aim to:

- develop and validate concepts and systems which allow the implementation of the operational concept of SNI Operations for the rotorcraft enabled by standard and advanced PinS procedures;

- identify best proposal for a possible Regulatory provisions for SNI IFR rotorcraft operations (using PinS)
- bring the SNI concept and related OI (AO-0316) to full V3 maturity level in Wave 1.

As additional Solution 02-05 objectives will be considered :

- the evaluation of the applicability of LPV PinS designing criteria to specific rotorcraft operations, GBAS technologies based (criteria not existing in PANS OPS documentation);
  - (radius to fix) RF legs
  - NAV SPEC RNP 0.3 for all flight phases
  - Different GP Glide Paths will be evaluated aiming at perform different tunings of the on-board receiver and optimize the approach paths.
  - Evaluation of possible interferences between GBAS station and current surveillance airport systems.
- the combination of SBAS (CAT I) procedure with RF leg and SVS (Synthetic vision System) for evaluating the opportunity to furtherly reduce the approach minima value of approach procedures.

The limited SNI evaluation in congested airport:

- Designing and testing a Point-In-Space "Approach/Departure (RNP 0.3)" 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 need to be further 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

The document follows the following structure:

- **Section 1 Executive Summary:** provides a summary of the key information and elements contained in the document.
- **Section 2 Introduction:** presents the purpose and scope of the document, the intended audience, the structure of the document and the main acronyms and terminology used throughout the document.
- **Section 3 Operational Service and Environment Definition:** provides the summary of the solution validated by PJ.02-05, the Detailed Operational Environment which reports the operational characteristics, the roles and responsibilities of the actors and constraints, and also the Detailed

Operating Method which contains the previous operating method, the new operating method and the difference between them.

- **Section 4 Safety, Performance and Interoperability Requirements:** contains the safety, performance and interoperability requirements relevant for the SESAR Solution PJ.02-05.
- **Section 5 References and Applicable Documents:** identifies the documents (name, reference, source project) this document has to comply to or uses as additional inputs.
- **Appendix A Benefit Mechanisms:** provides the benefit mechanisms for the solution.

2.6 Glossary of terms

Term	Definition	Source of the definition
ADS-B Application	A means by which aircraft, can automatically transmit and/or receive data such as identification, position and additional data, as appropriate, in a broadcast mode via a data link.	ICAO
Airspace Management	Airspace Management is the process by which airspace options are selected and applied to meet the needs of the ATM community.	ICAO 9854
	Airspace Management is integrated with Demand and Capacity Balancing activities and aims to define, in an inclusive, synchronised and flexible way, an optimised airspace configuration that is relevant for local, sub-regional and regional level activity to meet user's requirements in line with relevant performance metrics. Airspace Management primary objective is to optimise the use of available airspace, in response to the users demands, by dynamic time-sharing and, at times, by the segregation of airspace among various airspace users on the basis of short-term needs. It aims at defining and refining, in a synchronised and a flexible way, the most optimum airspace configuration at local, sub-regional and regional levels in a given airspace volume and within a particular timeframe, to meet users requirements while ensuring the most performance of the European Network and avoiding as much as possible any disruption. Airspace Management in conjunction with AFUA is an enabler to improve civil-military co-operation and to increase capacity for the benefit of all users.	P07.02 P04.02

Term	Definition	Source of the definition
Airspace Configuration:	Is a pre-defined and coordinated organisation of ATS routes of the ARN and /or terminal routes and their associated airspace structures, including airspace reservations/restrictions (ARES), if appropriate, and ATC sectorisation.	OSED 07.05.02 AFUA Step 1 V3 for V4
Airspace Restriction	A defined volume of airspace within which, variously, activities dangerous to the flight of aircraft may be conducted at specified times (a “danger area”); or such airspace situated above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions (a restricted area); or airspace situated above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited (a prohibited area).	OSED 07.05.02 Step 1 for V4
Airspace Structure	A specific volume of airspace designed to ensure the safe and optimal operation of aircraft.	OSED 07.05.02 Step 1 AFUA V3 for V4
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. *Note.— Area navigation includes performance-based navigation as well as other RNAV operations that do not meet the definition of performance-based navigation*	ICAO Doc 9613 PBN Manual
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	ICAO Doc 9613 PBN Manual

Term	Definition	Source of the definition
	on barometric altitude and is specified as a VPA from reference datum height (RDH). (PANS OPS).	
CDFA – Continuous Descent Final Approach	Continuous Descent Final Approach is a technique for flying the final approach segment of an NPA as a continuous descent. The technique is consistent with stabilized approach procedures and has no level-off. A CDFA starts from an altitude/height at or above the FAF and proceeds to an altitude/height approximately 50 feet (15 meters) above the landing runway threshold or to a point where the flare manoeuvre should begin for the type of aircraft being flown. This definition is harmonized with the ICAO and the European Aviation Safety Agency (EASA).	ICAO Documentation
Flight intent	The future aircraft trajectory expressed as a 4-D profile up to the destination (taking into account of aircraft performance, weather, terrain, and ATM service constraints). It is calculated and "owned" by the aircraft flight management system, and agreed by the Pilot.	ICAO Doc 9854
	In the SESAR Context, Flight Intent corresponds to the "agreed data of RB/MT" : the waypoints of the routes and associated altitude, possible time and/or speed constraints agreed between ATM actors.	WP B04.02 CONOPS Step 1
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	ICAO Annex 10

Term	Definition	Source of the definition
	integrity monitoring, augmented as necessary to support the required navigation performance for the intended operation.	
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
Low Level IFR Routes	Low Level IFR Routes dedicated to Rotorcraft integration in dense / constrained airspace. Rotorcraft altitude (2000-4000 ft.) specific Low Level IFR routes are designed and optimised based on route network using RNP-1 / RNP-0.3. The integration in dense and constraint airspace TMA is due to rotorcraft peculiar flight characteristics and type of operation conducted, such as: • Helicopters not pressurised: the Maximum allowed altitude: FL100 (e.g 3000 m) • Most helicopters have no de-icing capability - Risk of encountering icing conditions increases with altitude. Typically standard IFR FL are often too high • Health of on-board patients during medical flights - Recommended altitude for patients in critical condition: not more than 3000 ft. AGL • Safety and environment • Visual flight at very low height (500 ft. or sometimes less) to stay below clouds in marginal weather conditions is frequent accident cause and impacts environment (e.g noise footprint)	ICAO Documentation D11-P04.10 Sol 113
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	EUR RNP APCH Guidance Material

Term	Definition	Source of the definition
	approved according to AMC 20-27 or equivalent. LNAV/VNAV minima can also be used by SBAS capable aircraft.	
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
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. 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.	ICAO Doc 9613 and WP B04.02 CONOPS Step 1
Network Management	Network Management is an integrated activity with the aim of ensuring optimised Network Operations and ATM service provision meeting the Network performance targets., The Network Management Function is executed at all levels (Regional, Sub-regional and Local) throughout all planning and execution phases, involving, as appropriate, the adequate actors	P07.02 P04.02

Term	Definition	Source of the definition
	(NM, FM, LTM…)	
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
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	ICAO PBN Manual 9613

Term	Definition	Source of the definition
	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.	
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 System	SVS uses the basic elements of synthetic vision—a 3-D representation of terrain, obstacles and runways.	EUROCAE WG-79

Table 1: Glossary of terms

2.7 List of Acronyms

Acronym	Definition
AC	Advisory Circular
ADD	Architecture Definition Document
ADS-C	Automatic Dependent Surveillance - Contract

Acronym	Definition
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

Acronym	Definition
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

Acronym	Definition
IFR	Instrument Flight Rule
ILS	Instrument Landing System
INTEROP	Interoperability Requirements
I/O	Input/Output
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
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

Acronym	Definition
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
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 (Agency of the European Commission)
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

Acronym	Definition
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
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: List of acronyms

3 Operational Service and Environment Definition

3.1 SESAR Solution PJ.02-05_Independent Rotorcraft operations at the Airport: a summary

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).

<table>
<tr><th>OI Step code</th><th>OI Step title</th><th>OI Step coverage</th></tr>
<tr><td>AO-0316</td><td>Increased Airport Performance through Independent (parallel or convergent) IFR Rotorcraft Operations</td><td>Fully covered</td></tr>
<tr><td colspan="3">Using Rotorcraft specific independent IFR procedures to/from Final Approach & Take-Off areas (FATO) located at airports remove IFR rotorcraft from active runways and allow aircraft and rotorcraft simultaneous non-interfering operations (SNI).

This specific rotorcraft independent IFR procedure includes (parallel or convergent) Point-in-Space (PinS) procedure to enable access to/from VFR FATO. When reaching the PinS, the pilot shall decide either to proceed to a landing or to abort the approach. The PinS is also the MAPT (Missed Approach Point).

In case of IFR FATO implemented for SNI IFR operations, the specific independent IFR procedure could be designed as a direct procedure.</td></tr>
</table>

Table 3: SESAR Solution PJ.02-05 Scope and related OI steps

Id	High Level CONOPS Requirement Description	CONOPS section
S02-05-HLOR-01	Independent Rotorcraft operations shall: · permit independent IFR rotorcraft operations to/from FATO located at airport: by using, for rotorcraft: · point in space procedures · · DGNSS navigation while · offering simultaneous fixed wing operation in a non-interfering environment.	SESAR CONCEPT OF OPERATIONS (CONOPS 2019) § 3.1.2

Table 4: High Level CONOPS requirements related to SESAR Solution PJ.02-05

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

OI Step Code	OI Step title	Deviation
AO-0316	Increased Airport Performance through Independent (parallel or convergent) IFR Rotorcraft Operations	No deviation has been identified yet

3.2 Detailed Operational Environment

3.2.1 Operational Characteristics

Operational interactions per context (NOV-2)	Operating Environment
[NOV-2] SNI operations (rotorcraft)	Airport; Terminal Airspace;

Comment

1/Airspace Characteristics

The controlled airspace (e.g. Class “A”/TMA and Class "D"/CTR Airport considered) has been the operational environment in which all operations have been considered.

Nevertheless, no particular constrain to preclude the development of this kind of routes/procedures (e.g. RNP1, RNP0.30) in a class ““G”” airspace has been identified, provided that the concerned CAA allows IFR in Class G airspace (e.g. today, still forbidden in Switzerland).

2/Separation standard

The existing ICAO criteria for standard separation methods have been met for SNI operations. However, it resulted advisable to consider in depth the conditions related at the specific case observed, because of a lot of factors to be taken into consideration and that can easily affect the operations penalizing the capacity of airport or increasing the ATCO workload.

In any case, for SNI operations it should be advisable to consider for the rotorcraft approach (e.g. SBAS guided) the same lateral precision as ILS approaches:

- 1525 meters if no SSR - Secondary Surveillance Radar is available;
- 1310 meters if SSR is available;
- 1035 meters if SSR is available with at least of 0.06° lateral accuracy and 2,5 seconds update rate

3/Traffic Characteristics

No significant changes concerning the composition of the traffic have been considered, in terms of aircraft types, from today's global fleet. However, it is important to underline that the SNI concept is a mode of operation for mixed IFR traffic at airports.

4/CNS equipment

A general overview on the already existing equipment and futures ones that are part of the CNS requirements taking into consideration SNI Operations (operated using PinS to/from a VFR FATO) are reported as follows:

- Communication means: Direct Controller-Pilot Communication via voice (R/T) Surveillance means: Radar SSR (and PSR) / ADS-B surveillance (not mandatory)
- Navigation means: To support RNP routes and procedures structure, GNSS Augmentation Systems (e.g. mandatory SBAS, optional GBAS).

3.2.2 Roles and Responsibilities

Node	Responsibilities
Aerodrome ATS	Performs all the aerodrome ATS operations. [RELATED ACTORS/ROLES] Runway controller, ground controller, etc.
En-Route/Approach ATS	Performs all the en-route and approach ATS operations. [RELATED ACTORS/ROLES] Executive controller, planning controller, etc.
Flight Deck	Performs all the on-board AU operations including flight execution/monitoring according to agreed trajectory, compliance with ATC clearances/instructions, etc. [RELATED ACTORS/ROLES] Flight Crew

Operational interactions per context (NOV-2)	Operating Environment
[NOV-2] SNI operations (rotorcraft)	Airport; Terminal Airspace;

Node	Node instance	Node instance description
En-Route/Approach ATS	Executive Approach/Departure Control	Instance of En-Route/Approach ATS for the approach phase management. It Instance of En-route/Approach ATS for the approach (Upstream and Downstream) phase management. It represents the ATCO assigned to the role of Approach (EXE) In details, the main important responsibilities of an ATCO -with specific reference to this flight phase- are the ones usually adopted and described into the ICAO DOC 4444.

		Regarding the operational concept addressed within this Solution, the following activities shall be considered as the most important ones which an ATCO (he/she) have to secure: •• firstly, ensure the required separation between the relevant traffic in the airspace under his/she responsibility; •• provide the proper clearance for the route to be flown; •• provide the needed information to the crew about the guidance system (e.g. SBAS) status.
Flight Deck	Rotorcraft Flight Deck	Instance of Flight Deck to represent the rotorcraft flight crew. It represents the PILOT (and his/her crew). The crew of the helicopter is responsible to secure the adherence to the route cleared for the rotorcraft by ATCO and hence to the minimum altitudes and heights allowed by the law that the helicopter is allowed to fly. This includes: · The Terminal Area Altitude (TAA) and Minimum Sector Altitude (MSA); · The Decision Altitude/Height (DA/H) during the approach procedure with the Vertical Guidance (LPV); · Operating the rotorcraft and its sub-systems (Multifunction Control Display Unit\MCDU, PFD-Primary Flight Display, digital dual duplex 4-axis autopilot, FMS — Flight Management System, GNSS/SBAS WAAS/EGNOS technologies, fuel, landing gear, radios, etc.); · Performing a proper crew briefing including checking NOTAMs (e.g. about SBAS system status), Temporary orders of service, weather conditions, etc, so that to allow at all crew members to be fully aware and prepared for flight control especially for landing and approach phases.
Aerodrome ATS	Tower Runway Control	Instance of Aerodrome ATS for the approach phase management. It represents the ATCO assigned to the role of Tower Controller (EXE) In details, the main important responsibilities of an ATCO -with specific reference to this flight phase- are the ones usually adopted and described into the ICAO DOC 4444. Regarding the operational concept addressed within this Solution, the following activities shall be considered as the most important ones which an ATCO (he/she) have to secure:

		•• firstly, ensure the required separation between the relevant traffic in the airspace under his/she responsibility; •• provide the proper clearance for the route to be flown; •• provide the needed information to the crew about the guidance system (e.g. SBAS) status.

3.2.3 Technical Characteristics

Technical constraint	description
Airborne Capabilities	**1) Communication means** - Digital Radio Navigation System - A data link connection capability, which supports information exchanges (such as the SATCOM system). - Transmission of Graphical weather information **2) Surveillance means** - ADS-B out equipage - Cockpit Weather display - CDTI - Cockpit Display of Traffic Information - Emergency Avionics systems (CVR/FDR, ELT) - Health & Usage Monitoring System (HUMS) **3) Navigation means** - RNP capability - Dual Flight Management System (FMS) with GPS - 4-axis digital AFCS (Automatic Flight Control System) - GNSS/SBAS receiver linked to a FMS supporting all required PBN elements (including RFs) is necessary - MFD - Multi-Function Display - Navigation MAPTraffic and terrain avoidance systems (TCAS II, HTAWS)
CNS equipment	This should be intended as a general overview on the already existing equipment and futures ones that are part of the CNS requirements taking into consideration during the SNI Operations (operated using PinS to/from a VFR FATO) implementations. **1) Communication means** Direct Controller-Pilot Communication via voice (R/T) **2) Surveillance means** Radar SSR (and PSR) / ADS-B surveillance (not mandatory)

	3) Navigation means To support RNP routes and procedures structure, GNSS Augmentation Systems (e.g. supported by mandatory SBAS,
Ground Capabilities	The controller was provided with the conventional traffic surveillance data. . This set of tools may assist the controller in managing the potentially large number of interacting routes. The aspects of today's operations are the following : - Radar separation Minima (usually 5-3 NM in Terminal Airspace) and - Minima imposed by Wake Turbulence on the final approach segment. - It is still be possible to use conventional separation methods although there will be less tactical intervention.

3.2.3.1 Optional Technical Characteristics (nice to have)

The following Technical characteristics are not mandatory for Solution maturity scope, and are listed hereafter with the scope to highlight the future technological evolution on certain field of RC operation interest.

Airborne Capabilities	**1) Communication means** - Digital Radio Navigation System - A data link connection capability, which supports information exchanges on CPDLC and ADS-C / FIS B - Transmission of Graphical weather information **2) Surveillance means** - ADS-B surveillance (not mandatory). In the future SPACE based ADS-B and ADS -B- Health & Usage Monitoring System (HUMS) **3) Additional future Navigation capabilities** - AHRS - RNP lover than 0.3 - RNP AR APCH
CNS equipment	This should be read as a general overview on the future possible equipment and futures ones that are part of the CNS requirements

	evaluated during the SNI Operations (operated using PinS to/from a VFR FATO) implementations. **1) Communication means** - Datalink (CDPLC) and ADS-C capability **2) Surveillance means** - ADS-B surveillance (not mandatory). In the future SPACE based ADS-B and ADS -B-IN **3) Navigation means** - To support RNP routes and procedures structure, GNSS Augmentation Systems (e.g. supported by the optional GBAS)
Ground Capabilities	In addition to the conventional traffic surveillance tools the controller furthermore, in the future might be provided with additional tools so that be supported in the Conflict Detection in order to manage the Separation of the traffic. This set of tools may assist the controller in managing the potentially large number of interacting routes.

3.2.4 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
REG-0009_ AMC for Curved Approaches	
STD-025_ Harmonisation Specifications on Ground Based Augmentation System Ground Equipment to Support Category I Operations	
STD-067_ DO-253D 'GBAS MOPS' & DO-246E 'GBAS ICD'	

Table 4: Standards & Regulation considered within PJ.02-05 Use Cases (UCs)

3.3 Detailed Operating Method

3.3.1 Previous Operating Method

In the context of the full integration of airports into the ATM Network, the airport capacity was considered as a key challenge in the SESAR timeframe. The runway throughput (runway capacity) should be optimised at congested airports to respect this trend and create the expected and operationally appropriate ATM environment.

Thus, the runway capacity played a key role in the ATM Research Programmes and it has been also enhanced by facilitating Simultaneous-Non-Interfering (SNI) operations.

More in general, the main purpose of implementing simultaneous non interfering operations on parallel or near-parallel1 runways is to increase runway capacity and aerodrome flexibility, enhancing the airport capacity accordingly. It would be recommendable for this kind of operations to fly under Instrument Flight Rules (IFR) with high precision navigation capabilities.

The safety level of parallel runway operations is however affected by several factors such as:

- the accuracy of the surveillance radar monitoring system;
- the ability of controllers to intervene when an aircraft deviates from the instrument landing system (ILS) localizer course;
- the precision which aircraft can navigate to the runway;
- the controller, pilot and aircraft reaction times.

Currently the concept of SNI operations seems to be limited only to fixed-wing aircraft (IFR), flying into airports and under specific conditions.

[1] Near-parallel runways are non-intersecting runways whose extended centre lines have an angle of convergence/divergence of 15 degrees or less.

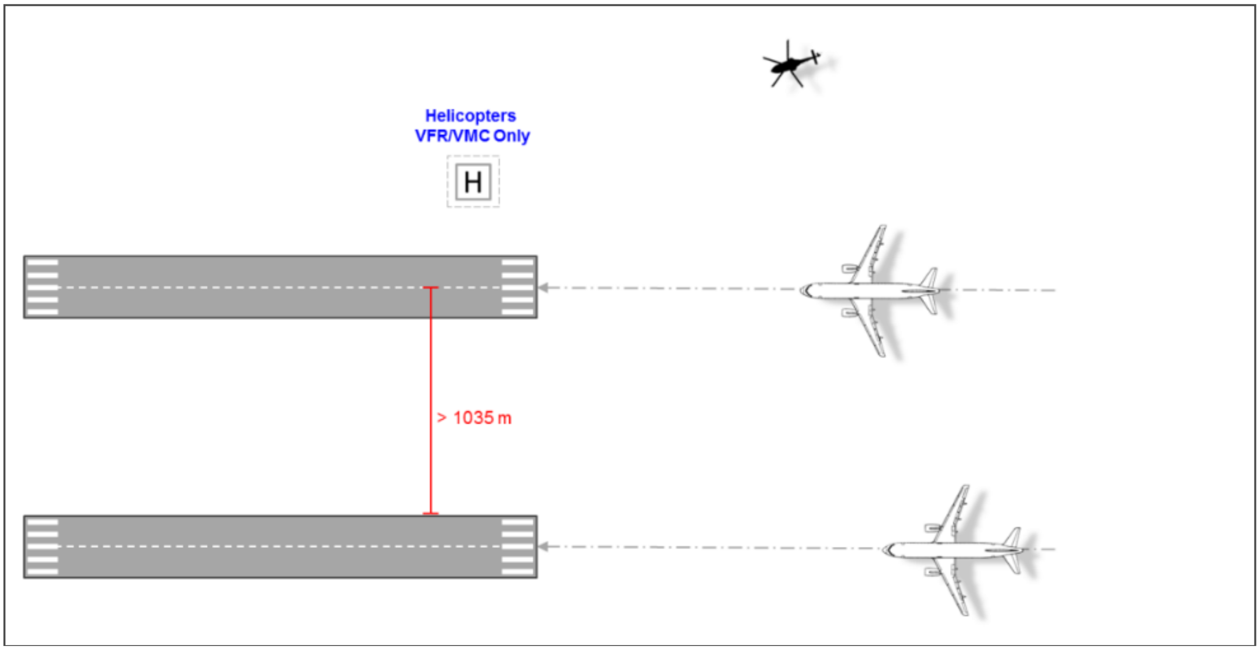


Figure 1: Current SNI implementation

The rotorcraft airspace users are allowed to fly to/from busy airports only in respecting the VFR/VMC conditions due to several reasons which concern the aforementioned points. Effectively, these kind of operations (RC – Rotorcraft in VFR only) are not allowed within a large number of EU TMA airspace, specifically during landing/taking off phases to/from a lot of congested airports [e.g. Milan TMA (airports: Malpensa, etc.), London TMA (airports: Heathrow, Birmingham, etc.) Rome TMA (airports: Fiumicino, Ciampino, etc)], irrespective of the weather conditions (due to class "A" airspace which doesn't allow VFR operations).

The only way at disposal of the rotorcraft AUs to be allowed to fly within class "A" airspace (e.g. M/M or H/H complex/density, Multi Airports TMA) and approach/take off to/from congested airports (included under these airspaces), is to convert their operating way into the IFR one.

Nevertheless, even if rotorcraft were capable of flying under IFR conditions (High technology available on-board), currently without the introduction of a specific operational solutions, however they would be constrained to use same approach/departure procedures than airplanes. This constraint can considerably affect the runway arrival/departure flows (the sequencing with main line aircraft becomes difficult to achieve) because of speed differences (increasing ATCO workload as consequence). Besides, the fixed-wing IFR procedures are too long and approach slopes (≈3°) too shallow for rotorcraft.

1/Mode of Operations

Specifically, the capacity of a busy airport can be accomplished either by using existing parallel runways more efficiently or by building additional runways. The cost of the latter can be very high as well as the cost of the needed technologies Installation/maintenance (e.g. ILS and MLS) can become very high to ensure that some already existing runways could be safely operated simultaneously and independently under IFR.

There are four Modes of Operations. The first two basic modes correspond to simultaneous parallel approaches, whilst there are two other separate modes for simultaneous parallel departures and segregated parallel approaches/departures.

- **Mode 1**, Independent parallel approaches: simultaneous approaches to parallel or near-parallel instrument runways where radar separation between aircraft on adjacent extended runway centre lines are not prescribed;
- **Mode 2**, Dependent parallel approaches: simultaneous approaches to parallel or near-parallel instrument runways where radar separation between aircraft on adjacent extended runway centre lines are prescribed;
- **Mode 3**, Independent parallel departures: simultaneous departures from parallel or near-parallel instrument runways;
- **Mode 4**, Segregated parallel operations: simultaneous operations on parallel or near-parallel instrument runways in which one runway is used exclusively for approaches and the other runway is used for departures.

2/ Runway minimum distances

ICAO Annex 14 vol. I recommends that where parallel runways are intended for simultaneous use, the minimum distances between their centre lines should be:

Runway Type	Higher Code Number			Mode of Operation			
	1	2	3 or 4	1	2	3	4
Non-Instrument RWYs	120 m	150 m	210 m				
Instrument RWYs				1035 m	915 m	760 m	760 m

Table 5: Minimum spacing required for parallel runways

The criterion is differently affected by several factors and mainly depends on whether the runways are intended for simultaneous instrument approaches or simultaneous non-instrument procedures.

In the case that non-instrumental procedures are intended to be used with related parallel runways, the minimum distance between these latter depends on higher code number of respective runway reference code, whereas that distance depends on the application of specific rules depending on the mode of operation.

3/ Solution PJ.02-05 ambition

The main objective of Solution PJ.02-05 is to assess and validate up to V3 level of maturity a means to move rotorcraft operations from the active runway to improve rotorcraft operations in the TMA/Airport and, at the same time, improve fixed wing aircraft operations in terms of more efficient arrival sequencing. The idea is to deploy new rotorcraft specific IFR Simultaneous Non-Interfering approach/departure procedures anchored to (VFR) FATO.

In the framework of SESAR 1 (baseline for the research thread proposed within Solution 02-05), all the validation activities covered the PinS procedure concept with straight segments based on RNP APCH specifications and DOC 8168 requirements (V3 maturity level). The development of curved procedures in the initial, intermediate, final and missed approach segment (e.g. Advanced PinS concept) together with new enablers (e.g. SVS, GBAS, …) is still not covered and remains to be addressed in S2020 PJ.02-05.

As well, in the context of PJ.02-05 has been suggested a proposal of standardization of procedure design criteria for rotorcraft operations in order to support the creation of a pan-European operational concept for independent rotorcraft operations (parallel or convergent) to/from a (VFR) FATO located at airport.

Finally, the PinS procedures concept (Standard and/or Advanced) shall be seen as enabler to develop the SNI operations (it was confirmed V2 MAT LEV as "achieved" at the end of SESAR 1\P04.10). The solution 02-05 aims to bring the SNI concept to fully V3 maturity in order to demonstrate any potential benefits in terms of improved capacity, predictability, safety and efficiency by removing the need of separations between fixed-wing aircraft and rotorcraft (Low speed/performance vehicles);

Furthermore, another PJ.02-05 proposed research thread, on top of what was already achieved within SESAR 1, is the introduction of the GBAS and SVS (Synthetic Vision System) rotorcraft operations in order to fully complete the scene. In particular, this proposal has been based on the achieved knowledge for fixed wing aircraft that has been deeply extended in SESAR projects 06.08.05, 05.06.03 and 09.12.

3.3.2 New SESAR Operating Method

3.3.2.1 **Use Cases for** [NOV-2] SNI operations (rotorcraft)

Nowadays, thanks to the GNSS technology, it's possible to design an operational environment made up of IFR procedures "SBAS based" and purposely designed for rotorcraft as the PinS Point in Space procedures.

Enhanced IFR rotorcraft procedures, PBN - based (e.g. RNP 1.0/0.3) with "Vertical Guidance" LPV (Localizer Performance with Vertical Guidance) represent a valid solution to improve the accessibility of rotorcraft to the heliports (existing VFR FATOs when VMC minima not achieved) included into the airport boundaries without interfering (SNI operations) with already existing traffic (mainly fixed-wing).

The LPV procedures represent an improvement for rotorcraft operations on several levels:

- LPV procedures do not require local ground installations and can be deployed at minimum cost and with no maintenance costs at almost any location;
- LPV procedures provide precise and geometric vertical guidance which improve not only the safety, but also the comfort of flight;
- LPV helicopter dedicated approach procedures, reduce air controller workload, improve access to airports whilst reducing flight time, noise pollution and fuel consumption.

The LPV procedures when designed as compliant with the SNI Simultaneous Non-Interfering (operations) criteria facilitate the introduction of rotorcraft in the congested airports. The SNI is a mode of operation for mixed IFR traffic at airports, not a specific type of procedure. The main objective achievable thanks to the possible implementation of the Simultaneous-Non-Interfering operations is to remove the IFR rotorcraft from runway traffic by using rotorcraft specific procedures which can be flown simultaneously and in a non-interfering way.

In this outlook, and in the context of SESAR, specifically within the Project 02 \ Solution 02-05, the SNI concept has been considered as a key factor to facilitate the integration of the rotorcraft operations in the future ATM environment.

These procedures provide a reliable and accurate mean of navigation for rotorcraft operations, since they allow to develop dedicated and tailored routes in addition to the instrument flight procedures to/from airport, completely decoupled from the traditional navigation aids (e.g. NDBs, VORs, ILS) and from the conventional ATS procedures specifically conceived for fixed-wing traffic, thus limiting strategically their interferences (SNI concept) with fixed wing operations themselves. In general, two classes of procedures for rotorcraft may be discerned.

1. **The straight-in final procedure**: is a "straight-in" final approach segment with only one track/approach course with the intermediate segment aligned with the final segment:

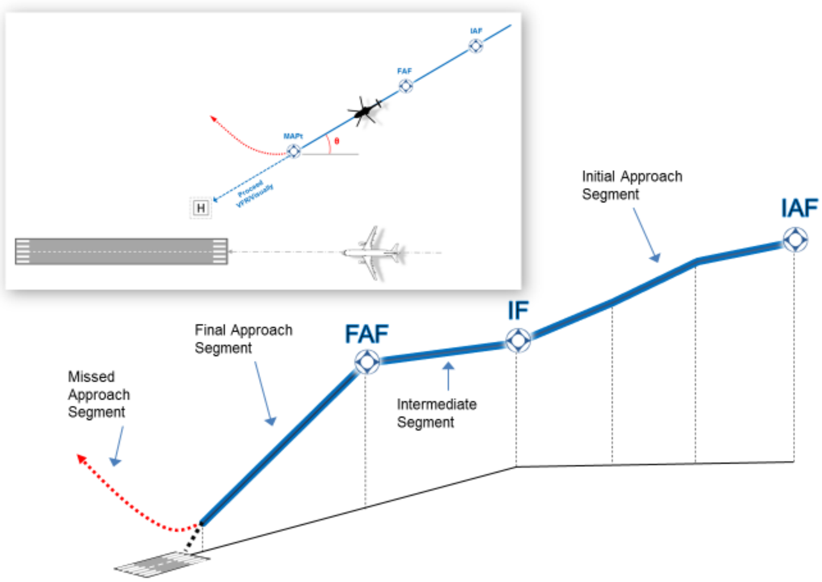


Figure 2: Example of straight final approach procedure

The curved final procedure: is a procedure which is made up of a "curved" final approach segment:

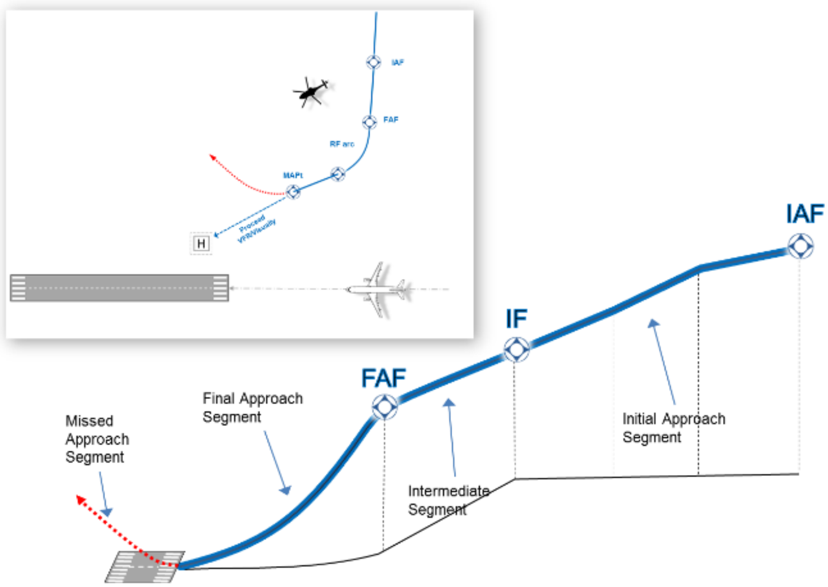


Figure 3: Example of curved (final approach) procedure

In the context of SESAR Research programme both kind of procedures are identified respectively as:

- Standard Point-In-Space procedures (**AOM-0104-A**), [V3 achieved in SESAR 1 \P04.10];
- Advanced Point-in-Space Procedures (**AOM-0104-B**) [V3 targeted and under S2020\ PJ.01-06 responsibility].

Key design features

- VFR FATO Point-In-Space (PinS) approach required (and related INTEROP REQs);
- FATO - Runway distance complying with ICAO Annex 14, Vol.2 (100000 Kg and over ---> 250m) ;
- Parallel or Convergent approach with LPV (minima) final segment (FAF PinS, FAS- Final Segment Approach);
- Minimum separation distance based on ICAO Annex 14 Vol. 1, Mode 1 (Independent Parallel Approach) requirements (Instrument RWYs\Mode 1---> 1035m).

Regarding the identification of new criteria for SNI operations PJ.02-05 analysis was based on the results achieved in the context of previous European research Programmes ([41],[42]).

As surrounding conditions, it was considered that current requirements for fixed-wing independent parallel approaches are the baseline for the analysis. Besides, the analysed use cases, include only the case in which all runways in use are equipped with ILS and for the fixed-wing operations only the straight approaches are intended to be used.

On the other hand, to identify the range of all possible rotorcraft procedures it is as fundamental requirement, the usage of GNSS technology, such as **SBAS** to provide also the vertical guidance.

Remaining focused on the Mode of Operation 1 (independent parallel approaches) the minimum performance of Surveillance Radar which allow to be able to reach the minimum distances stated in the Annex 14 are descript as following:

1. For minimum runway spacing of 1310 m (4300 ft) but not less than 1035 m (3400 ft), is required a suitable Secondary Surveillance Radar (SSR) with a minimum azimuth accuracy of 0.06 degrees, an update period of 2.5 seconds or less, and high resolution display providing position prediction and deviation alert;

2. For minimum runway spacing by less than 1525 m (5000 ft) but not less than 1310 (3400 ft), is required a SSR equipment with performance specifications other than the foregoing may be applied;

3. Where the runway centre lines are spaced by 1525m (5000 ft) or more, is required a suitable surveillance radar with a minimum azimuth of 0.3 degrees or better and an update period of 5 seconds or less.

As assumption we have been focused on the design of approaches procedures for rotorcraft assuming that they are spaced from runway centre line 1310 m (4300 ft) at least. This distance was considered sufficient to ensure a correct surveillance monitoring in addition to the possibility to disregard the wake vortex effect generated by fixed-wing aircraft flying in the final approach segment.

On the other hand, ICAO Annex 14 vol. II defines the distance between the FATO (Final Approach Take Off area) edge and the runway or taxiway edges where simultaneous VMC operations are planned:

Airplane and/or helicopter mass	Distance between FATO edge and Runway or Taxiway edges
Up to 3175 kg	60 m
Between 3172 kg and 5760 kg	120 m
Between 5760 kg and 100000 kg	180 m
100000 kg and over	250 m

Table 6: Minimum distance between FATO edge and runway/taxiway edge for SNI VMC operations[2]

Specifically referring to the location of the infrastructures for the heliports on an aerodrome, several previous studies have been launched in European research context (e.g. DGAC studies, etc.) and focused on this topic. First outcome to be considered showed that there is not obvious and available technical analysis behind the existing requirements published at ICAO and FAA level. Most probably in the future

[2] Please note that there is no obvious and available technical basis behind the existing requirements. These distances come from a qualitative analysis done by ICAO and further analysis have been performed in CleanSky framework in order to justify them.

different Working groups outcomes are going to be required to fully evaluate different impacts and perform a complete concatenation of the results.

New required Mode of Operations

The deployment of the simultaneous non-interfering operations between fixed-wing aircraft and rotorcraft under IFR, with the main scope not to interfere at all, neither the existing runway traffic nor the existing flight procedures for fixed-wing and at the same time reducing reliance on the weather conditions is the challenge which must be analysed during future research activities.

Regretfully, rotorcraft landing and lifting-off operations are out of the scope of the ICAO DOC 9643 which can be considered as the unique official and recognized documentation focused on the SNI operations concept and its characteristics.

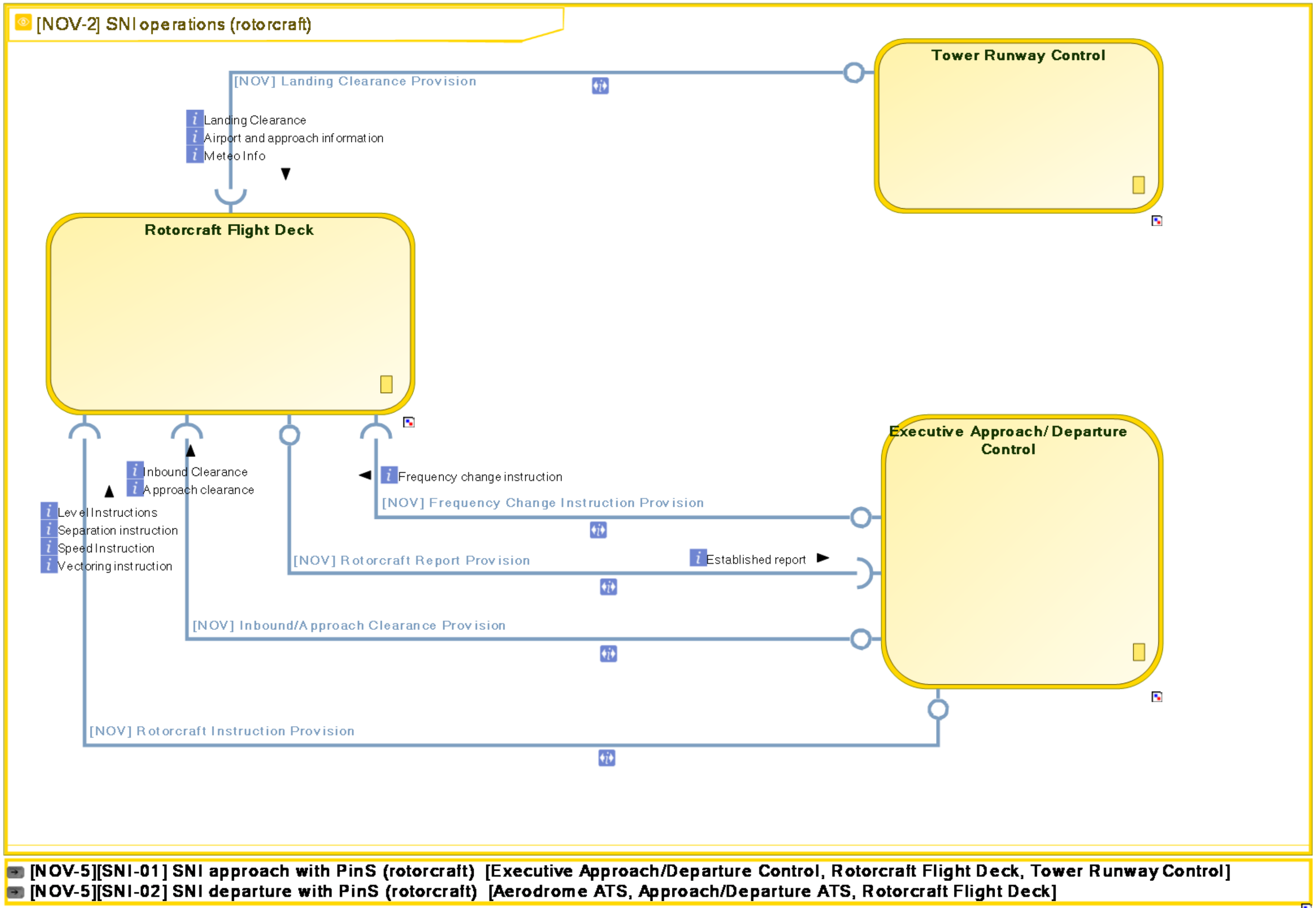
It could be useful to propose a **new Mode of Operation** to be added to the existing ones listed above (section § 3.3.1\ Point "1/Mode of Operations"), and already clearly analysed in the ICAO DOC 9643.

- 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.

Where the GNSS is the main technology proposed to support the navigation of rotorcraft in SNI operations. Specifically, GPS system such as SBAS (or GBAS where is possible) is mandatory to provide the vertical guidance.

The active runway has to be provided with (ILS) localizer course (or MLS track) to provide aircraft fixed-wing with the precision guidance in the final approach. In particular where the GBAS assistance for final approach is not available, the use of SBAS can be considerate for providing vertical guidance to fixed-wing traffic.

Below the NOV-2 diagram developed for the concerned Operational concept (SNI Operations for Rotorcraft



Click on http://webprisme.cfmu.eurocontrol.int/oneportal_working_validation/data/diagrams/EF17EFD65A9F4680 for zooming.

Use case	[NOV-5][SNI-01] SNI approach with PinS (rotorcraft)
Use case	[NOV-5][SNI-02] SNI departure with PinS (rotorcraft)

3.3.2.1.1 [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 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[3]:

- 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:

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

- 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
- 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:*

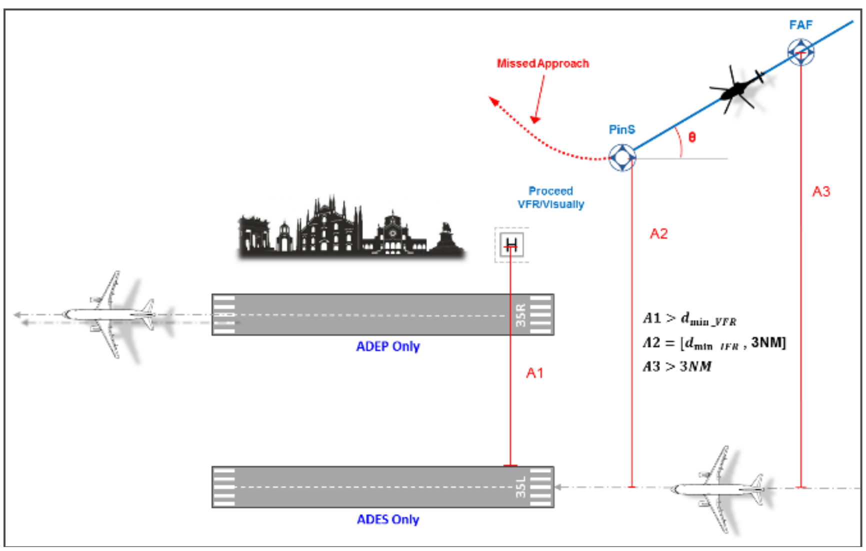


Figure 4: Case Study focused on Milano Malpensa Airport configuration (operative assumption)

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;
- **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 (Table 6);
- **d_{min}_IFR** is a reference parameter which takes the value of the minimum distance between parallel runways for independent parallel approaches (Table 6);

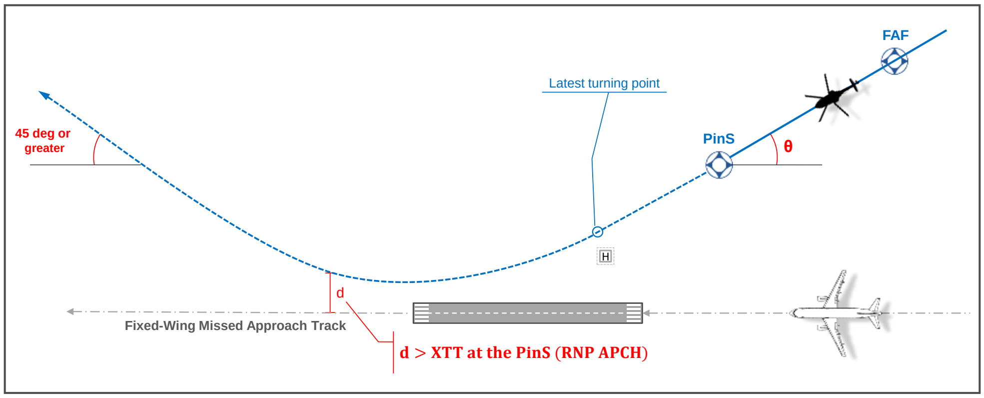


Figure 5: Missed Approach path. PinS convergent approach

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.

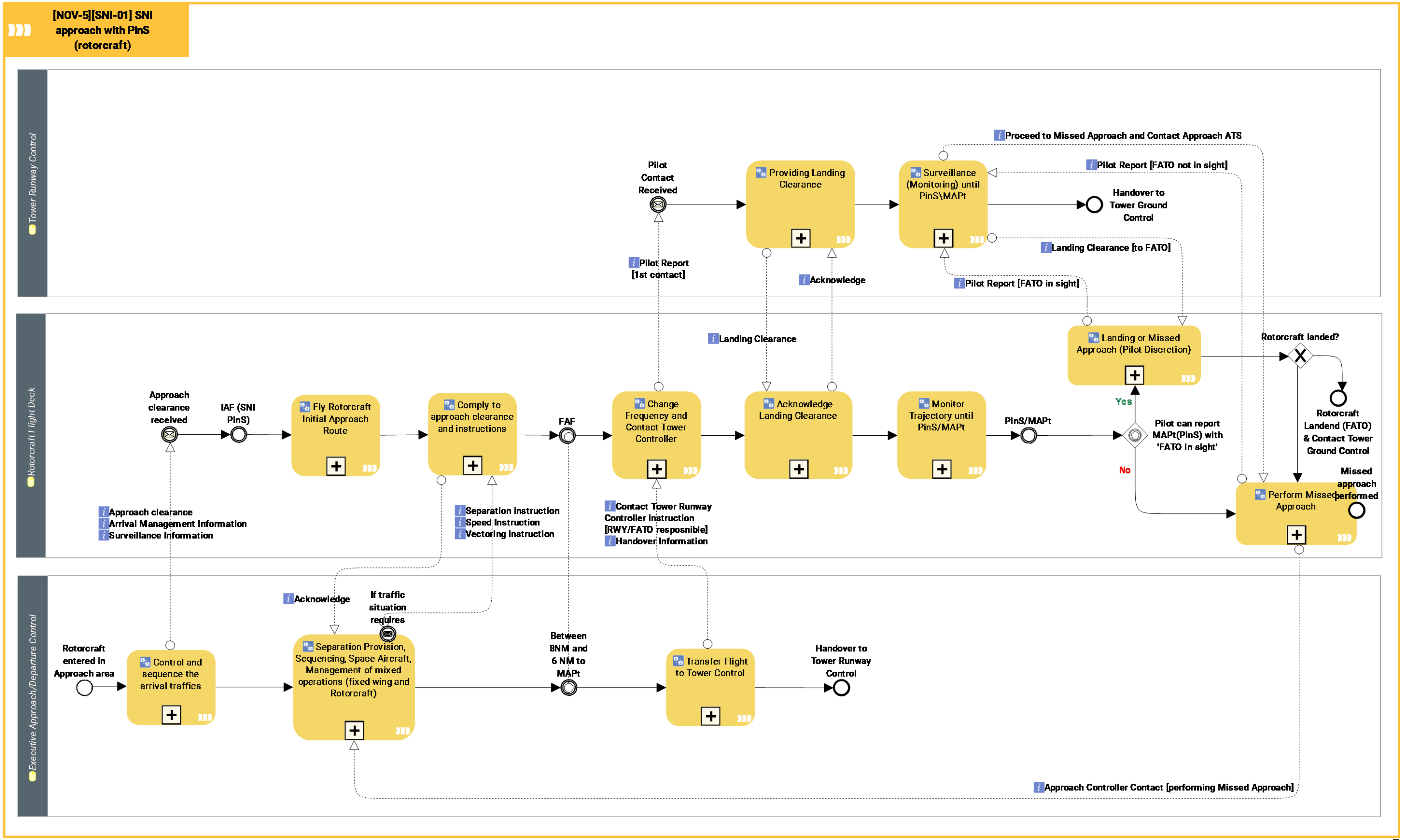
Post Condition

- **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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Activity	Description
Acknowledge Landing Clearance	The pilot acknowledges the landing clearance to the Tower Runway Controller.
Change Frequency and Contact Tower Controller	The pilot changes the frequency and contacts the Tower Runway Controller.
Comply to approach clearance and instructions	The pilot monitors the adherence of the rotorcraft to the RNP route whilst he/she is provided by the ATCO with additional information such separation, speed and vectoring if necessary.
Control and sequence the arrival traffics	Approach Controller, after receiving under his/her control the rotorcraft, gives the Approach Clearance. He/she monitors the inbound sequences to the airport which is made up of both traffic flows (fixed-wing and rotorcraft) direct to the active runway and FATO, respectively. As well, Approach Controller provides the flight crew with Info about the Delay (to the airport) and info about the other traffics performing approach to the airport concerned.
Fly Rotorcraft Initial Approach Route	The pilot conforms to the planned route (initial approach segments as published, including RF turns) or to the vectoring instructions provided by ATC during the approach initial segment. He monitors the approach initial segment for deviations from the planned trajectory, speed, altitude, and alerts ATC when excessive route deviation occurs. He informs the controller of a loss of GNSS or track keeping capability.
Landing or Missed Approach (Pilot Discretion)	For the helicopters, the final point of the IFR procedure that corresponds to the missed approach is the PinS/Mapt. After the PinS, the flight crew has the options to perform the approach using the "Proceed Visually" or "Proceed VFR" if clearly stated in the charts. Even if the Pilot can report "FATO in sight" at the PinS, he/she however can decide to land or start the missed approach procedure. This phase of flight is very depending on several factors which may interrupt landing such as Pilot's confidence, loss of navigation guidance, loss of integrity monitoring, failure of the ILS/GLS/LPV system, low altitude alert, etc.
Monitor Trajectory until PinS/MAPt	The pilot monitors the approach until PinS/MAPt, looking at the availability of guidance, adherence to guidance, navigation performance and alerts. If needed, he adjusts the trajectory and alerts the Tower Runway Controller of any issue with the LPV system that results in the loss of the approach capability.
Perform Missed Approach	The pilot executes and follows the missed approach as defined in the approach chart. The pilot will inform the controller of the go-around. The pilot monitors the missed approach and adjusts if needed the trajectory until above MSA (Minimum Safe Altitude). The final phase of the missed approach may include RF turns. If missed approach cannot be performed, the pilot executes a contingency procedure specific to the airport / approach.

Providing Landing Clearance	The Tower Runway Controller provides the landing clearance as well as the wind information while ensuring that the FATO is clear of traffic
Separation Provision, Sequencing, Space Aircraft, Management of mixed operations (fixed wing and Rotorcraft)	Approach Controller gives instructions (e.g. speed, altitude, etc.) and clearances in order to safely optimise both traffic flows (fixed-wing and rotorcraft) to the active runway and FATO, respectively. As well, the Approach Controller monitors/secures a safely separation between all the inbound traffic flows, providing the flight crews with Separation, Speed and Vectoring Instructions.
Surveillance (Monitoring)	The ATCO monitors the rotorcraft approach until PinS/Mapt, asking the pilot to report the ““FATO in sight””. If the Pilot can report ““FATO in sight””, the ATCO once received the pilot’s report, will release the ““Landing clearance to FATO””. The ATCO provides the landing clearance as well as the wind information while ensuring that the FATO is clear of traffic. Vice versa if the Pilot can’t report ““FATO in sight”” the ATCO instructs the Pilot to proceed to Missed approach procedure and contact Approach ATS (change frequency. The control tower controller transfers the rotorcraft to the approach controller frequency.
Transfer Flight to Tower Control	The Approach Controller transfers the Rotorcraft to the Tower Runway Controller frequency (e.g. provide the pilot with the info about the new frequency to be selected)

Issuer	Info Exchange	Addressee	Info Element	Info Entity
Executive Approach/Departure Control	If traffic situation requires o--> Comply to approach clearance and instructions	Rotorcraft Flight Deck	Vectoring instruction	OpenLoopInstruction
Executive Approach/Departure Control	If traffic situation requires o--> Comply to approach clearance and instructions	Rotorcraft Flight Deck	Separation instruction	ATCInstruction
Executive Approach/Departure Control	If traffic situation requires o--> Comply to approach clearance and instructions	Rotorcraft Flight Deck	Speed Instruction	IncreaseSpeedToSpeed

Issuer	Info Exchange	Addressee	Info Element	Info Entity
Executive Approach/Departure Control	If traffic situation requires o--> Comply to approach clearance and instructions	Rotorcraft Flight Deck	Speed Instruction	ReduceSpeedToSpeed
Executive Approach/Departure Control	If traffic situation requires o--> Comply to approach clearance and instructions	Rotorcraft Flight Deck	Speed Instruction	SpeedConstraint
Rotorcraft Flight Deck	Comply to approach clearance and instructions o--> Separation Provision, Sequencing, Space Aircraft, Management of mixed operations (fixed wing and Rotorcraft)	Executive Approach/Departure Control	Acknowledge	AIRM_OutOfScope
Rotorcraft Flight Deck	Change Frequency and Contact Tower Controller o--> Pilot Contact Received	Tower Runway Control	Pilot Report	AIRM_Change_Request
Tower Runway Control	Surveillance (Monitoring) o--> Landing or Missed Approach (Pilot Discretion)	Rotorcraft Flight Deck	Landing Clearance	LandingClearance
Tower Runway Control	Surveillance (Monitoring) o--> Perform Missed Approach	Rotorcraft Flight Deck	Proceed to Missed Approach and Contact Approach ATS	AIRM_Change_Request
Tower Runway Control	Surveillance (Monitoring) o--> Perform Missed Approach	Rotorcraft Flight Deck	Proceed to Missed Approach and Contact Approach ATS	MISSED_APPROACH

Issuer	Info Exchange	Addressee	Info Element	Info Entity
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck		
Rotorcraft Flight Deck	Perform Missed Approach o--> Surveillance (Monitoring)	Tower Runway Control	Pilot Report	AIRM_Change_Request
Rotorcraft Flight Deck	Landing or Missed Approach (Pilot Discretion) o--> Surveillance (Monitoring)	Tower Runway Control		
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	CTAInstruction
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	AircraftPerformance
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	TrajectoryPrediction
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	AMANGroundDelayAdvisory
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	AMANProcedureAdvisory

Issuer	Info Exchange	Addressee	Info Element	Info Entity
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	AMANRouteAdvisory
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	AMANSpeedAdvisory
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	ApproachSequence
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	LandingSequence
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	TimeToGainOrLose
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	EstimatedLandingTime
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	OverMeteringFix
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	AircraftIdentification

Issuer	Info Exchange	Addressee	Info Element	Info Entity
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	AircraftIntegratedConstraint
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Arrival Management Information	PlannedRoute
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Approach clearance	ApproachClearance
Executive Approach/Departure Control	Control and sequence the arrival traffics o--> Approach clearance received	Rotorcraft Flight Deck	Surveillance Information	
Executive Approach/Departure Control	Transfer Flight to Tower Control o--> Change Frequency and Contact Tower Controller	Rotorcraft Flight Deck	Handover Information	
Executive Approach/Departure Control	Transfer Flight to Tower Control o--> Change Frequency and Contact Tower Controller	Rotorcraft Flight Deck	Contact Tower Runway Controller instruction	FrequencyChangeInstruction
Rotorcraft Flight Deck	Perform Missed Approach o--> Separation Provision, Sequencing, Space Aircraft, Management of mixed operations (fixed wing and Rotorcraft)	Executive Approach/Departure Control	Approach Controller Contact	AIRM_OutOfScope

Issuer	Info Exchange	Addressee	Info Element	Info Entity
Rotorcraft Flight Deck	Landing or Missed Approach (Pilot Discretion) o--> Surveillance (Monitoring)	Tower Runway Control	Pilot Report	AIRM_Change_Request
Executive Approach/Departure Control	Handover Information Provision o--> Change Frequency and Contact Tower Controller	Rotorcraft Flight Deck	Contact Tower Runway Controller instruction	FrequencyChangeInstruction
Tower Runway Control	Providing Landing Clearance o--> Acknowledge Landing Clearance	Rotorcraft Flight Deck	Landing Clearance	LandingClearance
Rotorcraft Flight Deck	Acknowledge Landing Clearance o--> Providing Landing Clearance	Tower Runway Control	Acknowledge	AIRM_OutOfScope
Tower Runway Control	Providing Landing Clearance o--> Acknowledge Landing Clearance	Rotorcraft Flight Deck	Info (e.g. Delay, Meteo)	
Tower Runway Control	Providing Landing Clearance o--> Acknowledge Landing Clearance	Rotorcraft Flight Deck	Info about other traffic performing approach	

3.3.2.1.2 [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:

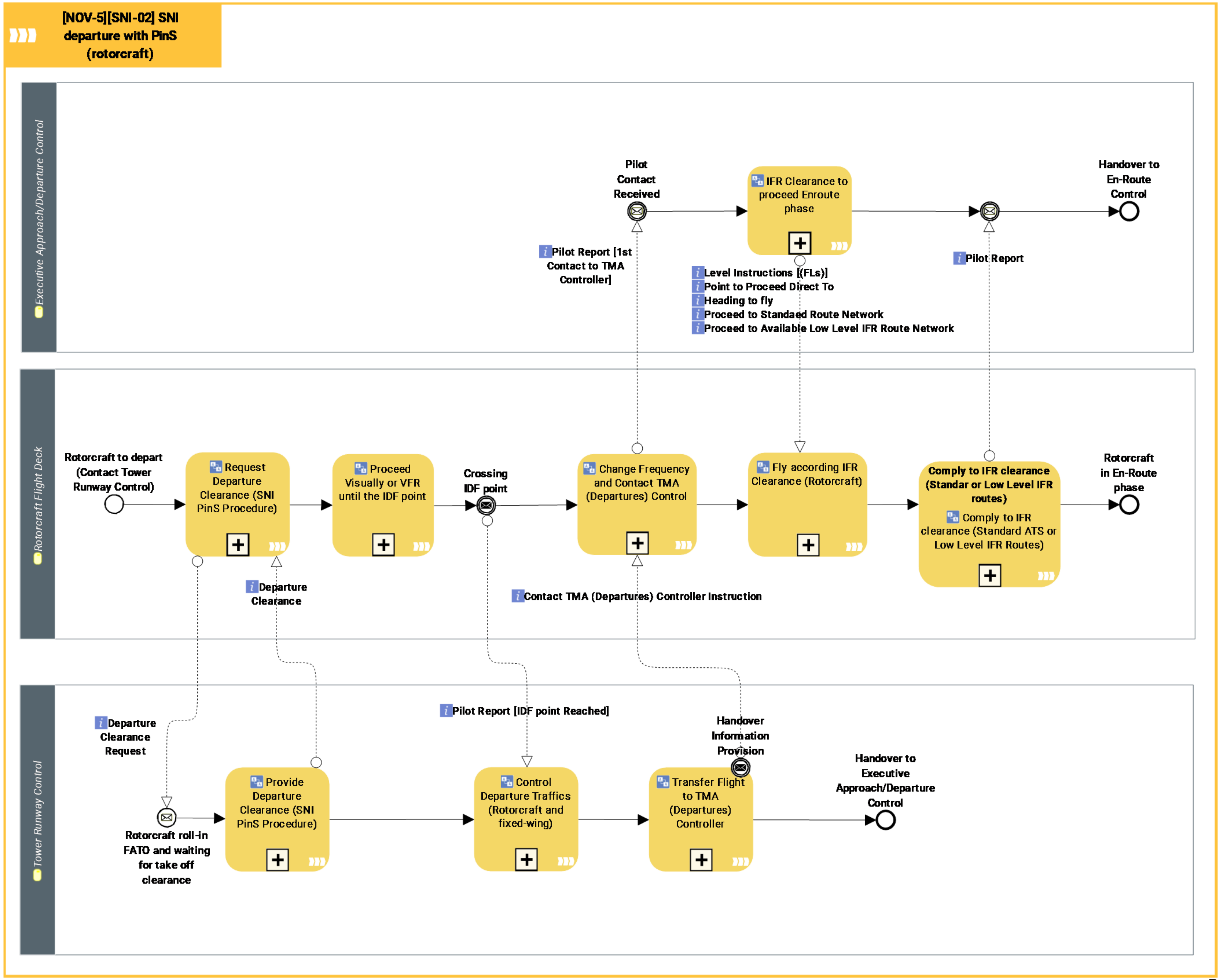
- The helicopter departs and is flown visually to cross the IDF at or above the IDF minimum crossing altitude (MCA) and join a route originating from the IDF;

- 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.



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Activity	Description
Change Frequency and Contact TMA (Departures) Control	The pilot changes the frequency and contacts the TMA (Departures) Controller.
Comply to IFR clearance (Standard or Low Level IFR routes)	The pilot monitors the adherence of the rotorcraft to the RNP route whilst he/she is provided by the ATCO with additional information such Flight Levels (FLs), points to proceed "direct to", headings to fly, or to proceed to a specific point of a Standard ATS route or preferably, along dedicated Low Level IFR route.
Control Departure Traffics (Rotorcraft and fixed-wing)	Tower Runway Controller in coordination with the Departure Manager (TMA Arrivals/Departures sectors) , monitors the departure traffic from the airport which is made up of both traffic flows (fixed-wing and rotorcraft) from the active runway and FATO, respectively.
Fly according IFR Clearance (Rotorcraft)	After IDF (PinS departure) point, the rotorcraft will fly the next departure segment till the en-route phase according to the IFR clearance, respecting the Performance Navigation requirements requested in each segment. The En-Route phase might take place in the standard route network, or preferably, along dedicated Low Level IFR routes.
IFR Clearance to proceed Enroute phase	Executive Approach/Departure Controller (TMA), provides Rotorcraft Flight Crew with further clearances in terms of: · Flight Levels (FLs); · points to proceed "direct to"; · headings to fly; · or to proceed to Standard ATS route network, or preferably, along dedicated Low Level IFR route.
Proceed Visually or VFR until the IDF point	This phase of the flight is related to that segment of the PinS departure from the landing location (FATO) to the IDF, for a PinS ""proceed visually"" or "Proceed VFR" procedures. The difference between the two ways is that the "Proceed visually" is however an instrumental part of the procedure (VFR conditions are not required) whilst with "Proceed VFR" the respect of the VMC conditions are mandatory to fly.
Provide Departure Clearance (SNI PinS Procedure)	The controller, accordingly, to submitted flight plan, provides the departure clearance and clears the Rotorcraft flight crew to join the IFR IDF point (prior having flown an initial departure segment with a "Proceed Visually or "Proceed VFR" following VFR rules).
Request Departure Clearance (SNI PinS Procedure)	The Rotorcraft crew requests departure clearance and relative instruction, accordingly to the Flight plan.
Transfer Flight to TMA (Departures) Controller	The Tower Runway Controller transfers the Rotorcraft to the Executive Arrivals/Departures (TMA) Controller in coordination with the Departure Manager frequency (e.g. provide the pilot with the info about the new frequency to be selected)

Issuer	Info Exchange	Addressee	Info Element	Info Entity
Rotorcraft Flight Deck	Request Departure Clearance (SNI PinS Procedure) o--> Rotorcraft roll-in FATO and waiting for take off clearance	Aerodrome ATS	Departure Clearance Request	PilotRequest
Rotorcraft Flight Deck	Request Departure Clearance (SNI PinS Procedure) o--> Rotorcraft roll-in FATO and waiting for take off clearance	Aerodrome ATS	Departure Clearance Request	DepartureClearance
Aerodrome ATS	Provide Departure Clearance (SNI PinS Procedure) o--> Request Departure Clearance (SNI PinS Procedure)	Rotorcraft Flight Deck	Departure Clearance	
Aerodrome ATS	Provide Departure Clearance (SNI PinS Procedure) o--> Request Departure Clearance (SNI PinS Procedure)	Rotorcraft Flight Deck	Departure Clearance	DepartureClearance
Approach/Departure ATS	IFR Clearance to proceed Enroute phase o--> Fly according IFR Clearance (Rotorcraft)	Rotorcraft Flight Deck	Level Instructions	
Approach/Departure ATS	IFR Clearance to proceed Enroute phase o--> Fly according IFR Clearance (Rotorcraft)	Rotorcraft Flight Deck	Point to Proceed Direct To	
Approach/Departure ATS	IFR Clearance to proceed Enroute phase o--> Fly according IFR Clearance (Rotorcraft)	Rotorcraft Flight Deck	Heading to fly	

Issuer	Info Exchange	Addressee	Info Element	Info Entity
Approach/Departure ATS	IFR Clearance to proceed Enroute phase o--> Fly according IFR Clearance (Rotorcraft)	Rotorcraft Flight Deck	Proceed to Standaed Route Network	
Approach/Departure ATS	IFR Clearance to proceed Enroute phase o--> Fly according IFR Clearance (Rotorcraft)	Rotorcraft Flight Deck	Proceed to Available Low Level IFR Route Network	
Rotorcraft Flight Deck	Comply to IFR clearance (Standar or Low Level IFR routes) o--> Catching	Approach/Departure ATS	Pilot Report	
Rotorcraft Flight Deck	Change Frequency and Contact TMA (Departures) Control o--> Pilot Contact Received	Approach/Departure ATS	Pilot Report	AIRM_Change_Request
Rotorcraft Flight Deck	Crossing IDF point o--> Control Departure Traffics (Rotorcraft and fixed-wing)	Aerodrome ATS	Pilot Report	AIRM_Change_Request
Aerodrome ATS	Handover Information Provision o--> Change Frequency and Contact TMA (Departures) Control	Rotorcraft Flight Deck	Contact TMA (Departures) Controller Instruction	
Aerodrome ATS	Request Departure Clearance (SNI PinS Procedure) o--> Provide Departure Clearance (SNI PinS Procedure)	Rotorcraft Flight Deck	Departure Clearance Request	

Issuer	Info Exchange	Addressee	Info Element	Info Entity
Aerodrome ATS	Request Departure Clearance (SNI PinS Procedure) o--> Provide Departure Clearance (SNI PinS Procedure)	Rotorcraft Flight Deck	Departure Clearance Request	
Rotorcraft Flight Deck	Rotorcraft Flight Deck o--> Control Departure Traffics (Rotorcraft and fixed-wing)	Aerodrome ATS		

3.3.3 Differences between new and previous Operating Methods

OI Step code – title (OI Step CR)		
AO-0316 - Increased Airport Performance through Independent (parallel or convergent) IFR Rotorcraft Operations (CR 03260 Update AO-0316 list of EN (PJ02-05))		
Activity	Impact	Change
Comply to approach clearance and instructions	Update	Rotorcraft flight crew complies to approach clearance and instructions. [PinS Operations executions]
Comply to IFR clearance (Standard ATS or Low Level IFR Routes)	Introduce	Rotorcraft complies to IFR clearance (Standard ATS or Low Level IFR Routes). The Low Level IFR Routes (LLR) concept was addressed in SESAR 1 Project and it was deployed as Solution#113. The "Optimised Low Level IFR routes for rotorcraft" consist of a series of innovative IFR routes at very low flight level (between 2500 - 7000 ft) and based on GNSS (SBAS/EGNOS) technology, using an enhanced Required Navigation Performance (RNP 1.0 / 0.3) that allow an optimized use of the airspace within High dense/complex TMA - Terminal Manoeuvring Area (e.g. Milan TMA). The LLR routes support the links form FATOs located at different airports without impacting the traditional ATS routes but, above all, without the need to reach elevate FLs where the rotorcraft is not used to fly (e.g. no pressurized cabin for a rotorcraft)
Control and sequence the arrival traffics	Introduce	This Activity was introduced to take into consideration those cases where the new SNI PinS procedures were implemented; The Approach/Departure Control should have to monitor both operations: the IFR Rotorcraft simultaneous operations towards the FATO located at airport (e.g. PinS approach) and the inbound fixed-wing traffic to the active runway.

OI Step code – title (OI Step CR)		
AO-0316 - Increased Airport Performance through Independent (parallel or convergent) IFR Rotorcraft Operations (CR 03260 Update AO-0316 list of EN (PJ02-05))		
Activity	**Impact**	**Change**
Control Departure Traffics (Rotorcraft and fixed-wing)	Introduce	The Tower Runway Control shall monitor both departing traffic (Rotorcraft from FATO and fixed-wing from the active runway). Specifically, the Tower Runway Control shall monitor the rotorcraft form the FATO to the Initial Departure FIx (IDF point) where the pilot should be instructed to change the frequency and contact the Arrival/Departure Control.
Fly according IFR Clearance (Rotorcraft)	Introduce	The Pilot passed the IDF point of the SNI PinS IFR departure procedure and thus he will be under the IFR rules towards the first en-route point (Standard ATS or Low Level IFR Routes)
Fly Rotorcraft Initial Approach Route	Update	The Activity is now referred to the Rotorcraft as well and not only to fixed-wing traffic. In details, the activity is referred to the Rotorcraft traffic inbound a FATO located in a congested airport.
Landing or Missed Approach (Pilot Discretion)	Introduce	For the Point-In-Space IFR rotorcraft procedures, the final point of the IFR procedure (PinS) usually corresponds to the missed approach point (Mapt). After the PinS, it will be at the Pilot's discretion to evaluate if there are the conditions to proceed for landing at the FATO or ask for the Missed Approach Procedure. To this scope, The Pilot must confirm to the ATCO (Tower Runway Control) that the ""FATO is in sight"" before receiving the Landing Clearance. If the FATO is ""not in sight"" the Pilot must communicate it to the Tower Runway Control, which will instruct the Pilot to proceed for the Missed Approach procedure.
Monitor Trajectory until PinS/MAPt	Introduce	The Pilot, looking at the availability of guidance, adherence to guidance, navigation performance and alerts, shall monitor the approach until PinS/MAPt (the PinS usually correspond to Missed approach point MapT), keeping informed the ATCO about the position of rotorcraft in respect of PinS waypoint. Thus, the Pilot should have to secure the ATCO that the Rotorcraft flown trajectory complies to the procedure cleared by the ATCO and, in proximity of the PinS/MapT WPT, communicate to the ATCO if there are the conditions for landing at the FATO or if it's necessary to asking for the Missed Approach procedure.
Provide Departure Clearance (SNI PinS Procedure)	Introduce	The ATCO provides the Rotorcraft Pilot with Departure clearance for the SNI PinS IFR departure procedure. The clearance is for the DEP PinS, departing from the FATO to the IDF waypoint, cleared to proceed as "Proceed Visually" and report the position when the rotorcraft is overflying the IDF point
Request Departure Clearance (SNI PinS Procedure)	Introduce	The Pilot ask to the Tower Runway Control for the clearance to depart form the FATO and use the SNI PinS IFR departure procedure.

OI Step code – title (OI Step CR)		
AO-0316 - Increased Airport Performance through Independent (parallel or convergent) IFR Rotorcraft Operations (CR 03260 Update AO-0316 list of EN (PJ02-05))		
Activity	Impact	Change
Separation Provision, Sequencing, Space Aircraft, Management of mixed operations (fixed wing and Rotorcraft)	Introduce	The Approach/Departure Executive Controller shall provide the Pilot with Separation, Speed, Vectoring Instructions and all the necessary info concerning the airport traffic situation. The ATCO shall continue monitoring both traffic (Rotorcraft and fixed-wing) in order to manage safely the traffics the airport, supposed as a unique system (made up runways and FATOs)
Surveillance (Monitoring) until PinS\MAPt	Introduce	The ATCO monitors the rotorcraft approach until PinS/Mapt, asking the pilot to report the "FATO in sight". If the Pilot confirm that FATO is in sight he/she can decide to continue landing to the FATO or proceed to the Missed Approach procedure.

Table 7: Differences between new and previous Operating Methods

Theoretical studies and practical examples indicated that maximum aerodrome capacities can be achieved by using parallel runways in a mixed mode of operation. In many cases, however, other factors such as the landside/air-side infrastructure, the mix of aircraft types, and environmental considerations result in a lower achievable capacity.

The decision to implement simultaneous operations at a particular location (between Runway and FATO) should take into account a series of influencing factors as well as other constraints (e.g. environmental impact):

ATM aspects:

- ATM separation standards: lateral distance between nominal trajectory of rotorcraft procedure and the runway axis before reaching the Final Approach Point must be considered;
- Radar monitoring: the radar monitoring is mandatory for SNI fixed-wing operations;
- Radar vectoring: the radar vectoring is usually used for independent parallel approach in order to intercept the ILS localizer frequency (usually with an angle not exceeding 30° degrees. On the other hand, the ATCO won't have to provide radar vectors to rotorcraft traffic unless the lateral spacing becomes lower than 3 nautical miles and the vertical separation minima of 1000 ft is not met.

Heliport Layout:

- FATO Characteristics: the FATO characteristics don't affect the type of operations used IFR/VFR, as they depend on the mass and performance class of the rotorcraft. Nevertheless, the availability of new IFR FATO Family will guarantee the possibility to design a fully IFR rotorcraft procedure instead of an hybrid like a Point In Space;
- Approach lighting system: the availability of a suitable approaching lighting system can surely improve the level of safety of the operations, but it can be considered as not mandatory;

- Procedure design considerations: several factors can influence the designing of the rotorcraft procedures (e.g. maximum glide path, visual segment flexibility after DA/H. etc), however the operating minima intended to be used should be well analysed specifically referring to the case concerning the single runway and FATO operations;
- Weather reliance: in case that PinS procedures are intended to be used, it's necessary to identify the minimum weather conditions which guarantee an acceptable safety level for the operations;
- Compliance with ICAO documentation: all procedures should be designed in accordance with ICAO DOC 8168 at least.

Taking into consideration the above factors, between all possible procedures, conceived for allowing the SNI operations between rotorcraft and fixed-wing airplane, the use of PinS approaches and departure procedures are the preferred solution instead of the conventional CAT H direct approaches to main runways:

- PinS parallel Approach
- PinS Convergent Approach

The PinS (SNI) approach and departure procedures represent today the best operational solution that allow the introducing of rotorcraft into busy airports (or in remote area) where heliports (existing VFR FATO or future IFR FATO generation) is located, considering positively that:

- these procedures facilitate the rotorcraft access at airports (and remote sites);
- the heliports are not always equipped in terms of ground navigation aids;
- flying new IFR / SNI procedures with RNP1.0/0.3 navigation capabilities allows to stay within narrow and well-defined horizontal airspace limits;
- flying new PinS LPV with Vertical Guidance (Localizer Performance with “vertical Guidance”) allow to have an “ILS alike” approach in terms of flyability, even where the ILS ground infrastructure is not available;
- flying shorter approaches compared to the standard ones will result in time and /or fuel saving;
- removing “slow traffic” form runway approaches allows easier separation between aircraft and rotorcraft (including wake vortex separation);
- these kinds of procedures offer the opportunity to reduce the environmental impact at airports, allowing the creation of an environment - friendly rotorcraft procedures;
- the concept adds movements without contributing to the runway congestion, so paving the way for the development of passenger transport with an improved speed profile and airport capacity
- these enhanced approach/departure procedures can really contribute to easing, the HEMS operations in particular when VMC conditions are not met;
- less VFR approaches conducted in marginal VMC.

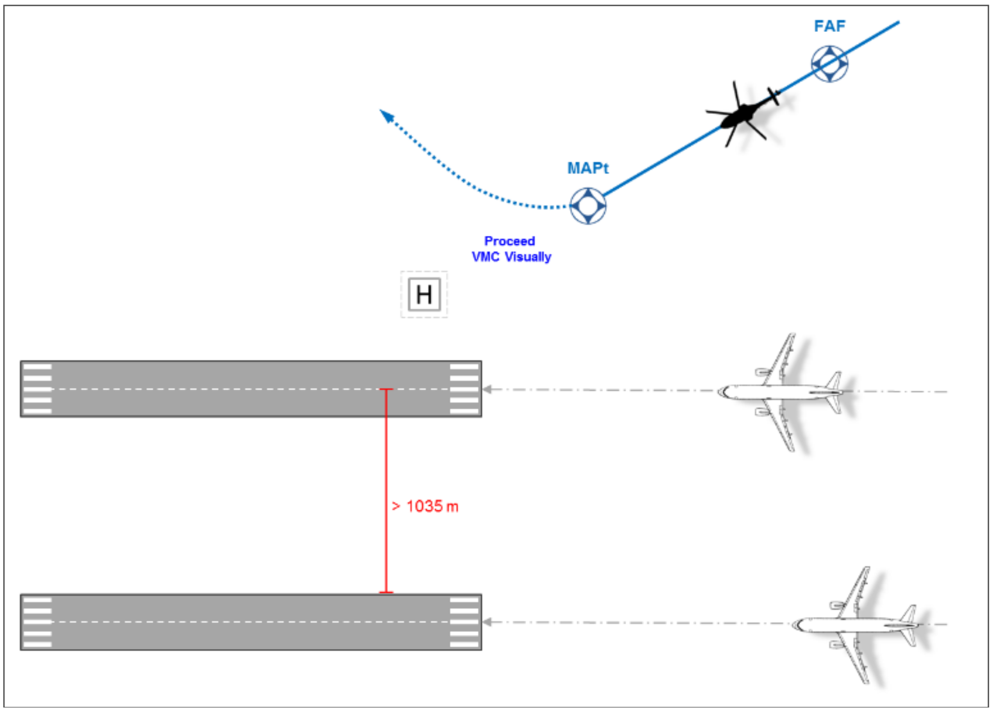

Figure 6: PinS procedures allow the introduction of RC into busy airports

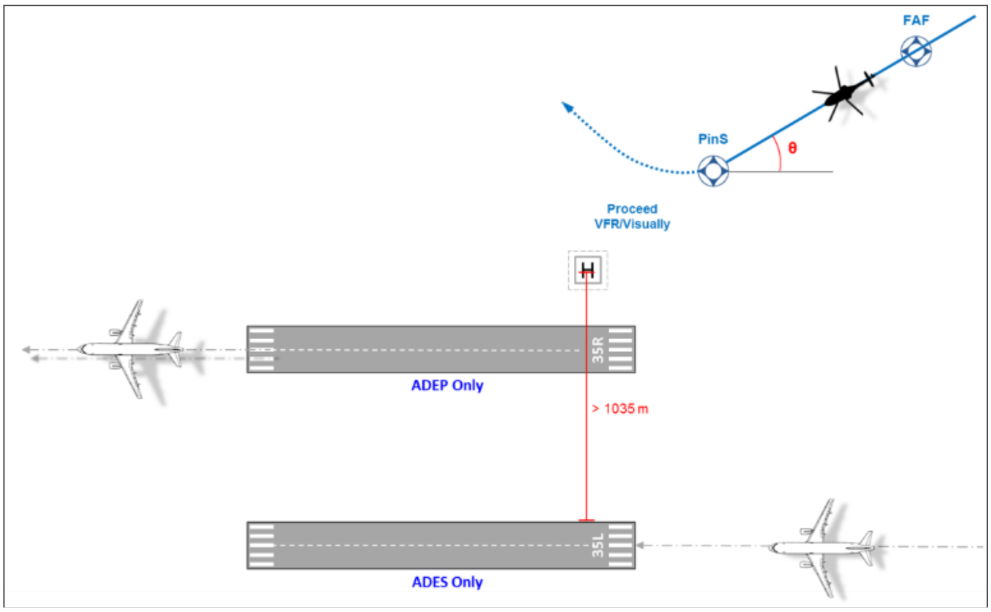

Figure 7: Example of PinS SNI in a busy airport as Milano Malpensa (PJ.02-05 UC)

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

4.1 Solution 02-05 Requirements

[REQ]

Identifier	REQ-02.05-SPRINTEROP-ALPV.0010
Title	APV concept procedure design criteria
Requirement	The construction of the Approach procedure with vertical guidance (APV) procedures shall respect the guidance given by PANS OPS 8168 volume II
Status	<Validated>
Rationale	To cope with current procedure design and ease the widespread use of the concept, and to prevent loss of separation with obstacles, terrain or other departing or arriving rotorcrafts.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0020

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) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0030
Title	Rotorcraft Display Capability
Requirement	Any means of navigation display shall be installed in order to display to the pilots, the actual navigation sources used, the active waypoint, velocity, time, distance and bearing to the active waypoint (IAF, IF, FAF) during PinS APCH procedure.
Status	<Validated>

Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0040
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) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0050
Title	Rotorcraft FMS Capabilities
Requirement	The functions and capabilities to execute path terminator 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) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0060
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) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0070
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) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0090
Title	Rotorcraft crew GNSS/SBAS monitoring Capabilities
Requirement	The crew on board shall be able to elaborate trough Avionic data an absolute aircraft position based on SBAS system
Status	<Validated>
Rationale	This is a rotorcraft operational required functionality required to Crew duties to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0110
Title	Rotorcraft crew FMS usage and Capabilities
Requirement	To perform an RNAV-GNSS approach (with LPV minima), the pilot shall monitor and compute angular deviations (ILS-Look-Alike) trough FMS system.
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0120
Title	Rotorcraft crew FMS usage and Capabilities

Requirement	When flying an RNAV-GNSS approach (with LNAV or LPV minima) associated to a missed approach procedure coded in the Navigation Database, when pilot engages 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 crew required operational functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0130
Title	Rotorcraft Crew Navigation Database Capabilities
Requirement	The pilot shall be able to retrieve and store in the system the precision RNAV-GNSS approach procedure (with LNAV or LPV minima) definitions, in the standard navigation database.
Status	<Validated>

Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0140
Title	Particularly, the procedure and relevant FAS data block shall be retrieved from FMS navigation database
Requirement	The Navigation function shall be able to manage the RNAV-GNSS approach procedure (with LNAV or LNAV/VNAV or LPV minima) and associated data.
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0150
Title	Rotorcraft FMS Capabilities
Requirement	The Navigation function shall allow the crew to select the RNAV-GNSS 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) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0160
Title	Rotorcraft Navigation Database Capabilities
Requirement	The system shall store the FAS Datablock with its relevant CRC for each RNAV GPS Approach procedure with LPV minima.
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0170
Title	Rotorcraft FMS Capabilities
Requirement	The Navigation function shall update the flight plan after inserting the selected RNAV-GNSS approach procedure
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0180
Title	Rotorcraft FMS Capabilities
Requirement	The FMS database will follow the RTCA/DO 200A process to format the ARINC 424 database, supplied by the provider, into the FMS proprietary Format, which shall include the FAS DB.
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0190
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) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0200
Title	Rotorcraft FMS Capabilities
Requirement	The function shall provide feedback to the crew on PFD that RNAV GNSS approach procedure (with LNAV or LPV minima) has been properly selected and validated [RNAV-GNSS approach procedure with LPV minima is initially validated through CRC check]
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0210
Title	Rotorcraft FMS Capabilities
Requirement	The function shall inform the crew about RNAV-GNSS approach procedure (with LNAV, LNAV/VNAV or LPV minima) engagement status before FAP.
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
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<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0220
Title	Rotorcraft FMS Capabilities
Requirement	The function shall allow the crew to select the RNAV-GNSS approach procedure (with LNAV, LNAV/VNAV or LPV minima).
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0230
Title	Rotorcraft GNSS/SBAS Capabilities
Requirement	GNSS-SBAS equipment shall be compliant with the functional, operational and performance requirements defined by the TSO C145c Class Beta3
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0240
Title	Rotorcraft FMS Capabilities
Requirement	The Navigation function shall calculate the Distance to MAPt
Status	<Validated>
Rationale	This is a rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0250
Title	Rotorcraft crew FMS monitor Capabilities
Requirement	When an RNAV-GNSS approach (with LNAV or LPV minima) is selected in the flight plan, the pilot shall be informed by thesystem about any loss of integrity/navigation of the LNAV or LPV capability on the pilot primary field of view during the TERMINAL and APPROACH flight phase.
Status	<Validated>
Rationale	This is a crew rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0260
Title	Rotorcraft crew Display Capabilities
Requirement	When an RNAV-GNSS approach (with LNAV or LPV minima) has been selected, the pilot shall be informed through the system displays about the course to the final LPV approach segment.
Status	<Validated>
Rationale	This is a crew rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0270
Title	Rotorcraft crew Display Capabilities
Requirement	When performing an RNAV-GNSS approach (with LPV minima), the pilot shall be informed through the system on lateral and vertical angular scales.
Status	<Validated>
Rationale	This is a crew rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0280
Title	Rotorcraft Navigation Capabilities
Requirement	When pilot engages the missed approach while on a RF leg, the crew shall be able to fly the RF leg as the active leg trough the FMS system
Status	<Validated>
Rationale	This is a crew rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0290
Title	Rotorcraft crew Flight Control System Capabilities
Requirement	When initiating the missed approach, pilots and crew has to monitor that the FCS shall remain in LNAV mode or automatically engage the LNAV mode; if the LNAV mode is not kept or automatically engaged, the FCS shall allow to pilot the engagement of LNAV mode
Status	<Validated>
Rationale	This is a crew rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0300
Title	Rotorcraft Missed Approach requirements Capabilities
Requirement	Based on the performance requirements for the RNP missed approach; pilot and crew shall reliable to the system in such way : - The lateral TSE shall be within ± the RNP value (1, 0.5 or 0.3 less than 1 NM) for at least 95 percent of the total flight time; - The along-track error shall also be within ± the RNP value for at least 95 percent of the total flight time; - FTE should not exceed half the RNP value (0.5, or 0.25 or 0.15 NM); - An alert shall be activated if the accuracy requirement is not met or if the probability that the lateral TSE exceeds twice the RNP value (2, 1 or 0.6 NM) is greater than 10-5.
Status	<Validated>
Rationale	This is a crew HMI rotorcraft required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.0310
Title	Rotorcraft FMS requirements Capabilities
Requirement	When flying RNAV procedure with LPV minima, pilot shall have the monitoring of vertical guidance based on vertical deviations computed by the GNSS receiver
Status	<Validated>
Rationale	This is a rotorcraft HMI required functionality to support APV operations (departure and approach) whether they are Independent or not
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed ApproachN/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0320
Title	Safety requirement for PinS SNI procedure
Requirement	The occurrence of an SBAS system failure during the approach shall not compromise flight safety
Status	<Validated>
Rationale	In case of an SBAS failure the flight safety is not compromised provided that a back-up/lower precision approach procedure was provided
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0330
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.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0340
Title	APV Display capable in case of GNSS failures
Requirement	The function shall inform the crew in case of GNSS signal integrity loss through PFD.
Status	<Validated>
Rationale	This requirement is derived from the SPR level model of the APV system
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0350
Title	APV FMS capability in case of GNSS/Signal failures
Requirement	In case of loss of signal integrity, the Navigation function shall allow the crew to select an alternative approach procedure or to start a missed approach procedure.
Status	<Validated>
Rationale	This requirement is derived from the SPR level model of the APV system.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0360
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 in case of SBAS level of service unavailability
Status	<Validated>
Rationale	This requirement is derived from the SPR level model of the APV system.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0370
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, 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.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0380
Title	APV FMS go –around capability in case of GNSS/SBAS failures
Requirement	The Guidance function shall use its sensors to provide the guidance functionality with accuracy, integrity, continuity and availability compliant with APV requirements.
Status	<Validated>
Rationale	The Guidance function shall use its sensors to provide the guidance functionality with accuracy, integrity, continuity and availability compliant with APV requirements.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0390
Title	Flight crew APV Arrival/Approach and Departure Procedure
Requirement	Flight crew shall select the APV arrival/approach or departure procedure to be flown from the rotorcraft FMS (the procedure being extracted from the NAV database system), including transition from RNP (with or without VNAV) to LPV guidance mode, based on compliance and certification with EASA AMC 20-27 and 20-28.
Status	<Validated>
Rationale	Flight crew shall select the APV arrival/approach or departure procedure to be flown from the rotorcraft FMS (the procedure being extracted from the NAV database system), including transition from RNP (with or without VNAV) to LPV guidance mode, based on compliance and certification with EASA AMC 20-27 and 20-28.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0400
Title	Display Operation data to Flight Crew
Requirement	The APV operations data from the NAV database system shall be displayed to the flight crew, including degraded modes, in accordance with the published procedure (they are RNAV flight path and associated data –e.g. constraint-, timely display, combined RNP 0.3/1NM segments, change from the RNP segment to the LPV segment, missed approach and LPV approach data –e.g. ident, channel…) based on compliance and certification with EASA AMC 20-27 and AMC 20-28.
Status	<Validated>
Rationale	This requirement is derived from the SPR-level model of the-APV systems
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0410
Title	NOTAM for Degradation of SBAS System from AIS Service Provider
Requirement	SBAS Service Provider shall inform the NAV Service Provider on a foreseen degradation of the SBAS system performance by providing a NOTAM in accordance with ICAO Annex 15., in order to preventable inform Flight crew on board or before the flight initiation.
Status	<Validated>
Rationale	This requirement is derived from the SPR-level model of the-APV systems
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0420
Title	Final Approach Segment Data Block Data Provision
Requirement	The Final Approach Segment Data Block (FAS DB) description (including the CRC) shall be provided by the ANS Provider for navigation database coding in compliance with the aeronautical data quality requirements of ICAO Annex 10, ICAO Doc 9613 (PBN Manual) and ICAO Doc 8168 volume II
Status	<Validated>
Rationale	The Final Approach Segment Data Block (FAS DB) description (including the CRC) shall be provided by the ANS Provider for navigation database coding in compliance with the aeronautical data quality requirements of ICAO Annex 10, ICAO Doc 9613 (PBN Manual) and ICAO Doc 8168 volume II
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0430
Title	Design of the airspace concept
Requirement	The airspace concept shall be designed with respect to the guidance given by PANS OPS 8168 volume II and ICAO Doc 9613 (PBN Manual).
Status	<Validated>
Rationale	This requirement is derived from the SPR-level model of the ADV-APV systems
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0440
Title	On board Cross-check procedure selection
Requirement	Flight crew (Pilots) shall verify and ensure that the correct approach or departure has been selected before undertaking the -PINS procedure.
Status	<Validated>
Rationale	This safety requirement was identified as to ensure the procedure selection by flight crew does not introduce an unacceptable level of risk
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0450
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>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.A460
Title	Operational conditions to perform rotorcraft operations
Requirement	In case of operational conditions different from ones taken as reference, rotorcraft operations shall be suspended giving priority to normal operations.
Status	<Validated>
Rationale	This requirement is derived from Safety Assessment performed by Italian Air Navigation provider and approved by Regulator.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.B460
Title	Operational conditions to perform rotorcraft operations
Requirement	Rotorcraft operations shall be resumed when operational conditions abovementioned are restored.
Status	<Validated>
Rationale	This requirement is derived from Safety Assessment performed by Italian Air Navigation provider and approved by Regulator.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0470
Title	Interactions between live trial procedures and other IFR procedures
Requirement	Interactions between live trial rotorcraft procedures and other IFR procedures shall be available to Air traffic controllers.
Status	<Validated>
Rationale	This requirement is derived from Safety Assessment performed by Italian Air Navigation provider and approved by Regulator.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Control and sequence the arrival traffic; Separation Provision, Sequencing, Space Aircraft, Management of mixed operations (fixed wing and Rotorcraft)
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Executive Approach/Departure Control
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0480
Title	Orders of service to inform ATCO
Requirement	Temporary orders of service during activity shall be available for all Units affected by rotorcraft operations.
Status	<Validated>
Rationale	This requirement is derived from Safety Assessment performed by Italian Air Navigation provider and approved by Regulator.

Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Control and sequence the arrival traffic; Separation Provision, Sequencing, Space Aircraft, Management of mixed operations (fixed wing and Rotorcraft)
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Executive Approach/Departure Control
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0490
Title	VMC conditions
Requirement	Orders of service shall specify that rotorcraft operations are performed in VMC conditions.
Status	<Validated>
Rationale	This requirement is derived from Safety Assessment performed by Italian Air Navigation provider and approved by Regulator.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Control and sequence the arrival traffic; Separation Provision, Sequencing, Space Aircraft, Management of mixed operations (fixed wing and Rotorcraft)
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Executive Approach/Departure Control
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0500
Title	Information to users
Requirement	An AIM shall be put in place in order to inform Airspace users of rotorcraft activities.
Status	<Validated>
Rationale	This requirement is derived from Safety Assessment performed by Italian Air Navigation provider and approved by Regulator.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0510
Title	Planning of activities
Requirement	At least three hours before the beginning of operations, a planning of activities shall be provided to Air traffic controllers
Status	<Validated>
Rationale	This requirement is derived from Safety Assessment performed by Italian Air Navigation provider and approved by Regulator.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0520
Title	Time slot for performing Flight Trial
Requirement	The best time slot available to perform the Flight Trial shall be identified taking into account the needs of airport ATS Units
Status	<Validated>
Rationale	This requirement is derived from Safety Assessment performed by Italian Air Navigation provider and approved by Regulator.

Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0530
Title	Coordination with Italian Airforce and airport management company
Requirement	In order to avoid runway closures or military zones activation (TRA 424) F35 causing runway change from RWY 35L to RWY 35R a coordination between Milano Malpensa TWR with Italian Airforce and Airport Management Company (SEA) shall be performed
Status	<Validated>
Rationale	This requirement is derived from Safety Assessment performed by Italian Air Navigation provider and approved by Regulator.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0540
Title	Identification of COP
Requirement	COPs between LIMC and Milano ACC (TMA/Approach Sectors) shall be provided for the transfer of responsibility of rotorcraft during procedure execution
Status	<Validated>
Rationale	This requirement is derived from Safety Assessment performed by Italian Air Navigation provider and approved by Regulator.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0550
Title	Generic ground requirement
Requirement	The ATCO needs to be fully aware about the route, altitude and the speed that rotorcraft will follow while flying the procedure
Status	<Validated>
Rationale	The ATCO in order to execute his rule and ensure mainly the correct separation from the other traffics needs to fully know the route that rotorcraft is going to fly
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Control and sequence the arrival traffic; Separation Provision, Sequencing, Space Aircraft, Management of mixed operations (fixed wing and Rotorcraft) Surveillance (Monitoring) Providing Landing Clearance
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Executive Approach/Departure Control Tower Runway Control
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0560
Title	TC working methods to ensure the SNI application

Requirement	Vertical separation of 1000 ft before reaching the FAF (Intermediate segment) shall be ensured with respect to fixed-wing aircraft
Status	<Validated>
Rationale	During the approach, before reaching the FAF (intermediate segment) a vertical separation of 1000 ft shall be ensured, with respect of the fixed-wing traffic, giving the upper side to the rotorcraft which can have a steeper approach than the aircraft one
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Control and sequence the arrival traffic; Separation Provision, Sequencing, Space Aircraft, Management of mixed operations (fixed wing and Rotorcraft) Surveillance (Monitoring)
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Executive Approach/Departure Control
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0570
Title	Performance requirement for PinS SNI procedure
Requirement	PinS approach (straight-in and/or curved in final approach) based on SBAS
Status	<Validated>

Rationale	When executing a deceleration steep final approach extra rotorcraft provisions shall be provided to pilot/crew to reduce the workload.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0580
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 with the following characteristics: A. Accordingly to Rotorcraft specific performance and surrounding obstacle and operational environments “shorter” as much possible; meaning: forthcoming to the FATO. B. with a FAF/FAP located at lowest possible height accordingly to surrounding obstacle and operational environments
Status	<Validated>
Rationale	The goal is to ease and optimise the Rotorcraft performances-maintained transition between modes and track/height conformance.

Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0590
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 final phase; B. an RNP 1 or down to 0.3
Status	<Validated>
Rationale	Avoidance of obstacles/terrain, reduce flight path lengths, optimisation in accordance to Rotorcraft performances and through increased precision paths.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0600
Title	Compliance with applicable Navigation Specifications (Missed Approach)
Requirement	The rotorcraft shall be capable to perform A PinS approach procedure compliant with the applicable Navigation Specification (RNP APCH) in order to perform the coded RNP Missed Approach with RNP 1 values, including an eventually coded RF legs.
Status	<Validated>
Rationale	The Missed Approach RNP requirements shall be respected when flying the coded missed approach..
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0610
Title	Compliance with applicable Navigation Specifications
Requirement	The rotorcraft shall be capable of allowing the Flight Crew to conduct an APV procedure compliant with the applicable Navigation Specification (RNP APCH), sufficient to perform approach operations to LPV minima with initial and final segments with: A. RNP 1 or 0.3 B. RNP straight ending at the FAP and/or RF in final MA leg C. CDFA technique
Status	<Validated>
Rationale	The flight execution shall respect the RNP requirements of the RNP APCH operations down to LPV minima with segments with RNP values of 1 or 0.3 ending at the FAP together with the CDFA technique.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0620
Title	Benefit: Optimised and reduced track miles VS a standard ILS on Runway
Requirement	The PinS APCH shall allow reducing the overall approach track miles, resulting in less fuel consumption and consequently less pollution emission respect standard ILS.
Status	<Validated>
Rationale	It has been available thanks to the flexibility and trajectories optimisation with RNP 1 and 0.3; thanks to a shorter and tighter FAS. This composition can allow the construction of shorter trajectories, (e.g. when noise sensitive areas and rich terrain obstacles areas are to be considered). This favours rotorcraft optimised shorter paths.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0630
Title	Benefit: improved airport accessibility
Requirement	The PinS procedure (approach/departure) procedures shall improve the airport accessibility.
Status	<Validated>
Rationale	Thanks to a procedure with optimised segments with different RNP values in SNI airport environment may allow to reduce the LNAV/LPV minima where missed approach must confront terrain obstacles. There is no the necessity to maintain RWY heading as during ILS missed approach
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	Comply to approach clearance and instructions Fly Rotorcraft Initial Approach Routes Monitor Trajectory until the PinS/MAPt Landing or Missed Approach (Pilot Discretion) Perform Missed Approach
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

4.2 Solution 02-05 Optional Requirements outside SBAS coverage

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PINS.080
Title	Rotorcraft crew GBAS monitoring Capabilities
Requirement	The crew on board shall be able to elaborate trough Avionic data an absolute aircraft position based on GBAS system
Status	<Validated>
Rationale	This is an optional rotorcraft operational required functionality requested to support APV operations (departure and approach) whether they are Independent or not, with specific reference to those locations where GNSS signal is not guaranteed (e.g: due to the latitude values)
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-PSNI.0100
Title	Rotorcraft SVS system Capabilities
Requirement	The crew on board shall be able to elaborate trough Avionic data an absolute aircraft position based on GBAS system
Status	<Validated>
Rationale	This is an optional rotorcraft operational required functionality requested to increase pilot situational awareness supporting APV operations (departure and approach) whether they are Independent or not, with specific reference to those locations where SVS, will enhanced the obstacle ground awareness in the final phases of the approach.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	Rotorcraft Flight Deck (Pilot, Flight Crew)
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

4.3 Recommended High Level Security Requirements

[REQ]

Identifier	REQ-02.05-SPRINTEROP-SEC1.0001
Title	Network components segregated
Requirement	The systems • EN/APP ATC Flight Data Processing • EN/APP ATC Ground-Ground Datalink Management System • EN/APP ATC Surveillance System • Ground-based augmentation system (GBAS) shall operate within a segregated network.
Status	<Validated>
Rationale	Segregated components will make transmissions more secure as well as protect reducing the likelihood of specific attacks
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-SEC1.0002
Title	Encrypted Communication

Requirement	Communication between systems • EN/APP ATC Flight Data Processing • EN/APP ATC Ground-Ground Datalink Management System • EN/APP ATC Surveillance System • Ground-based augmentation system (GBAS) shall be encrypted to guarantee confidentiality and integrity of data transmitted.
Status	<Validated>
Rationale	Encrypted communications ensures a proper level of confidentiality and integrity of data.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-SEC1.0003
Title	Intrusion Detection System
Requirement	The systems • EN/APP ATC Flight Data Processing • EN/APP ATC Ground-Ground Datalink Management System • EN/APP ATC Surveillance System • Ground-based augmentation system (GBAS),

	shall be protected with Intrusion Detection system to avoid malicious software installation or unauthorized access to systems.
Status	<Validated>
Rationale	Specific Intrusion Detection System will reduce the likelihood of malicious software operations impacting the specified systems
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-SEC1.0004
Title	Anti-spoofing
Requirement	Air-Ground Datalink Management system, if applicable (e.g. TMA phase) shall be protected with Anti-spoofing to block traffic by a person or program that masquerades itself as authorized user.
Status	<Validated>
Rationale	Anti-spoofing is able to detect a person or program that masquerades its identity as an authorized one and to block its traffic.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-SEC1.0005
Title	Anti-jamming
Requirement	Air-Ground Datalink Management system, if applicable (e.g. TMA phase) shall be protected with Anti-jamming to identify denial of service attacks.
Status	<Validated>
Rationale	Anti-jamming is able to detect a denial of service attack.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

[REQ]

Identifier	REQ-02.05-SPRINTEROP-SEC1.0006
Title	Data protection
Requirement	The systems: • EN/APP ATC Flight Data Processing • EN/APP ATC Ground-Ground Datalink Management System • EN/APP ATC Surveillance System • Ground-based augmentation system (GBAS) shall protect stored data and any data exchanged through communication channels that could compromise confidentiality and integrity
Status	<Validated>
Rationale	Implementation of specific control will prevent hackers from clearly understanding and modifying in a consistent and detrimental way confidential data
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	02-05
<SATISFIES>	<Information Exchange>	N/A
< ALLOCATED_TO >	<Information Flow>	N/A
<ALLOCATED_TO>	<Activity>	N/A
<ALLOCATED_TO>	<Functional Block>	N/A
<ALLOCATED_TO>	<Role>	N/A
<ALLOCATED_TO>	<Sub-Operating Environment>	TMA HC, APT Very Large, APT Large

5 References and Applicable Documents

5.1 Applicable Documents

Content Integration

[1] B.04.01 D138 EATMA Guidance Material

[2] EATMA Community pages

[3] SESAR ATM Lexicon

[4] ATM Capability Model (https://www.eatmportal.eu/working/rnd/atm-capability-model)

Content Development

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

System and Service Development

[6] 08.01.01 D52: SWIM Foundation v2

[7] 08.01.01 D49: SWIM Compliance Criteria

[8] 08.01.03 D47: AIRM v4.1.0

[9] 08.03.10 D45: ISRM Foundation v00.08.00

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

[11]B.04.03 D128 ADD SESAR1

[12]B.04.05 Common Service Foundation Method

Performance Management

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

[14]B.04.01 D42 SESAR2020 Transition Validation

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

[16]16.06.06-D68 Part 1 –SESAR Cost Benefit Analysis – Integrated Model

[17]16.06.06-D51-SESAR_1 Business Case Consolidated_Deliverable-00.01.00 and CBA

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

[19]ATM Cost Breakdown Structure_ed02_2014

[20]Standard Inputs for EUROCONTROL Cost Benefit Analyses

[21]16.06.06_D26-08 ATM CBA Quality Checklist

[22]16.06.06_D26_04_Guidelines_for_Producing_Benefit_and_Impact_Mechanisms

Validation

[23]03.00 D16 WP3 Engineering methodology

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

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

System Engineering

[26]SESAR 2020 Requirements and Validation Guidelines

Safety

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

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

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

[30]SESAR, Resilience Engineering Guidance, May 2016

Human Performance

[31]16.06.05 D 27 HP Reference Material D27

[32]16.04.02 D04 e-HP Repository - Release note

Environment Assessment

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

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

Security

[35]16.06.02 D103 SESAR Security Ref Material Level

[36]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[37]16.06.02 D131 Security Database Application (CTRL_S)

5.2 Reference Documents

[38]ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.[4]

[39]04.10 D23 FINAL - SESAR Solution Guidance ZZ (SNI) – GEN (ed. 00.01.00)

[40]04.10 D10 FINAL - SESAR Solution Guidance XX (PinS) – GEN (ed. 00.01.01)

[41]OPTIMAL D2.3-1 Rotorcraft procedures definition, 08/03/2007;

[42]GARDEN - D1-2 Criteria for Simultaneous Non Interfering (SNI) Aircraft-Rotorcraft operations, 2011;

[43]

4

Appendix A Cost and Benefit Mechanisms

A.1 Stakeholders identification and Expectations

Stakeholder	Involvement	Why it matters to stakeholder
ANSPs	Solution contributor (Internal to the Project)	Exercise preparation, run and report to provide evidence on capacity, efficiency, predictability, human performance and Safety
Aircraft Manufacturers (Rotorcraft)	Solution contributor (Internal to the Project)	To assess technical feasibility and to obtain consistent and validated requirements and specifications.
ATCOs	End User	To assess operational feasibility and acceptability of the new procedures and working methods
Airspace Users	End User	The concept improves predictability, environmental sustainability and fuel efficiency.
Airport Operators	End User	The concept improves capacity, safety, predictability, environmental sustainability and fuel efficiency.
SJU	Solution contributor\Leader (Internal to the Project)	The concept may improve the ATCO efficiency in terms of airspace/airport capacity (Approach sectors, Runway/Airport efficiency), predictability, safety and fuel efficiency. As a consequence, it also leads to improved flexibility, resilience and access and equity KPAs. Human performance and environmental sustainability will also benefit from it.

Table 8: Stakeholder's expectations

A.2 Benefits mechanisms

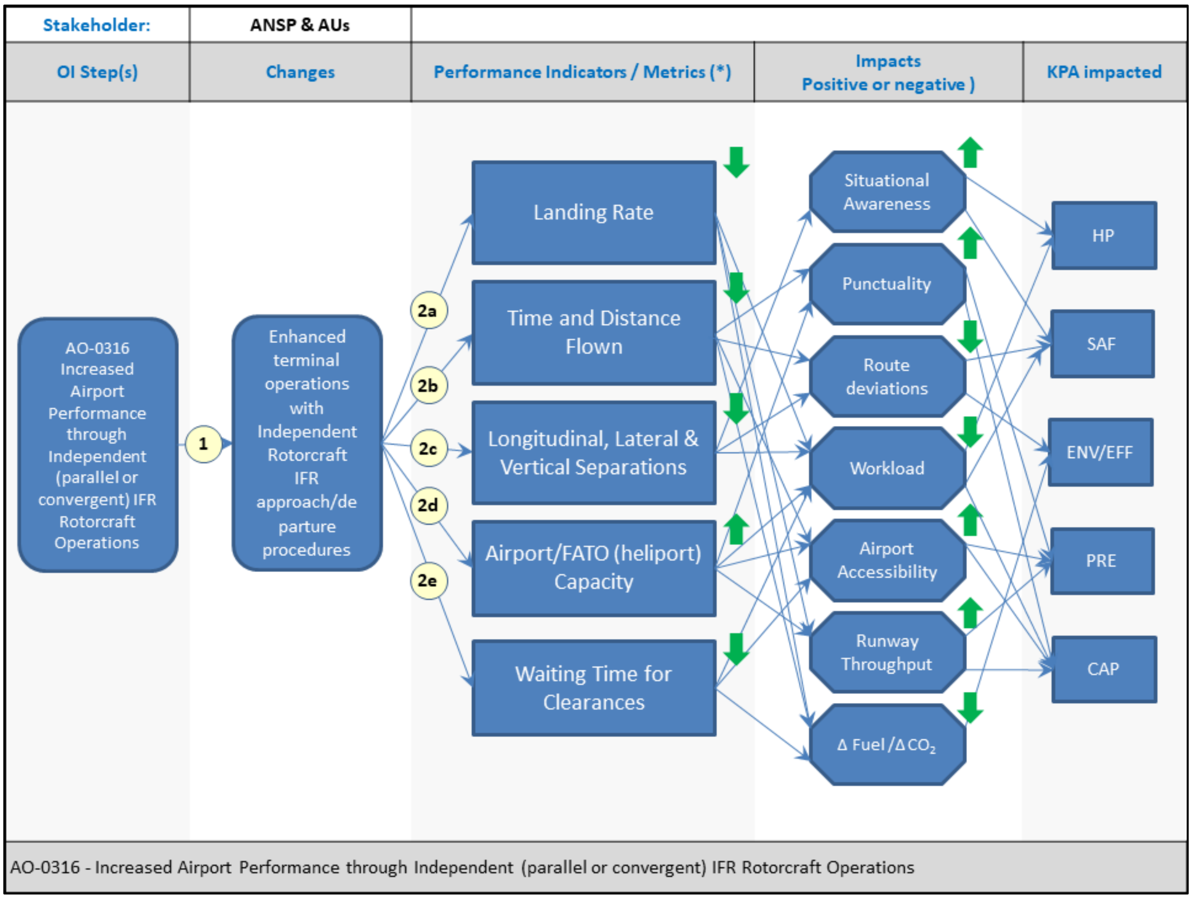

Figure 8: PJ.02-05 Benefits Mechanism

N°	Mechanism descriptions
1	**Enhanced terminal operations with Independent Rotorcraft IFR approach/departure procedures** Better access to aerodromes w/o conventional navaids in low visibility. There is a reduction of flights cancelled on the ground due to weather at destination Airport /VFR FATOs or diversion flight in the air if weather conditions are adverse. Using Rotorcraft specific independent IFR procedures to/from Final Approach & Take-Off areas (FATO) located at airports removes IFR rotorcraft from active runways and allow aircraft and rotorcraft simultaneous non-interfering operations (SNI). It has a positive effect on Rotorcraft IFR traffic.
2a	**Landing Rate** At airports, rotorcraft use approach/departure procedures (SNI) and operational processes that are independent to those used by fixed-wing traffic (by using Simultaneous Non Interfering - SNI procedures). In that manner sequencing with main airlines are easier to achieve w/o Low Speed/Performances vehicles as rotorcraft (ATCOs workload will decrease). Independent rotorcraft approach/departure procedures enable independent approaches/departure to/from the airports, increasing capacity, reducing waiting times and consequently increasing the runway landing rate. An increase of airport capacity (intended as system made up of RWYs and FATOs) is expected.
2b	**Time and Distance Flown** Average of arrival distance flown in executed dedicated RC IFR SNI PinS approach procedure (in nautical miles/minutes per flight from the IAF till VFR FATOs) and Average of departure time flown in executed dedicated RC PinS departure procedure (in nautical miles/minutes per flight, from VFR FATOs till first en-route point) are expected to be reduced. It is expected a positive impact on the airport mixed traffic flows (fixed-wing and rotorcraft).

2c	**Longitudinal, Lateral & Vertical Separations** Decrease of longitudinal deviations due to the guidance provided by GNSS (SBAS signal) and on RC independent approach procedures. Decrease of lateral deviations due to greater accuracy provided by GNSS system (RNP0,3). Approach/Departure procedures separated by design (ICAO designing criteria – Doc9643 SOIR), increase situational awareness in the cockpit in the air and on the surface, increase safety and reduce the probability of not detecting oncoming traffic. Lower probability of unauthorized runway incursion. Lower workload of ATCO (freed time that would otherwise be spent on controlling and monitoring traffic inside or in the vicinity of busy airspace/TMAs) and better situational awareness in the cockpit from pilots point of view.
2d	**Airport/FATO (heliport) Capacity** Increase of landing rate derived by the use of SNI procedures dedicated to the rotorcraft (IFR PinS strategically separated based on ICAO Doc 9643 SOIR criteria). The proposed solution adds movements “without contributing to the runway congestion”, so increasing the passenger throughput, hence airport capacity (new free runway slots for CAT). In case the landing rate increases, a better access to aerodromes w/o conventional navaid is expected. There are benefits for ANSPs, Airport Operators and Airspace Users.
2e	**Waiting Time for Clearance** Rotorcraft using specific independent (Strategically separated) procedures (SNI) to/from FATOs don’t create any interferences with the runway traffic. In this way it's expected a considerable reduction in time for receiving the departure clearance or the clearance for landing when the RC is coming from the holding circuit

Table 9: PJ.02-05 Benefit Mechanism Description

A.3 Costs mechanisms

The following table summarises the costs associated with the solution PJ.02-05 in accordance with the categorisation of costs made by PJ19. The costs of this solution have only been identified for ANSPs.

Category	Sub-category	**Cost type**	**Description**
Pre-implementation Costs			
			R&D and Pre-Industrialisation costs are already incurred in the SESAR Development Phase and therefore not included in the cost assessment
Implementation Costs			
	One-Off Costs		Costs incurred during the implementation period and that are paid once
		Implementation Training & Staffing	implementation Training for the new actors (GS) Training in simulator
		Project Management	Project Definition, Programme management and support, Planning costs, including design costs, planning authority resources and other planning costs Change management Procurement activities Meeting/ travel costs Processes and documentation costs
		Airspace design & Procedures	Changes to and design of new ATC procedures. Modification of Letter of Agreements
		Administrative costs	New procedures, regulation, processes to put in place Documentation
		Installation & Commissioning	Installation costs, Initial Test and evaluation (*Test plans, procedures, reports ; Test equipment/tools, including aircraft ; Test staff and training)* Functional integration (*standardisation*) Human/product interface

Category	Sub-category	Cost type	Description
		Validation & Certification costs	Validation Safety assessments / audits
		Other One-off Costs	
	Capital Costs		
		Equipment & System	Hardware and software acquisition, Software development (*development, engineering, knowledge base: adaptation data, production, reviews and audit*) Initial software licensing
		Integration costs	Physical integration Software development System integration
		Building & Facilities	N/A
		Land & property costs	N/A
		Licences, patent	N/A
		Other Capital Costs	N/A
	Transition Costs		Costs for maintaining current systems, during transition to a new system
		Transition Investments costs	N/A
		Transition Operations costs	
		Transition Staff costs	N/A
		Regulation implementation	cost of implementation and compliance demonstration to revised or new regulations enabling this solution
Operating costs (includes **only delta costs**, i.e. changes to the operating costs that this project(s) will bring when deployed)			
	Raw Material		
		Material, supplies, utilities	
	Personal & Training		Change in costs for staff, training due to operational improvements implemented
		Personnel cost	N/A.
		Training	N/A
		Staff support	N/A
	Maintenance & Repair		
		Hardware & Software	TBC
		Other services	N/A
	Facility costs		
		Rent & Lease	N/A
		Furniture & equipment	N/A
		Communication costs	N/A

Category	Sub-category	Cost type	Description
		Energy	N/A
		Property Taxes	N/A
	Administration Costs		
		Standard expenditures related to changes in procedures, regulation, processes	TBC
		Documentation	
		Travel	
	Other Operating Costs		

Table 10: Costs Mechanism