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Authoring & Approval

Authors of the document			
Beneficiary	Date		
Indra	21/02/2023		
Leonardo	27/12/2022		

Reviewers internal to the project

Beneficiary	Date
DFS	21/02/2023
ENAIRE	21/02/2023

Reviewers external to the project

Beneficiary

Approved for submission to the S3JU By - Representatives of all beneficiaries involved in the project

Beneficiary	Date
DFS	24/02/2023
ENAIRE	24/02/2023
ENAV	24/02/2023
EUROCONTROL	24/02/2023
Indra	24/02/2023
Leonardo	24/02/2023

Rejected By - Representatives of beneficiaries involved in the project

Beneficiary	Date





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PJ.02 AIRPORT AIRSIDE AND RUNWAY THROUGHPUT

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Abstract

This document collects and describes the Technical System Requirements (functional and non-functional) which shall guide the development of procedures and required system support for an extension of the Conflicting ATC Clearances (CATC) and Conformance Monitoring Alerts for Controllers (CMAC) alerting functions, in order to cover the entire airport surface, ensuring an adequate level of Safety under all weather conditions.

Such System Requirements are derived from the Operational Requirements collected by the specification of previous R&D projects and studies, and from SESAR project PJ.02-W2-21.1: Extended Airport Safety Nets for Controllers at A-SMGCS Airports.





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1 Executive summary

Safety is enhanced for airport operations as Support Tools for controllers at A-SMGCS Airports detect potential and actual conflicting situations, incursions and non-conformance to procedures or ATC clearances, involving mobiles (and stationary traffic) on runways, taxiways and in the apron/stand/gate area as well as unauthorised/unidentified traffic. Controllers are provided in all cases with the appropriate alerts.

This document lists and details the Technical System Requirements (functional and non-functional) that shall guide the development and implementation of prototypes involved in PJ02-W2-21.1 Validation exercises. This document also addresses Interface Requirements.

It is based on the work developed within SESAR2020 Wave 1 solution PJ.03b-01: Enhanced Airport Safety Nets for Controllers.

In line with the SPR-INTEROP/OSED [29], functional and non-functional requirements are addressing the following OI and its corresponding Enablers:

- Extended Airport Safety Nets for Controllers at A-SMGCS Airports AO-0104-B the CATC and CMAC alerting functions defined in the scope of the SESAR 1 Solution #02 are updated and extended to cover the entire airport surface, ensuring an adequate level of Safety under all weather conditions.
 - AERODROME-ATC-06b A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface.
 - AERODROME-ATC-07b A-SMGCS incorporating the function that provides an advanced set of Conformance Monitoring Alerts for Controllers (CMAC) on the movement area.
 - AERODROME-ATC-115 A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts.
 - AERODROME-ATC-116 A-SMGCS incorporating the function that provides Runway-Busy notifications.

The Architecture of the main EATMA elements (Capability Configurations, Roles, Technical Systems and Functional Blocks) impacted by the Solution is summarized in the following table:

Capability Configuration	Role	Technical System	Functional Block
TWR	Tower Clearance	Aerodrome ATC	Aerodrome Safety Nets
	Tower Ground Controller		Conformance Monitoring
			Controller Human Machine Interaction Management Aerodrome ATC
	Tower Runway Controller	Voice	A/G Voice Communication

Table 1. EATMA elements used in the Architecture and Modelling activities for PJ.02-W2-21.1





In SESAR2020 the intention is to ensure consistency and coherency between the delivered documents using EATMA, and the architectural diagrams showed in this document are present in EATMA.





2 Introduction

2.1 Purpose of the document

The objective of the implementation of the TS/IRS document is to complete the V3 SESAR Solution datapack in order to increase the SESAR Solution maturity level. The different deliverables as per type of project are divided in three groups: ATM Solution Projects, Enabling Projects and VLD's, being this TS document part of the ATM Solution Projects group [41].

This TS/IRS document provides the requirements specification of the PJ.02-W2-21.1 Solution addressing Extended Airports Safety Nets for Controllers at A-SMGCS Airports, covering functional, non-functional and interface requirements related to the aforementioned SESAR Solution. This document focuses on specifying the functional description and the logical interfaces between the different functional blocks impacted by the Solution¹.

The aim is not to answer *how* the Extended Airport Safety Nets procedures are implemented, but to describe on a general level the functionality such a solution must provide in order to fulfil the operational methods and scenarios described in the PJ.02-W2-21.1 OSED [29].

The Technical Specification includes the Functional Blocks impacted by the Solution, as well as the functional breakdown of the system, in order to understand how the systems that play a key role in the EATMA Architecture and modelling are structured.

2.2 Scope

This Technical Specification (TS/IRS) covers functional, non-functional and interface requirements related to the SESAR Solution PJ.02-W2-21.1, aiming for V3 maturity.

The listed requirements shall satisfy the requirements listed in the PJ.02-W2-21.1 SPR-INTEROP/OSED document [29].

The Validation preparation activities give early advice to drive correctly the technical specifications. Besides, TS/IRS requirements are updated based on consolidation of technical feedback from the validation activities performed within the PJ.02-W2.21.1 framework.

The TS/IRS covers the aspects related to the following Enablers (the description for each Enabler is presented in the following sections of the document:

¹ The opinions expressed herein reflect the author's view only. Under no circumstances shall the SESAR 3 Joint Undertaking be responsible for any use that may be made of the information contained herein.





OI Step code	OI Step title	Enabler	Required / Optional	V3 coverage
AO-0104-B	Extended Airport	AERODROME-ATC-06b	Required	Fully
	Safety Nets for	AERODROME-ATC-07b	Required	ired Fully ired Fully
	Controllers at A- SMGCS Airports	AERODROME-ATC-115	Required	
		AERODROME-ATC-116	Required	Fully

Table 2. PJ.02-W2-21.1 OIs and Enablers

This TS/IRS document considers the outcomes of the following SESAR2020 validation exercises:

- EXE-02-W2-21.1-V3-001 DFS
- EXE-02-W2-21.1-V3-003 ENAIRE/INDRA
- EXE-02-W2-21.1-V3-004 LEONARDO/BULATSA

2.3 Intended readership

This document is intended for various stakeholders;

Internal to SESAR 2020

- Project PJ02 Increased Runway and Airport Throughput consistency with PJ.02-W2 solutions (PJ.02-W2-17, PJ.02-W2-21), alignment with ATM Master Plan managed by PJ.02-W2 PCIT.
- Solution PJ.02-W2-21.3 Digital surface management for airport vehicles.
- Solution PJ.02-W2-21.4 Full Guidance Assistance to mobiles using 'Follow the Greens' procedures based on Airfield Ground Lighting (aprons/taxiways/runways) common interest for guidance related No FtG alert.
- Solution PJ.02-W2-21.5 Enhanced Safety in LVP through use of Dynamic Virtual Block Control shared responsibility for enhanced guidance of vehicles.
- Solution PJ.02-W2-21.6 Advanced Automated Assistance to Controller for Surface Movement Planning and Routing.
- SESAR 2020 Transversal Projects:
 - PJ19 (Content Integration) responsible for managing the content integration process to ensure the needed coherency (in terms of operational concept, architecture) between the different SESAR 2020 projects.





o PJ20 (Master Plan Maintenance) responsible for ATM Master Plan maintenance.

External to SESAR Programme

- EUROCAE Working Group WG41.
- Post SESAR 2020 Wave 2 Future audience involved in industrialisation (V4) and deployment activities (V5).

2.4 Background

This section provides information on previous activities relevant for SESAR Solutions PJ.02-W2-21.1, including the work performed both internal and external to SESAR 1 Programme and SESAR2020 Programme Wave 1.

The baseline from which this document has been written consists of SESAR 1 Technical Specification documents:

Internal to SESAR 1

- SESAR 1, 12.03.02-D64- Technical Specifications- Final Report, Edition 00.02.00. [29]
- SESAR 1, 12.05.04-D93- Final System Requirements, Edition 00.03.00.- [31]

Besides, this document considers the work performed during SESAR2020 Wave 1.

Internal to SESAR 2020

• Solution PJ03b-01 V2 TS/IRS (PJ03B-01 D2.1.130) [32]

External to SESAR Programme

- EUROCAE Working Group WG41: ED-87D MASPS for A-SMGCS [33]
- EUROCONTROL Specification for A-SMGCS Services EUROCONTROL-SPEC-171 [35]

2.5 Structure of the document

The document is organised as described hereafter:

- Section 1 gives a brief summary of this Technical Specification document
- Section 2 gives an introduction to how the document is organised
- **Section 3** describes the Functional Blocks included in the Solution as well as the Capability Configurations and the changes from the architecture in EATMA.
- Section 4 describes the Functional Architecture and the Functions needed to realise the Solution and provides a functional view of how the technical systems, functional blocks, system ports and roles participate in realising the operational needs. It contains the technical Requirements.





- Section 5 lists the recommendations for implementations
- Section 6 explains the assumptions for the technical feasibility of the solution
- Section 7 lists the Applicable documents and the references
- Appendix A Service Description Document (SDD)
- Appendix B Service Technical Design Document (STDD)

2.6 Glossary of terms

Term	Definition	Source of the definition
Advanced Surface Movement Guidance and Control System (A- SMGCS)	A system providing as a minimum Surveillance and can include Airport Safety Support, Routing and Guidance to aircraft and vehicles in order to maintain the airport throughput under all local weather conditions whilst maintaining the required level of safety.	[35]
Alert	An indication of an existing or pending situation during aerodrome operations, or an indication of abnormal A-SMGCS operation, that requires attention/action.	[36]
CATC	CATC provides an alert when the Controller inputs an electronic clearance via the Human Machine Interface (HMI), which according to a set of locally agreed rules is not permitted from an operational and safety point of view when compared to any other previously input electronic clearance.	[35]
Clearance	A generic term used that covers instructions, approvals and clearances issued to mobiles by a Controller.	[35]
CMAC	CMAC provides Controllers with appropriate alerts when the A-SMGCS detects the non-conformance to procedures or clearances for traffic on runways, taxiways and in the apron/stand/gate area.	[35]
Conditional Clearance	A clearance issued by an air traffic controller which does not become effective until a specified condition has been satisfied	[40]





Term	Definition	Source of the definition
Conflict (abstract)	A situation where there is a risk for collision between aircraft and/or vehicles. Note by PJ.02-W2-21.1: Safety is enhanced for airport operations as Support Tools for controllers at A-SMGCS Airports detect potential and actual conflicting situations, incursions and non- conformance to procedures or ATC clearances, involving mobiles (and stationary traffic) on runways, taxiways and in the apron/stand/gate area as well as unauthorised/unidentified traffic.	[36]
EFS	Electronic Flight Strip (EFS) - Throughout this document the term EFS is used generically as the means to digitally input the clearances into the ATC System. Although EFS are used at many airports in Europe, Electronic Clearance inputs may also be performed using other ways such as via the radar label.	[38]
False Alert	Alert which does not correspond to an actual alert situation. Note: It is important to understand that it refers only to false alerts and does not address nuisance alerts (i.e. alerts which are correctly generated according to the rule set but are inappropriate to the desired outcome).	[35]
Mobile	A mobile is either an aircraft, an aircraft being towed or a vehicle. Note: when referring to an aircraft or a vehicle, and not another obstacle, the term "mobile" is preferred to "target". The term "target" is only used when considering an image of a mobile or other obstacle displayed on a surveillance screen.	[35]
Nuisance Alert	Alert which corresponds to an actual Alert Situation but is deemed to be unnecessary by the user	[35]
Obstacle on RWY	All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located	[36]







Term	Definition	Source of the definition
	on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.	
Predictive Indicator	A predictive indicator is a visual element on an Electronic Flight Strip (or any aircraft representation on the controller's main screen) associated to a clearance that has not yet been given to a mobile, showing that this clearance, if delivered, would be conflictual with another one given to another aircraft.	As defined within PJ.02-W2-21.1
Restricted Area	An area on an aerodrome where the presence of a mobile is permanently or temporarily forbidden.	[35]
Runway	A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.	[35]
Runway Incursion	Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft.	[35]
Runway Protected Area	The area around a particular runway the boundaries of which are defined by the runway holding positions (CAT I/II/III according to the prevailing weather (LVP) conditions) and a line connecting the different adjacent holding positions.	[35]

Table 3: Glossary of terms for PJ.02-W2-21.1

2.7 Acronyms and Terminology

Term	Definition
A/C	Aircraft
ADD	Architecture Description Document
ADS-B	Automatic Dependent Surveillance-Broadcast
AIRM	ATM Information Reference Model





Term	Definition
AoR	Area of Responsibility
A-SMGCS	Advanced-Surface Movement Guidance and Control System
ATC	Air Traffic Control
АТСО	Air Traffic Control Officer
ATM	Air Traffic Management
ATS	Air Traffic Service
САТ	Category
CATC	Conflicting ATC Clearances
СВА	Cost Benefit Analysis
СС	Capability Configuration
СНМІМ	Controller Human Machine Interaction Management
CMAC	Conformance Monitoring Alerts for Controllers
CR	Change Request
CTR	Control Area
CWP	Controller Working Position
DEP	Departure
EASA	European Aviation Safety Agency
EATMA	European ATM Architecture
EFS	Electronic Flight Strips
EN	Enabler
FB	Functional Block
FDP	Flight Data Processing system
HMI	Human Machine Interface
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
INTEROP	Interoperability Requirements
IRS	Interface Requirements Specification

Founding Members





Term	Definition
ISRM	Information Services Reference Model
MASPS	Minimum Aviation System Performance Standards
NAF	NATO Architecture Framework
NOV	NAF Operational View
NSV	NAF System View
01	Operational Improvement
OSED	Operational Service and Environment Definition
RMCA	Runway Monitoring and Conflict Alerting
RPA	Runway Protected Area
RPAS	Remotely Piloted Aircraft Systems
R/T	Radio Telephony
RWY	Runway
SAR	Safety Assessment Report
SDD	Service Description Document
SESAR	Single European Sky ATM Research Programme
SID	Standard Instrument Departure
SJU	SESAR Joint Undertaking
SPR	Safety and Performance Requirements
SWIM	System Wide Information Model
TCL	Taxiway Centreline Lights
TMA	Terminal Manoeuvring Area
TS	Technical Specification
TSAT	Target Start-up Approval Time
VALS	Validation Strategy

Table 4. PJ.02-W2-21.1 Acronyms





3 SESAR Solution Impacts on Architecture

3.1 Target Solution Architecture

The following tables are extracted from MEGA modelling activities that were conducted for the concepts addressed by this Solution. The following OI is covered:

• AO-0104-B - Extended Airport Safety Nets for Controllers at A-SMGCS Airports

3.1.1 SESAR Solution(s) Overview

Extended Airport Safety Nets for Controllers at A-SMGCS Airports

This solution updates and extends the Airport Safety Net concepts Conflicting ATC Clearances (CATC) and Conformance Monitoring Alerts for Controllers (CMAC) to cover the entire airport surface.

Based on airport surveillance data and electronic environment integrating ATC clearances, taxi-routes and local procedures the Safety Support Tools for controllers upgrade the Advanced Surface Movement Guidance and Control System (A-SMGCS) to detect potential and actual conflicting situations, incursions and non-conformance to procedures or ATC clearances, involving mobiles (and stationary traffic) on runways, taxiways and in the apron/stand/gate area as well as unauthorized/unidentified traffic.

The solution targets traffic Safety on the entire movement area and during take-off and landing.

Appropriate predictive indications and alerts are provided to controllers in all cases, increasing situational awareness and giving automated support in order to avoid hazardous situations.

For PJ.02-W2-21.1 the main elements based on EATMA that are used are stated below. To be highlighted that these are the FBs impacted by the mandatory Enablers of this Solution; therefore, these FBs will be the main impacted ones and the core of this Solution.







Figure 1. PJ.02-W2-21.1 relations between EATMA Elements

The Aerodrome ATC Technical System provides a set of functionalities split in different Functional Blocks. The functionalities related with this Solution are the Safety Nets alerts and conflict management on the airport surface.

The image bellow shows all the Functional Blocks included in the Aerodrome ATC system. The Functional Blocks related to this Solution are highlighted in blue and they are further described in the following sections.



Figure 2. Functional Blocks included in the Aerodrome ATC system impacted by PJ.02.W2-21.1





The following table and figure detail the ID, description and coverage of the Enablers, the related Functional Blocks and the Roles involved in this Solution according to the EATMA DS23.

SESAR Solution ID and Title	Functional Blocks/Role impacted by the SESAR Solution (from EATMA)	Enabler ID (from EATMA)	Enabler Title (from EATMA)	Enabler coverage
PJ.02-W2-21.1 – Extended Safety Nets for Controllers at A- SMGCS Airports	Aerodrome Safety Nets Controller Human Machine Interaction Management Aerodrome ATC	AERODROME- ATC-06b	A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface	Full
	Conformance Monitoring Aerodrome Safety Nets Controller Human Machine Interaction Management Aerodrome ATC	AERODROME- ATC-07b	A-SMGCS incorporating the function that provides an advanced set of Conformance Monitoring Alerts for Controllers (CMAC) on the movement area	Full
	Aerodrome Safety Nets Controller Human Machine Interaction Management Aerodrome ATC	AERODROME- ATC-115	A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts	Full
	Aerodrome Safety Nets Controller Human Machine Interaction Management Aerodrome ATC	AERODROME- ATC-116	A-SMGCS incorporating the function that provides Runway-Busy notifications	Full

Table 5: SESAR Solution PJ.02-W2-21.1 Scope and related Functional Blocks/roles & Enablers

The roles directly impacted on this Solution are the Tower Clearance Delivery Controller, Tower Ground Controller and Tower Runway Controller.





- **Tower Clearance Delivery Controller:** responsible for issuing departure clearances to departing IFR flights, issuing Start-Up Approval and verifying Flight data, e.g. FPL, Stand, TSAT, etc.
- **Tower Ground Controller**: Responsible for the provision of ATS to aircraft and vehicles on the manoeuvring area. An Extended Set of Airport Safety Nets will be available for the Tower Ground Controller, focused on preventing conflicts in the airport taxiways.
- **Tower Runway Controller:** Responsible for the provision of ATS to aircraft within the control zone, or otherwise operating in the vicinity of controlled aerodromes. An Extended Set of Airport Safety Nets will be available for the Tower Runway Controller, focused on preventing conflicts regarding airport runways and conflicting SIDs.

The following table presents the Change Requests that have been raised in EATMA for the OI Steps and Enablers within the Solution.

OI Step	OI description	Open CR
AO-0104-B	Extended Airport Safety Nets for Controllers at A-SMGCS Airports	CR 05540 for updating the links to EATMA based on the Wave2 work and unlink AERODROME-ATC-61b Enabler. CR 07104 for updating the links to EATMA in order to include the Activities related to Runway Situational Notifications.
EN Code	EN description	Open CR
AERODROME- ATC-06b	A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface	 CR 05577 for updating the links to EATMA based on the Wave2 work and updating V3 date to align with the maturity gate date. CR 07100 for updating the links to EATMA. CR 07380 for creating STD-164 (update of EUROCONTROL-SPEC-171 version 3.0) and set it as an Enabling Enabler for AERODROME-ATC-06b. CR 07381 for creating STD-165 (update of ED-87 MASPS document, version F) and set it as an Enabling Enabler for AERODROME-ATC-06b. CR 07376 for updating the maturity status following V3 Gate for PJ.02-W2-21.1.





AERODROME- ATC-07b	A-SMGCS incorporating the function that provides an advanced set of Conformance Monitoring Alerts for Controllers (CMAC) on the movement area	 CR 05578 for updating the links to EATMA based on the Wave2 work and updating V3 date to align with the Maturity Gate date. CR 07101 for updating the links to EATMA and the description. CR 07380 for creating STD-164 (update of EUROCONTROL-SPEC-171 version 3.0) and set it as an Enabling Enabler for AERODROME-ATC-07b. CR 07381 for creating STD-165 (update of ED-87 MASPS document, version F) and set it as an Enabling Enabler for AERODROME-ATC-07b. CR 07377 for updating the maturity status following V3 Gate for PJ.02-W2-21.1.
AERODROME- ATC-115	A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts	CR 07099 for creating AERODROME-ATC-115 and updating the EATMA links. CR 07380 for creating STD-164 (update of EUROCONTROL-SPEC-171 version 3.0) and set it as an Enabling Enabler for AERODROME-ATC- 115. CR 07381 for creating STD-165 (update of ED- 87 MASPS document, version F) and set it as an Enabling Enabler for AERODROME-ATC-115. CR 07378 for updating the maturity status following V3 Gate for PJ.02-W2-21.1.
AERODROME- ATC-116	A-SMGCS incorporating the function that provides Runway-Busy notifications	 CR 07098 for creating AERODROME-ATC-116 and updating the EATMA links. CR 07380 for creating STD-164 (update of EUROCONTROL-SPEC-171 version 3.0) and set it as an Enabling Enabler for AERODROME-ATC-116. CR 07381 for creating STD-165 (update of ED-87 MASPS document, version F) and set it as an Enabling Enabler for AERODROME-ATC-116. CR 07379 for updating the maturity status following V3 Gate for PJ.02-W2-21.1.





Table 6: PJ.02-W2-21.1 Solution Overview - Open Change Requests

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

Enabler AERODROME-ATC-61b has been unlinked from AO-0104-B through CR 05540.

The technical background of AERODROME-ATC-61b is not compatible with A-0104-B. The link was established by PJ03b-01 because in Wave1 the integrated validation exercises used Follow the Greens from PJ03a-01 and the Safety Nets from PJ03b-01 (AO-0104-B). Now, there is only the NO TAXI (FtG) alert considered in AO-0104-B which uses guidance information to detect the non-conformance indicated by the NO TAXI (FtG) alert. All other AO-0104-B alerts use routing information for conflict detection. Therefore it make sense to move the NO TAXI (FtG) to AO-0222-B (which is already enabled by AERODROME-ATC-61b). PJ.02-W2-21.4 is validating the NO TAXI (FtG) in their Follow the Greens exercise and, therefore, are addressing the full AO-0222-B package.

Also, AERODROME-ATC-06b scope has been split, moving the Airfield Ground Lighting aspects to the newly created AERODROME-ATC-07c (which has been linked to PJ.02-W2-21.4). As a result, AERODROME-ATC-06b includes the following Conformance Monitoring Alerts for Controllers (CMAC) capabilities:

• CMAC Stand Occupied.

While AERODROME-ATC-07c is focused on the CMAC No Follow-the Greens alert. It is to be noted that the basic version of the CMAC No Taxi alert was already V3 validated as part of SESAR 1 activities.

Besides, as a result of the activities within the Solution, two new Enablers have been created in order to present the functionalities that have been developed.

Firstly, AERODROME-ATC-116 has been created through CR 07098, which incorporates the function that provides the Runway Busy notification.

At the same time, AERODROME-ATC-115 has been created through CR 07099, introducing the function that provides Runway In Conflict notifications and RMCA/CMAC vs ATC Clearance alerts (which were already part of the concept from the previous projects but did not have a proper Enabler to reflect it in the roadmap).

Concerning the applicable standards and regulations, there are some actions that have been performed in EATMA for reflecting the findings of the Solution in this aspect, namely:

- CR 05533 Creation of STD-105 (for update of EUROCONTROL-SPEC-171) and subsequent CR 07003 for updating the EUROCONTROL-SPEC-171 publication date to the one corresponding to Edition 2.0 (30th April 2020)
- CR 05541 Creation of STD-016 (for update of EUROCAE ED-87E) linked to AERODROME-ATC-06b and AERODROME-ATC-07b
- CR 07030 Deletion of STD-106 (as STD-016 is an advanced version of this STD and is already linked to the proper Enablers)

The reason for these changes are presented more in detail in section 3.1.1.3.





3.1.1.2 Relevant Use Cases

All relevant SESAR Solution PJ.02-W2-21.1 Operational Use Cases are described in Section 3.3.2.2 of the PJ.02-W2-21.1 SPR-INTEROP/OSED [29].

Use Case group	OSED Use Case Identifier	TS/IRS NSV-4 diagram
Common Use Cases	UC-CATC-01 Predictive Indicator	[NSV-4][CATC-01] Predictive Indicator
	UC-CATC-02 Conditional Clearance	[NSV-4][CATC-02] Conditional Clearance
Extended CATC (for Ground	UC-CATC-03 Pushback vs Pushback	hback vs Pushback [NSV-4][CATC-03-04-05-06-07-08] Extended CATC (for Ground
Operations)	UC-CATC-04 Taxi vs Pushback	operations)
	UC-CATC-05 Pushback vs Taxi	
	UC-CATC-06 Taxi vs Taxi (no pushback required)	
	UC-CATC-07 Taxi vs Taxi (Deadlock)	
	UC-CATC-08 Taxi vs Cross (Deadlock)	
Updated CATC (for	UC-CATC-09 Land vs Land	[NSV-4][CATC-09-10-11-12]
operations)	UC-CATC-10 Take Off vs Land	operations)
	UC-CATC-11 Cross vs Land	
	UC-CATC-12 Take Off vs Take Off	
RMCA/CMAC	UC-CATC-13 RMCA vs Clearance	[NSV-4][CATC-13-14] RMCA/CMAC
Alerts	UC-CATC-14 CMAC vs Clearance	
Updated CMAC Alerts	UC-CMAC-01 Stand Occupied Alert	[NSV-4][CMAC-01] Stand Occupied
Runway Situational Notifications	UC-RWY-01 Runway Busy Notification	[NSV-4][RWY-01] Runway Busy Notification
	UC-RWY-02 Runway In Conflict Notification	[NSV-4][RWY-02] Runway In Conflict Notification

Table 7 : PJ.02-W2-21.1 Solution Overview - Relevant Use Cases





A technical Architecture and its corresponding system models have been developed in order to cover the previous operational Use Cases described in the PJ.02-W2-21.1 SPR-INTEROP/OSED [29]. The technical modelling is included in the dedicated sections of this document (see 4.1 Functional architecture overview).





Use Case group	Use Case Identifier
[NSV-4][CATC-01] Predictive Indicator	This view summarizes the system resource interaction for Use Case CATC-01 Predictive Indicator from PJ.02-W2-21.1 SPR INTEROP OSED.
	The HMI can be adapted to give a Predictive Indication to the Controller showing that if a specific clearance is entered it triggers a CATC alert. The clearance that is probed for a conflict is the next clearance to be given by the Controller according to the current clearance status of the route assigned to the considered mobile. This supports the Controller's situational awareness and normally prevents a
	predicted clearance conflict that is indicated to the Controller.
	The availability of CATC Predictive Indication is a safety measure on top of existing CATC alerts. Therefore, it is considered as an additional Safety barrier.
	Scope/Description
	This Use Case describes how the ATC system detects a potential CATC before it is entered by the Controller and how it will be presented on the Controller's HMI. This Use Case is designed to be an optional element in CATC Use Cases.
	Actors
	Tower Runway Controller/Tower Ground Controller/Apron Manager (collectively referred to as Controller)
	Pre-conditions
	• The ATC system is equipped with A-SMGCS surveillance and a means to input ATC clearances.
	 The controller's HMI has a Predictive Indication GUI element that indicate a potential CATC to the controller (e.g. on the track label or the Electronic Flight Strip of the aircraft). A planned route is assigned to the aircraft assessed for potential CATC.
	Post conditions
	• The notential CATC is displayed on the Predictive Indication CLII element of the
	Controller's HMI (e.g. on the track label or the Electronic Flight Strip of the aircraft).
	• If no potential CATC is detected the Predictive Indication GUI element is blank.
	Trigger
	This UC is triggered by a parent CATC UC.





[NSV-4][CATC-02] Conditional	This view summarizes the system resource interaction for Use Case CATC-02 Conditional Clearance from PJ.02-W2-21.1 SPR INTEROP OSED.
Clearance	A Conditional Clearance is an instruction that is issued by an air traffic controller and only takes effect when a certain condition is met, e.g. CLEARED TO CROSS BEHIND THE LANDING AIRCRAFT (NOTE: The aircraft referenced in the conditional clearance is clearly identified by the responsible air traffic controller and pilot). The controller issues the Conditional Clearance to the aircraft and enters the clearance including the condition into the ATC system. The ATC system monitors the correct execution of the condition.
	The availability of Conditional Clearances is considered a Safety measure that extends the respective use case flow. It is considered, thus, an additional Safety barrier.
	Scope/Description
	This Use Case describes the use of Conditional Clearances to avoid potentially critical situations which trigger CATC alerts.This Use Case is designed to be an optional element in CATC Use Cases.
	Actors
	Tower Runway Controller/Tower Ground Controller/Apron Manager (collectively referred to as Controller), Pilot, Vehicle Driver
	Pre-conditions
	• The ATC system is equipped with A-SMGCS surveillance and a means to input ATC clearances.
	• The controller's HMI provides means to enter conditional clearances.
	• The ATC system is able to monitor the execution of the Clearances Cross, Enter, Line-up, Take-off, Push Back, Taxi under conditions and to detect if the conditional clearance is disregarded.
	Post conditions
	• The condition is fulfilled and the clearance becomes effective.
	Trigger
	This UC is triggered by a parent CATC UC.





[NSV-4][CATC-03- 04-05-06-07-08] Extended CATC	This NSV-4 describes the Use Cases CATC-03-04-05-06-07-08, corresponding to the Push-Back, Taxi, Cross and Deadlock situations.
	The new operating method introduces a number of new situations for which an Extended CATC alert is triggered. The new situations are described as Use Cases in PJ.02-W2-21.1 SPR INTEROP OSED.All Extended CATC Use Cases follow the same basic scheme that is visualised in this diagram, [NSV-4][CATC-03-04-05-06-07-08] Extended CATC
	General Conditions (Scope and Summary)
	This Use Case describes how the ATC system detects a:
	Push Back vs Push Back
	Taxi vs Push Back
	Taxi vs Taxi (no pushback required)
	Taxi vs Taxi (deadlock)
	Taxi vs Cross (deadlock);
	CATC Alert and how it will be presented on the Tower Runway Controller's HMI.
	Pre-Conditions
	The ATC system is equipped with A-SMGCS surveillance, Routing and a means to input ATC clearances.
	Planned routes are assigned to the aircrafts considered in this UC.
	If a Push Back procedure is part of the route, it includes the orientation of the aircraft after Push Back (e.g. "nose to the East").
	Aircraft A has already received a clearance (i.e. Push-Back, Taxi, Cross)
	Post Conditions
	The CATC Alert is resolved and the system no longer displays the alert.
	Actor
	Tower Runway Controller/Tower Ground Controller/Apron Manager
	Trigger
	Aircraft is ready to receive the ATC Clearance, either 'Push Back', 'Taxi' or 'Cross', that is in conflict with another ATC Clearance of this kind, from the Tower Ground Controller (Tower Runway Controller in case of 'Cross' ATC Clearance).





[NSV-4][CATC-09- 10-11-12] Updated	This NSV-4 describes the Use Cases CATC-09-10-11-12, corresponding to the Take Off, Land and Cross situations.
CATC	The new operating method updates a number of situations for which an Updated CATC alert is triggered. The updated situations are described as Use Cases in PJ.02-W2-21.1 SPR INTEROP OSED. All Updated CATC Use Cases follow the same basic scheme that is visualised in
	this diagram, [NSV-4][CATC-09-10-11-12] Updated CATC
	General Conditions (Scope and Summary) This Use Case describes how the ATC system detects a:
	Land vs Land
	Take Off vs Land
	Cross vs Land
	Take Off vs Take Off (converging SIDs)
	CATC Alert and how it will be presented on the Tower Runway Controller's HMI.
	Pre-Conditions The ATC system is equipped with A-SMGCS surveillance, Routing and a means to input ATC clearances.
	Aircraft A has already received a clearance (i.e. Land, Take Off, Cross)
	Post Conditions The CATC Alert is resolved and the system no longer displays the alert.
	Actor Tower Runway Controller/
	Trigger Aircraft is ready to receive the ATC Clearance, either 'Push Back', 'Taxi' or 'Cross', that is in conflict with another ATC Clearance of this kind, from the Tower Ground Controller (Tower Runway Controller in case of 'Cross' ATC Clearance).





[NSV-4][CATC-13- 14] RMCA/CMAC	This NSV-4 describes the Use Cases CATC-13-14, corresponding to the RMCA/CMAC versus ATC Clearance Alerts.
Clearance	The new operating method introduces two new situations for which an RMCA/CMAC Alerts vs ATC Clearance alert is triggered. The new situations are described as Use Cases in PJ.02-W2-21.1 SPR INTEROP OSED.
	All Use Cases below follow the same basic scheme that is visualized in this diagram, [NSV-4][CATC-13-14] RMCA/CMAC versus ATC Clearance.
	General Conditions (Scope and Summary)
	This Use Case describes how the ATC system detects a RMCA/CMAC alert versus a ATC Clearance alert, and how it will be presented on the Tower Runway Controller's HMI.
	Pre-Conditions
	• The ATC system is equipped with A-SMGCS surveillance and a means to input ATC clearances.
	• There is an active RMCA/CMAC Alert for the runway.
	• The triggered RMCA/CMAC alert is presented on the Tower Runway Controller's HMI.
	• A mobile is waiting to enter or landing on the runway.
	Post Conditions
	The RMCA/CMAC vs Clearance situation is resolved and the alert is no longer presented on the Controller's HMI.
	Actor
	Tower Runway Controller.
	Trigger
	A mobile is ready to enter or landing on the runway with a RMCA/CMAC Alert ongoing.





[NSV-4][CMAC-01] Stand Occupied	This View describes the Use Case CMAC-01 Stand Occupied Alert.	
	If the parking stand of an arriving aircraft is occupied an information alert should be displayed to provide the Controller with situational awareness that he might need to hold the aircraft on a taxiway until the departing aircraft vacates the stand or until an alternative stand is allocated to the arriving aircraft.	
	General conditions (Scope and summary)	
	This Use Case describes how the ATC system detects a Stand Occupied Alert and how it will be presented in the Tower Runway Controller's/Tower Ground Controller's/Apron Manager's HMI	
	Pre-Conditions	
	The ATC system is equipped with A-SMGCS surveillance, Routing and a means to input ATC clearances.	
	A planned route (Taxi In) is assigned to the aircraft considered in this UC.	
	In addition, information regarding the assigned parking stands for each aircraft is available in the ATC system.	
	The ATC system is continuously verifying that any newly assigned parking stand does not conflict with an already allocated stand.	
	Post Conditions	
	The Stand Occupied CMAC is resolved and the alert is no longer displayed on the Controller's HMI.	
	Actor	
	Tower Ground Controller/Apron Manager (collectively referred to as Controller)	
	Trigger	
	A parking stand is assigned to the aircraft taxiing in. (a trigger is not explicitly required here because the parking stand is checked continuously.	





[NSV-4][RWY-01	The Runway Busy Notification is one of the Runway Situational Notifications.
Runway Busy Notification]	It is not a safety nets alert per se, but it is rather an awareness augmentation tool available to the controller in order to constantly keep him/her informed about the operational status of a runway. This notification consists of colour-coding the runway strip (typically yellow) on the HMI to remind the controller that the runway is currently occupied by a mobile, or if him/her or another controller have already granted the runway for usage by landing or departing traffic. The runway is the key shared resource for ATC/ATM, and as such is the most critical area where accidents/incidents can happen. While CATC alerts inform the controller about any potential mistake in giving a clearance, the runway busy notification provides an even more proactive visual indication that a-priori prevents the controller from giving another clearance to use the runway. As soon as all the runway occupancy conditions cease, runway colouring returns to normal.
	The availability of Runway Situational Notifications is a safety measure on top of existing safety net alerts, and it is therefore considered as an additional Safety barrier.
	Scope/Description
	This Use Case describes the working principles and the presentation of the Runway Busy Notifications for ATC.
	Actors
	Tower Runway Controller/Tower Ground Controller (collectively referred to as Controller).
	Pre-conditions
	• The ATC system is equipped with A-SMGCS surveillance and a means to input ATC clearances.
	• The controller's HMI has a Runway Busy Notification GUI element (the runway strip) that indicates the runway operational status to the controller on the HMI.
	Post conditions
	• The notification is displayed on the HMI of the Controller's HMI (directly on the runway strip).
	 If the conditions cease to exist the notification disappears.
	Trigger
	1. There is currently a target (vehicle or aircraft) on the runway, OR





2. a Landing, Line Up, Take-Off or Cross clearance has been given to at least one
flight on that runway.





[NSV-4][RWY-02]	The Runway In Conflict Notification is one of the Runway Situational Notifications.
Notification	It is an enhancement in the presentation of safety net alerts concerning the runway (RMCA, CMAC or CATC). During his routine work, especially in high-density traffic and peak hours, the controller is constantly receiving stimuli and simultaneously focusing on different movements and different portions of his/her area of interest. In heavy workload conditions, stress and fatigue, even if the safety nets alerts are in place and work correctly, they might be overlooked or ignored.
	The Runway In Conflict Notification consists of colour-coding the runway strip (typically red) on the HMI to immediately show to the controller that the runway is currently involved in at least one conflict. The notification is triggered simultaneously with the first safety net alert involving a runway (RMCA, CMAC or CATC). Once the Runway In Conflict colouring happens, the controller, in case he/she has not noticed the alert via the track labels on the HMI or via alert lists, will immediately assess the situation on the runway and recover his awareness about the impending danger, therefore being able to take necessary actions. As soon as all the alerting conditions cease, and the safety net alerts are removed, also the runway colouring returns to normal.
	The availability of Runway Situational Notifications is a safety measure on top of existing safety net alerts, and it is therefore considered as an additional Safety barrier.
	Scope/Description
	This Use Case describes the working principles and the presentation of the Runway In Conflict Notifications for ATC.
	Actors
	Tower Runway Controller/Tower Ground Controller/Apron Manager (collectively referred to as Controller).
	Pre-conditions
	• The ATC system is equipped with A-SMGCS surveillance and Safety Net alerting tool.
	• The controller's HMI has a Runway Busy Notification GUI element that indicates the runway operational status to the controller on the HMI.
	Post conditions
	• The notification is displayed on the HMI of the Controller's HMI (directly on the runway strip).





• If the conditions cease to exist, the notification disappears.

Trigger

One or more of the following conditions:

1. a RMCA alert is triggered;

2. a CMAC alert involving the runway (e.g., a landing on wrong runway) is triggered;

3. a runway CATC alert is triggered (e.g., LAND/LAND, LINEUP/LAND, CROSS/LAND, etc...).

Table 8. PJ.02-W2-21.1 Solution Overview - System Process

3.1.1.3 Applicable standards and regulations

Regulatory Framework Considerations

This SESAR Solution is currently not part of the European regulatory framework.

Nevertheless.

- The sub-service 'Extended Airport Safety Nets for Controllers at A-SMGCS Airports' is linked • to the deployment of the SESAR Solution #02, which is part of the Common Project One (CP1) in Commission Implementing Regulation (EU) No 2021/116². Hence, the enhancements proposed in the specific function of previous Wave 1 Solution PJ03B-01 should be considered for the deployment of SESAR Solution #02. Particularly, the two subfunctions "Update of CATC for Runway operations" and "Update of CMAC" are relevant as they clarify or enhance the triggering conditions of alerts defined in SESAR Solution #02:
 - To even more reduce the risk of nuisance alerts:
 - To cover additional conflicting situations

Performance of Airport Safety Net for Controller (Probability of conflict detection and probability of false alert) strongly relies on the airport surveillance (A-SMGCS or Alternative surveillance). Consequently, and depending on the local environment, the implementation of the European ADS-B Mandate³ could further support the deployment of AO-0104-B.

³ In Europe, Regulation 1207/2011 laying down requirements for the performance and the interoperability of surveillance for the single European sky (SPI-IR) and its amendments Regulation 1028/2014 and Regulation 2017/386 apply. The EU legislation requires all aircraft operating Instrument Flight Rules (IFR)/General Air Traffic (GAT) in Europe to be compliant with Mode S Elementary Surveillance, whilst aircraft with maximum Take-Off Mass greater than 5700kg or maximum cruising True Air Speed Founding Members 35



² The Common Project One ('CP1') is established to support the implementation of the European Air Traffic Management ('ATM') Master Plan.



Standardization Framework Considerations

EUROCAE, through its Working Group WG-41 (A-SMGCS) was supported by the Project in SESAR 1 for the update of the Minimum Aviation System Performance Standards (MASPS) for the A-SMGCS for the coverage of the SESAR Solution #02.

As part of PJ.02-W2-21.1 activities, Institutional Enablers have been created for published standards, so that they are linked to the relevant system Enablers. Through this Institutional Enablers, the needs for updating the relevant Standards are documented. The actions performed in EATMA through the proper Change Requests are presented below.

Firstly, STD-164 has been created for updating EUROCONTROL-SPEC-171 (Version 3.0), which contains the specification for A-SMGCS Services. STD-164 has been set as an "Enabling" Enabler for AERODROME-ATC-06b, AERODROME-ATC-07b, AERODROME-ATC-115 and AERODROME-ATC-116. EUROCONTROL-SPEC-171 will need to be updated by EUROCONTROL in order to integrate the "Extended CMAC and CATC" function.

Code	STD-164
Title	EUROCONTROL-SPEC-171 (Version 3.0)
Description	EUROCONTROL Specification for Advanced-Surface Movement Guidance and Control System (A-SMGCS) Services (edition 3.0)
Publication date	Targeted Q1 2025
System EN it is supporting	AERODROME-ATC-06b, AERODROME-ATC-07b, AERODROME-ATC-115, AERODROME-ATC-116
Change Request	CR-07380

Also, it was agreed that EUROCAE ED-87F should consider the Solution, so STD-165 Enabler was created linked to this Standard via CR 07381.

Code	STD-165
Title	EUROCAE ED-87F
Description	MASPS for Advanced Surface Movement Guidance and Control Systems (A- SMGCS) Levels 1 and 2
Publication date	Targeted Q2 2026
System EN it is supporting	AERODROME-ATC-06b, AERODROME-ATC-07b, AERODROME-ATC-115, AERODROME-ATC-116
Change Request	CR-07381

STD-165 has been set as an "Enabling" Enabler for AERODROME-ATC-06b, AERODROME-ATC-07b, AERODROME-ATC-115 and AERODROME-ATC-116. Similarly to EUROCONTROL-SPEC-171 (version 3.0),

greater than 250kts must be compliant with both Mode S Enhanced Surveillance and ADS-B out requirements. Compliance is mandated by 7 June 2020 for both retrofit and new made aircraft.




EUROCAE WG-41 will need to update the MASPS in EUROCAE ED-87F to also integrate this sub-function of the SESAR Solution.





3.1.2 Capability Configurations required for the SESAR Solution

The following table provides a picture of the Capability Configurations required for implementing the SESAR Solution PJ.02-W2-21.1.

SESAR Solution ID and Title	Capability Configurations (CCs) (from EATMA)	Sub-Operating Environment(s) where the CCs operate	Capabilities (from EATMA)	Nodes (from EATMA)	Stakeholders (from EATMA)
PJ.02- W2-21.1 – Extended Airport Safety Nets at A-SMGCS Airports	Civil Aircraft	Airport; Terminal Airspace;	Clearance/Instruction Management; Ground Collision Avoidance; Mid-Air Collision Avoidance; Surface Route Management;	Flight Deck;	Civil Scheduled Aviation;
	Communication Infrastructure	Airport; En-Route; Network; Terminal Airspace;	Communication;		Civil CNS Service Provider; Military CNS Service Provider;
	TWR	Airport;	Ground Collision Avoidance; Surface Guidance Provision; Surface Route Management;	Aerodrome ATS;	Civil ATS Aerodrome Service Provider; Military ATS Aerodrome Service Provider;

Table 9: List of Capability Configuration required for the SESAR Solution PJ.02-W2-21.1

3.2 Changes imposed by the SESAR Solution on the baseline Architecture

This section describes which changes are needed compared to the baseline in EATMA in order to deliver the Capabilities improvements (using Technical Systems/Functional Blocks, Functions and Roles). The information in this section is provided by Enablers (system Enablers in the case of PJ.02-W2-21.1). The table contains the Functions created within PJ.02-W2-21.1, which are linked to the Enablers through the proper Change Requests.





Enabler ID (from EATMA)	Enabler Title (from EATMA)	Changes
AERODROME-ATC-06b	A-SMGCS incorporating	The following improvements have been introduced (documented in CR 05578).
	detects Conflicting ATC Clearances (CATC) on the entire airport surface	Aerodrome Safety Nets is able to perform the following Functions:
		 Detect Conflict with Given ATC Clearance (for entire airport surface)
		- Detect Conflict with Given ATC Clearance (Runway Related)
		 Detect Conflict with Potential ATC Clearance (for entire airport surface)
		- Detect Runway In Conflict
		 Raise CATC Alert (for entire airport surface)
		- Raise CATC Alert (Runway Related)
		- Raise Runway In Conflict Notification
		Controller Human Machine Interaction Management Aerodrome ATC is able to perform the following Function:
		- Display CATC Alert (extended set)
		- Display CATC Alert (runway related)
		- Display Predictive Indicator
		- Display Runway In Conflict Notification
		- Record Conditional Clearance





AERODROME-ATC-07b	A-SMGCS incorporating the function that provides an advanced set of Conformance Monitoring Alerts for Controllers (CMAC) on the movement area	 The following improvements have been introduced (documented in CR 05578). Conformance Monitoring is able to perform the following Functions: Check Updated Stand Information Deactivate Stand Occupied Alert Detect CMAC Conflict Alert (extended set) Raise CMAC Conflict Alert (extended set) Controller Human Machine Interaction Management Aerodrome ATC is able to perform the following Functions: Display Runway In Conflict Notification Display Stand Occupied Alert Remove Stand Occupied Alert Detect Runway In Conflict 0 Detect Runway In Conflict 0 Detect 0
		- Raise Runway in Conflict Notification
AERODROME-ATC-115	A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts	introduced (documented in CR 07099).
		Aerodrome Safety Nets is able to perform the following Functions:
		 Raise RMCA/CMAC vs ATC Clearance Alert
		- Detect Runway In Conflict Notification
		- Raise Runway In Conflict Notification
		Controller Human Machine Interaction Management Aerodrome ATC is able to perform the following Function:





		 Display RMCA/CMAC vs ATC Clearance Alert Display Runway In Conflict Notification
AERODROME-ATC-116	A-SMGCS incorporating the function that provides Runway-Busy notifications	 The following improvements have been introduced (documented in CR 07098). Aerodrome Safety Nets is able to perform the following Functions: Detect Runway Busy Raise Runway Busy Notification Controller Human Machine Interaction Management Aerodrome ATC is able to perform the following Function: Display Runway Busy Notification

Table 10: PJ.02-W2-21.1 Changes on the baseline's Architecture





4 Technical Specifications

4.1 Functional architecture overview

Solution PJ.02-W2-21.1 impacts the EATMA Dataset 21 Architecture, by improving the following existing Functional Blocks (by duplicating them and creating new Functions for them):

Technical System	Functional Block	Description
Aerodrome ATC	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-W2-21.1)	This functional block provides controllers with a graphical user interface and with the means to interact with the Aerodrome ATC system. The CHMIM Functional Block collects and integrates different Human Machine Interfaces developed for the different airport systems into just one homogenous set of configurable and customisable Tower Human Machine Interfaces. This duplication intends to provide the CHMI with functionalities to provide the Controllers with the appropriate information in order to deal with the Extended Safety Nets at A-SMGCS airports.
	Aerodrome Safety Nets (PJ.02-W2- 21.1)	This functional block detects and triggers alerts within manoeuvring areas (runway/s and taxiways) potential conflicts between two objects (i.e. aircraft or vehicles), or between an object and a restricted area, by processing the actual traffic situation. It is also extended on final approach and take-off path. The potential safety hazards situations on the airport movement area comprise runway incursion, intrusion in protected areas, aircraft/aircraft and aircraft/vehicle collisions.
		This duplication intends to detect potential and actual conflicting situations, incursions and non-conformance to procedures or ATC clearances, involving mobiles (and stationary traffic) on runways, taxiways and in the apron/stand/gate area as well as unauthorised/unidentified traffic. Controllers are provided in all cases with the appropriate alerts.
	Conformance Monitoring (PJ.02- W2-21.1)	This functional block is responsible for monitoring and detecting deviations of an aircraft from its taxi plan (including taxi route, parking-bay, runway, and clearance requested and approved as Push-Back, Taxi, Line-Up, Crossing Runway, Take-Off, Landing) and/or from planning times. This function checks the actual aircraft position against the predicted trajectory. In case of detected deviation this function triggers warning distribution in order to alert concerned controllers. This function also perform the detection of





Technical System	Functional Block	Description
		conflicting ATC clearances (CATC) and the detection of non- conformance to ATC instructions and/or procedures.
		In addition, this Functional Block detects the situation where the assigned stand for an aircraft is occupied by another aircraft. Also, the Conformance Monitoring is capable of detecting aircraft which starts taxiing without the proper clearance, which is one of the alerts included in the Extended CMAC Alerts.

Table 11. Functional Blocks introduced by PJ.02-W2-21.1

New Functions are defined for the abovementioned Functional Blocks (which are part of the Aerodrome ATC Technical System), in order to improve them so that the Solution concept can be implemented.

The following context diagram depicts the functions, inputs and outputs of the Surface Guidance and Routing Management that enable its correct functioning, where the Safety related data are included. The diagram belongs to EUROCONTROL SPEC-171 [35].









4.1.1 Resource Connectivity view (one section per NSV-1)

The following diagram represents the high-level interactions between the Capability Configurations involved in the Solution PJ.02-W2-21.1. The Resource Connectivity for the Solution is described, namely the voice exchanges between the Tower and the Civil Aircraft. No Services have been created for this Solution.

This view supports the Use Cases referred to Common Use Cases, Extended CATC (for Ground operations), Updated CATC (for Runway operations), RMCA/CMAC Alerts vs Clearance Alerts and Updated CMAC Alerts. These Use Cases are presented in section 3.1.1.2.



Figure 4 : Resource Connectivity Model – PJ.02-W2-21.1 (AO-0104-B)





4.1.1.1 Resource Infrastructure view (of the NSV-2)

Infrastructure elements show the physical realization of Resource Interactions and Services.

This Supporting Infrastructure is the set of:

- Capability Configurations:
 - o TWR
 - Communication Infrastructure
 - o Civil Aircraft
- Main Technical Systems:
 - Aerodrome ATC
 - \circ Voice
 - \circ Aircraft
- System Ports:
 - ATC_VOICE
 - VOICE_RADIO_AIR
 - VOICE_GND
 - VOICE_TELEPHONE







Figure 5 : Infrastructure connectivity model – PJ.02-W2-21.1 (AO-0104-B)

4.1.1.2 Resource Orchestration view (all NSV-4s linked to the NSV-1)

Different NSV-4 diagrams have been modelled in order to describe the resource orchestration corresponding to the Solution Use Cases.

The logical architecture is modelled in MEGA, and therefore compliant with EATMA, and lists all functional components of the Extended Safety Nets for Controllers at A-SMGCS Airports and their dependencies and relations. The logical architecture is modelled in MEGA, and therefore compliant with EATMA, and lists all functional components of the remote tower solutions and their dependencies and relations.

The diagrams included in this document may lack resolution. All the models are available at (credentials needed to access MEGA tool required):

https://www.srvs.nm.eurocontrol.int/Hopex/default.aspx#start





4.1.1.2.1 [NSV-4][CATC-01] Predictive Indicator



Figure 6. [NSV-4][CATC-01] Predictive Indicator



Function	Description	
Assess Predictive Conflict Indication	The ATCO (Tower Runway Controller/Tower Ground Controller/Apron Manager) assesses the Predictive CATC Indication. The Controller decides either not to give the next clearance or that the situation is safe, so he/she ignores the Predictive Indicator display.	
Detect Conflict with Potential ATC Clearance (for entire airport surface)	The system detects a potential conflict between a potential ATC Clearance and an already triggered ATC clearance. This is the predictive part of the alert. As an example, this predictive indicator can be triggered each time the ATCO hovers over a particular flight label area displaying the "next clearance". The Safety Net probe function detects if there is a potential clearance conflict and sends that info to the HMI to be displayed on the screen.	
Display Predictive Indicator	In the case that the Safety probe identifies a potential CATC, the HMI flags the concerned aircraft with an indication in order to warn the ATCO that a CATC will be a consequence of giving the next clearance to that aircraft.	
Table 12. [NSV-4][CATC-01] Predictive Indicator Functions		





4.1.1.2.2 [NSV-4][CATC-02] Conditional Clearance



Figure 7. [NSV-4][CATC-02] Conditional Clearance



Function	Description
Provide Clearance under a Specific Condition	The Controller issues a clearance for a mobile A by R/T (or data link) under a specific condition (e.g. that aircraft B has passed).
Record Conditional Clearance	The Controller enters the conditional clearance and the condition on the HMI.
Table 13. [NSV-4][CATC-02] Conditional Clear	ance Functions





4.1.1.2.3 [NSV-4][RWY-01] Runway Busy Notification



Figure 8. [NSV-4] [RWY-01] Runway Busy Notification





Table 14. [NSV-4][RWY-01] Runway Busy N	Notification Functions
Raise Runway Busy Notification	When the busy status is detected for a specific runway, the Aerodrome Safety Nets shall send a notification to the HMI.
Display Runway Busy Notification	The Controller is notified via HMI about the busy status of the runway. The HMI shall colour-code according to local customization the runway for which the Runway Busy Notification is received. The default colouring is resumed when the notification is cancelled, or upon a timeout.
	4. a Runway Cross clearance is given to cross the runway.
	3. a Line Up or Take-Off clearance is given to depart from the runway;
	2. a Landing clearance is given to land on the runway;
	1. a mobile is physically on the runway;
Detect Runway Busy	The Extended Airport Safety Nets detects that a specific runway is busy when at least one in the following conditions is verified:
Assess Runway Busy Notification	The Controller sees the information regarding the busy status of the runway and, if unaware, assesses the reason for the notification. Then, the Controller will conduct operations normally by taking into account the visible information in his decision-making process.
Function	Description





[NSV-4][RWY-02] Runway In Conflict Notification Ā 🛃 Aerodrome Safety Nets (PJ.02-W2-21.1) A RMCA / CMAC / Runway in CATC alert for the conflict is 👝 Detect Runway 🐻 Raise Runway In notified runway is triggered In Conflict Conflict Notification **→**O () + $\left| + \right|$ Management ATC (PJ.02-W2-21.1) * Runway In Conflict roller Human Machine Notification is 🐻 Display displayed Runway in Conflict TWR CC **→**O Notification + Runway In Conflict Notification 🛃 Tower Runway Controller (PJ.02-W2-21.1) ATCO verifies the alert and conducts Assess Runway operations In Conflict accordingly Notification **►**O $\left| + \right|$

4.1.1.2.4 [NSV-4][RWY-02] Runway In Conflict Notification

Figure 9. [NSV-4][RWY-02] Runway In Conflict Notification



Function	Description
Assess Runway In Conflict Notification	The Controller sees the information regarding the conflict in the runway and, if unaware, assesses the reason for the notification. Then, the Controller will verify the alerts triggering the notification and will treat them as any Safety Nets alert.
Detect Runway In Conflict	The Extended Airport Safety Nets detects that a specific runway is in conflict when at least one in the following conditions is verified:
	1. an RMCA alert is triggered on the runway;
	2. a CMAC alert is triggered on the runway, e.g. Landing wIthout Clearance, Lineup without Clearance, Landing on Wrong Runway, etc.;
	3. a CATC alert involving the runway is triggered, e.g. LAND/LAND, CROSS/LAND, LINEUP/LAND, LINEUP/LAND, LINEUP/LINEUP, TAKEOFF/TAKEOFF, CROSS/TAKEOFF.
Display Runway in Conflict Notification	The Controller is notified via HMI about the runway in conflict situation. The HMI shall colour-code according to local customization the runway for which the Runway In Conflict Notification is received. The default colouring is resumed when the notification is cancelled, or upon a timeout.
Raise Runway In Conflict Notification	When the runway in conflict status is detected, the Aerodrome Safety Nets shall send a notification to the HMI.
Table 15. [NSV-4][RWY-02] Runway In Conflic	t Notification





4.1.1.2.5 [NSV-4][CATC-03-04-05-06-07-08] Extended CATC (for Ground operations)



Figure 10. [NSV-4][CATC-03-04-05-06-07-08] Extended CATC (for Ground operations)





Function	Description
Detect Conflict with Given ATC Clearance (for entire airport surface)	The ATC system verifies the relative position of both aircraft which have been given a clearance based on A-SMGCS surveillance data. The system detects whether there is a CATC between aircrafts.
Assess CATC Alert	The Controller (Tower Runway Controller/Tower Ground Controller/Apron Manager) assesses the Conflicting ATC Clearance (CATC) Alert to determine whether the alert needs resolving actions and which ones would be needed in that case (e.g. Cancel Push Back, Stop Taxi, Hold at Point, etc).
Display CATC Alert (extended set)	The ATC system displays a Conflicting ATC Clearance (CATC) Alert for the entire airport surface on the Controller's HMI, clearly identifying the pair of aircraft involved and the reason for the alert (Push/Push, Taxi/Push, Taxi/Taxi, Taxi/Taxi deadlock, Taxi/Cross deadlock).
Manage CATC Alert	The Controller (Tower Runway Controller/Tower Ground Controller/Apron Manager) verifies the situation and applies the proper actions to resolve the CATC situation.
Provide ATC Clearance	The Controller (Tower Runway Controller/Tower Runway Controller/Apron Manager) gives the ATC Clearance to an aircraft.
Raise CATC Alert (for entire airport surface)	The system has detected a CATC in the entire airport surface and raises an alert to inform the ATCO about it.
Record ATC Clearance	The Controller (Tower Runway Controller/Tower Runway Controller/Apron Manager) inputs the ATC Clearance in the CHMI.
Record Clearance	The ATC Clearance is recorded in the CHMI.

Table 16. [NSV-4][CATC-03-04-05-06-07-08] Extended CATC (for Ground operations) Functions









Figure 11. [NSV-4][CATC-09-10-11-12] Updated CATC (for Runway operations)

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Function	Description
Assess CATC Alert	The Controller (Tower Runway Controller/Tower Ground Controller/Apron Manager) assesses the Conflicting ATC Clearance (CATC) Alert to determine whether the alert needs resolving actions and which ones would be needed in that case (e.g. Cancel Push Back, Stop Taxi, Hold at Point, etc.).
Detect Conflict with Given ATC Clearance (Runway Related)	The ATC system verifies the relative position of both aircraft which have been given a clearance based on A-SMGCS surveillance data. The system detects whether there is a CATC between aircrafts. The system performs this check for the Runway area. The possible CATC cases are the following: Land vs Land, Take Off vs Land, Cross vs Land, Take Off vs Take Off (converging SIDs).
Display CATC Alert (runway related)	The ATC system displays a Runway related Conflicting ATC Clearance (CATC) Alert for on the Controller's HMI, clearly identifying the pair of aircraft involved and the reason for the alert (Land vs Land, Take Off vs Land, Cross vs Land, Take Off vs Take Off).
Manage CATC Alert	The Controller (Tower Runway Controller/Tower Ground Controller) verifies the situation and applies the proper actions to resolve the CATC situation.
Provide ATC Clearance	The Controller (Tower Runway Controller/Tower Runway Controller) gives the ATC Clearance to an aircraft.
Raise CATC Alert (Runway Related)	The system has detected a Runway related CATC and raises an alert to inform the ATCO about it.
Record ATC Clearance	The Controller (Tower Runway Controller/Tower Runway Controller) inputs the ATC Clearance in the CHMI.
Record Clearance	The ATC Clearance is recorded in the CHMI.

Table 17. [NSV-4][CATC-09-10-11-12] Updated CATC (for Runway operations) Functions





4.1.1.2.7 [NSV-4][CATC-13-14] RMCA/CMAC versus ATC Clearance



Figure 12 : [NSV-4][CATC-13-14] RMCA/CMAC versus ATC Clearance





Function	Description
Assess RMCA/CMAC vs ATC Clearance Conflict Alert	The Tower Runway Controller assesses the possible solutions for RMCA/CMAC vs ATC Clearance.
Display RMCA/CMAC vs ATC Clearance Alert	The RMCA/CMAC vs ATC Clearance alert is displayed in the Tower Runway Controller's HMI, clearly identifying the mobiles involved and the reason for the alert.
Manage Conflict RMCA/CMAC vs ATC Clearance	The Tower Runway Controller manages properly the RMCA/CMAC vs ATC Clearance conflict, presumably by cancelling the ATC Clearance.
Provide ATC Clearance	The Controller (Tower Runway Controller/Tower Runway Controller/Apron Manager) gives the ATC Clearance to an aircraft.
Raise RMCA/CMAC vs ATC Clearance Alert	The ATC detects that the input of LAND/CROSS/ENTER/LINE-UP/TAKE-OFF is not compatible with an active RMCA/CMAC for the same runway and triggers a RMCA/CMAC vs ATC Clearance alert to warn the Tower Runway Controller that a potential conflict has been detected.
Record ATC Clearance	The Controller (Tower Runway Controller/Tower Runway Controller/Apron Manager) inputs the ATC Clearance in the CHMI.
Record Clearance	The ATC Clearance is recorded in the CHMI.

Table 18. [NSV-4][CATC-13-14] RMCA/CMAC versus ATC Clearance Functions





4.1.1.2.8 [NSV-4][CMAC-01] Stand Occupied



Figure 13 : [NSV-4][CMAC-01] Stand occupied





Function	Description
Assess Stand Occupied Alert	The responsible Tower Controller/Apron Manager verifies the situation and assesses the necessary actions to resolve the conflict.
Check Updated Stand Information	The ATC system verifies that the updated stand information is no longer conflicting. This function is part of the actions to solve the 'Stand occupied' alert. This is only an alert resolution example.
Deactivate Stand Occupied Alert	The ATC system removes the Stand Occupied Alert from the Tower Controller Working Positions HMI.
Detect CMAC Conflict Alert	The ATC System checks whether the stand that has been assigned to the aircraft is already occupied by another aircraft.
Display Stand Occupied Alert	A Stand Occupied alert is displayed in the Controller's HMI.
Manage Stand Occupied Alert	The responsible Tower Controller/Apron Manager manages the Stand Occupied conflict by the means of Clearances and including possible co-ordination with other involved Airport actors.
Raise CMAC Conflict Alert	The system triggers a CMAC Stand Occupied alert when it is detected that the newly assigned stand is already being occupied by another aircraft.
Record ATC Clearance	The Controller (Tower Runway Controller/Tower Runway Controller/Apron Manager) inputs the ATC Clearance in the CHMI.
Record Clearance	The ATC Clearance is recorded in the CHMI.
Remove Stand Occupied Alert	The Stand Occupied Alert is no longer displayed in the Controller's HMI.

Table 19. [NSV-4][CMAC-01] Stand Occupied Functions





4.1.2 Resource Composition

The following Functional Blocks within Aerodrome ATC Technical System have been duplicated in order to create new Functions for them:

- Aerodrome Safety Nets
- Conformance Monitoring
- Controller Human Machine Interaction Management Aerodrome ATC

Aerodrome ATC	Conformance Monitoring Surface Routing Surface Buidance Management Surface Management Surface Management Surface Management
Aerodrome Weather Information Management	Support Functions Aerodrome ATC
Departure Management	Aerodrome Flight Data Processing Querational Aerodrome ATC Aerodrome Safety Nets Query illance Window

Table 20. Functional Blocks duplicated within Aerodrome ATC

4.1.3 Service view

N/A, since no new Services have been created for Solution PJ.02-W2-21.1.

4.2 Functional and non-Functional Requirements

4.2.1 Generic Requirements

Identifier	REQ-02-W2-21.1-TS-RWAY.0010
Title	Runway Situational Notifications - Runway Busy logic





Requirement	 The Extended Airport Safety Nets function shall send to the Controller HMI a "Runway Busy Notification" for a specific runway when at least one in the following conditions is verified: a mobile is physically on the runway; a Landing clearance is given to land on the runway; a Line Up or Take-Off clearance is given to depart from the runway; a Runway Cross clearance is given to cross the runway. 	
Status	<in progress=""></in>	
Rationale	Define the logic of the Runway Busy notification	
Category	<functional></functional>	

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-RWAY.0010
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-116_A-SMGCS incorporating the function that provides Runway-Busy notifications
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Detect Runway Busy Raise Runway Busy Notification

Identifier	REQ-02-W2-21.1-TS-RWAY.0020
Title	Runway Situational Notifications - Runway Busy presentation
Requirement	The Controller's HMI shall colour-code according to local customization the runway for which a Runway Busy Notification is received.
Status	<in progress=""></in>





Rationale	One option is to colour the runway strip in yellow. The default colouring is resumed when the notification is cancelled, or upon a timeout.
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-RWAY.0010
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-116_A-SMGCS incorporating the function that provides Runway-Busy notifications
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Display Runway Busy Notification

Identifier	REQ-02-W2-21.1-TS-RWAY.0030	
Title	Runway Situational Notifications - Runway In Conflict logic	
	The Extended Airport Safety Nets function shall send to the Controller HMI a "Runway In Conflict Notification" for a specific runway when at least one in the following conditions is verified:	
Requirement	1. an RMCA alert is triggered on the runway;	
	2. a CMAC alert is triggered on the runway;	
	3. a CATC alert involving the runway is triggered.	
Status	<in progress=""></in>	
Rationale	Define the logic of the Runway In Conflict notification. Examples of CMAC involving the runway are: Landing without Clearance, Lineup without Clearance, Landing on Wrong Runway, etc Examples of CATC involving the runway are: LAND/LAND, CROSS/LAND, LINEUP/LAND, LINEUP/LINEUP, TAKEOFF/TAKEOFF, CROSS/TAKEOFF.	
Category	<functional></functional>	





Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-RWAY.0005
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-115_A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Detect Runway In Conflict Raise Runway In Conflict Notification

[REQ]

Identifier	REQ-02-W2-21.1-TS-RWAY.0040
Title	Runway Situational Notifications - Runway In Conflict presentation
Requirement	The Controller's HMI shall colour-code according to local customization the runway for which a Runway In Conflict Notification is received.
Status	<in progress=""></in>
Rationale	One option is to colour the runway strip in red. The default colouring is resumed when the notification is cancelled, or upon a timeout.
Category	<functional></functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-RWAY.0005
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-115_A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Display Runway In Conflict Notification





[REQ]

Identifier	REQ-02-W2-21.1-TS-CA01.0010
Title	Generic CATC – what-if triggering (predictive indicator)
Requirement	The Extended Airport Safety Nets should trigger a "what if" clearance indication for a mobile if giving the next clearance leads to a CATC alert.
Status	<in progress=""></in>
Rationale	The clearance is the next clearance on the planned route assigned to the mobile The Controller HMI displays an indicator beside the clearance button, so that the Controller is warned about the potential CATC conflict.
Category	<functional></functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0021
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Detect Conflict with Potential ATC Clearance (for entire airport surface)

Identifier	REQ-02-W2-21.1-TS-CA01.0020
Title	Generic CATC – alert communication
Requirement	The Extended Airport Safety Nets shall send an alert report to the Controller HMI when an alert is triggered.





Status	<in progress=""></in>
Rationale	The appropriate Controller(s)' HMI needs the information of the alert in order to present it.
Category	<functional></functional>

Relationship	Linked Element Type	ldentifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0004
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0003
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0002
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<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0008
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<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0020
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-RWAY.0005
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-RWAY.0010
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise CATC Alert (for entire airport surface) Raise CATC Alert (Runway Related)





[REQ]

Identifier	REQ-02-W2-21.1-TS-CA01.0030
Title	Generic CATC – alert display
Requirement	When a CATC alert is triggered, the HMI should give the controller a quick way to revoke the clearance given or to suppress the audio alert.
Status	<in progress=""></in>
Rationale	The revocation of the clearance should be entered in the alert list or where the clearance entry was made (ECI, e.g., on the flight strip or the destination label).
	The audio alert can be suppressed if the controller is in control of the situation and entered the conflicting clearance on purpose.
Category	<functional></functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0002
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0003
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0004
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0006
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0007
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<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0009
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<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0013
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0020





<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-RWAY.0005
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-RWAY.0010
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-W2- 21.1)
<allocated_to></allocated_to>	<function></function>	Display CATC Alert (extended set) Display CATC Alert (runway related)

[REQ]

Identifier	REQ-02-W2-21.1-TS-CA01.0040
Title	Generic CATC – what-if display (predictive indicator)
Requirement	The HMI should show an indicator if the "what if" clearance indication is triggered.
Status	<in progress=""></in>
Rationale	The Controller needs to know that a potential conflict can occur in case the second clearance is given.
Category	<functional></functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0021
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-W2- 21.1)
<allocated_to></allocated_to>	<function></function>	Display Predictive Indicator





Identifier	REQ-02-W2-21.1-TS-CA01.0050
Title	Generic CATC – alert termination
Requirement	The Extended Airport Safety Nets shall terminate the alert when their triggering conditions no longer hold.
Status	<in progress=""></in>
	ATCO needs to know that the alert conditions no longer exist, i.e. the conflict is resolved
Rationale	The alert will remain activated until the conflicted situation changes because of a Controller action or other circumstances
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0003
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0004
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0005
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0006
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<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0008
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0002
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0009
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0010
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0011
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0012
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0013
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0014
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0015
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0020





<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-RWAY.0005
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-RWAY.0010
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)

[REQ]

Identifier	REQ-02-W2-21.1-TS-CA01.0060
Title	Generic CATC – what-if termination (predictive indicator)
Requirement	The Extended Airport Safety Nets shall terminate the "what if" clearance indication when their triggering conditions no longer hold.
Status	<in progress=""></in>
Rationale	ATCO needs to know that the "what if" conditions no longer exist .The "what if" clearance indication will remain activated until the predicted conflicted situation changes because of a Controller action or other circumstances.
Category	<functional></functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0021
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)

Identifier	REQ-02-W2-21.1-TS-CA01.0061
Title	Generic CATC – alert state




Requirement	The HMI shall show the severity of the alert (based on a two- level scale) to the Controller if an alert is triggered.	
Status	<in progress=""></in>	
	ATCO needs to be informed promptly about the severity of any alert triggered by the Extended Airport Safety Nets.	
Rationale	The severity can be configurable depending on local implementations for Ground alerts. The classification of alerts allows the Controller to better understand the severity of the situation.	
	Yellow and Red are the normal visual colours coding for these types of alerts, depending on the severity.	
Category	<functional></functional>	

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0020
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-W2- 21.1)
<allocated_to></allocated_to>	<function></function>	Display CATC Alert (extended set) Display Conflict RMCA/CMAC vs ATC Clearance Display CATC Alert (runway related)

Identifier	REQ-02-W2-21.1-TS-CA01.0160
Title	CATC - Conditional Clearance





Requirement	The Controller HMI shall allow the introduction of a condition linked to a clearance issued to a mobile.
Status	<in progress=""></in>
Rationale	The input of conditional clearances allows the Controller to pass mobile priorities via RT to the Flight Crew and into the HMI.
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0022
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-W2- 21.1)
<allocated_to></allocated_to>	<function></function>	Record Conditional Clearance

4.2.2 CATC for Ground Operations

Identifier	REQ-02-W2-21.1-TS-GN01.0010	
Title	Push Back vs Push Back – alert triggering	
Requirement	The Extended Airport Safety Nets shall trigger an alert upon a PUSH BACK clearance if the PUSH BACK trajectory is identified to be conflicting with the trajectory of a previously input PUSH BACK clearance according to local rules.	
Status	<in progress=""></in>	
Rationale	The local rules could consist of matching the two estimated trajectories in space and time. The system should predict if the two mobiles will be distant more than a given threshold all the time.	
Category	<functional></functional>	





Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0002
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise CATC Alert (for entire airport surface)

[REQ]

Identifier	REQ-02-W2-21.1-TS-GN01.0020	
Title	Push Back vs taxi – alert triggering	
Requirement	The Extended Airport Safety Nets shall trigger an alert upon a TAXI clearance if the TAXI trajectory is identified to be conflicting with the trajectory of a previously input PUSH BACK clearance according to local rules.	
Status	<in progress=""></in>	
Rationale	The local rules could consist of matching the two estimated trajectories in space and time. The system should predict if th two mobiles will be distant more than a given threshold all the time. Time and distance separation parameters of the aircraft	
	concerned will be subject to a local implementation decision.	
Category	<functional></functional>	

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0003
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects





		Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise CATC Alert (for entire airport surface)

Identifier	REQ-02-W2-21.1-TS-GN01.0030	
Title	Taxi vs Push Back – alert triggering	
Requirement	The Extended Airport Safety Nets shall trigger an alert upon entering a PUSH BACK clearance if the PUSH BACK trajectory conflicts with the cleared route of a previously input TAXI clearance according to local rules.	
Status	<in progress=""></in>	
Rationale	The local rules could consist of matching the two estimated trajectories in space and time. The system should predict if th two mobiles will be distant more than a given threshold all th time. Time and distance separation parameters of the aircraft	
	concerned will be subject to a local implementation decision.	
Category	<functional></functional>	

[REQ Trace]

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0004
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise CATC Alert (for entire airport surface)





Identifier	REQ-02-W2-21.1-TS-GN01.0040
Title	Taxi vs Taxi (deadlock) – alert triggering
Requirement	The Extended Airport Safety Nets shall trigger an alert upon entering a TAXI clearance if the TAXI cleared route is identified to be on the same taxiway and in opposite direction with respect to the cleared route of a previously input TAXI clearance.
Status	<in progress=""></in>
Rationale	The situation of two mobiles cleared to proceed on the same taxiway from opposite directions would create a deadlock. Time and distance separation parameters of the aircraft concerned will be subject to a local implementation decision.
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0006
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise CATC Alert (for entire airport surface)

Identifier	REQ-02-W2-21.1-TS-GN01.0050
Title	Taxi vs Taxi (conflict) – alert triggering
Requirement	The Extended Airport Safety Nets shall trigger an alert upon entering a TAXI clearance if the cleared route is identified to be conflicting with the route of a previously input TAXI clearance according to local rules.
Status	<in progress=""></in>





Rationale	This concerns the case when an aircraft can be taxied without prior pushback. The local rules could consist on matching the two estimated trajectories in space and time. The system should predict if the two mobiles will be distant more than a given threshold all the time. Time and distance separation parameters of the aircraft concerned will be subject to a local implementation decision
	concerned will be subject to a local implementation decision.
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0005
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise CATC Alert (for entire airport surface)

Identifier	REQ-02-W2-21.1-TS-GN01.0060
Title	Taxi vs Cross (deadlock) – alert triggering
Requirement	The enhanced airport safety nets will trigger an alert upon entering a CROSS clearance if it detects that the cleared route on the exitway/taxiway beyond the runway meets an aircraft with a TAXI clearance in opposite direction.
Status	<in progress=""></in>





Rationale	The situation of two mobiles cleared to proceed on the same taxiway from opposite directions might create a deadlock. This requirement is identical to REQ-02-W2-21.1-TS-GN01.0040 with the difference that the runway crossing aircraft rolls over one or more AoR borders. This must be taken into account in conflict detection, i.e., conflicts must also be detected across AoR borders. Time and distance separation parameters of the aircraft concerned will be subject to a local implementation decision. Note: The sequence of the clearances is not relevant. CROSS versus TAXI leads to the same deadlock situation. The crucial condition is that the clearances are entered nearly at the same time.
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0007
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise CATC Alert (for entire airport surface)

4.2.3 CATC for Runway Operations

Identifier	REQ-02-W2-21.1-TS-CA01.0070
Title	Land vs Land – alert triggering
Requirement	The Extended Airport Safety Nets shall trigger an alert if it predicts that the distance between two aircrafts with LAND clearances on the same RWY will not meet the RWY separation minima at the time the second aircraft on final approach crosses the threshold





Status	<in progress=""></in>
	The requirement can be expressed by the following formula
	TLR_A > TTT_B
	with
	TLR_A = predicted time to leave RWY (for Aircraft A with LAND clearance)
	and
	TTT_B = predicted time to threshold (for Aircraft B with LAND clearance)
Rationale	
	The prediction of the TLR is calculated based on the remaining distance to the next RWY exit and the actual velocity and deceleration. The prediction of the TTT is calculated based on the remaining distance to the threshold and the actual velocity and deceleration.
	The separation minima and alerting thresholds are configurable parameters that must take into account the local rules, such as low visibility procedures and application of the reduced runway separation minima.
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0009
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise CATC Alert (Runway Related)





Identifier	REQ-02-W2-21.1-TS-CA01.0080
Title	Take off vs Land – alert triggering
Requirement	The Extended Airport Safety Nets shall trigger an alert if they predict that the RWY will still be occupied by Aircraft A, cleared to TAKE OFF, when Aircraft B, on final approach and cleared to LAND, crosses the threshold.
Status	<in progress=""></in>
	The requirement can be expressed by the following formula
	TLR_A > TTT_B
	with
	TLR_A = predicted time to leave RWY (for Aircraft A with LAND clearance)
	and
Rationale	TTT_B = predicted time to threshold (for Aircraft B with LAND clearance)
	The separation minima and alerting thresholds are configurable parameters that have to take into account the local rules, such as low visibility procedures and aplication of the reduced runway separation minima.
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0010
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise CATC Alert (Runway Related)





Identifier	REQ-02-W2-21.1-TS-CA01.0090	
Title	Cross vs Land – alert triggering	
Requirement	The Extended Airport Safety Nets shall trigger an alert if they predict that the runway protected area will be occupied by Aircraft A, cleared to CROSS, when Aircraft B, on final approach and cleared to LAND, crosses the threshold.	
Status	<in progress=""></in>	
	The requirement can be expressed by the following formula	
	TLR_A > TTT_B	
	with	
	TLR_A = predicted time to leave RWY (for Aircraft A with LAND clearance)	
	and	
Rationale	TTT_B = predicted time to threshold (for Aircraft B with LAND clearance)	
	The separation minima and alerting thresholds are configurable parameters that have to take into account the local rules, such as low visibility procedures and application of the reduced runway separation minima.	
	Note: A similar situation is given for LAND versus CROSS where the CROSS clearance is given after the LAND clearances. This is also covered by this requirement.	
Category	<functional></functional>	

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0011
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0012





<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise CATC Alert (Runway Related)

Identifier	REQ-02-W2-21.1-TS-CA01.0100	
Title	TAKE OFF vs TAKE OFF (converging SIDs) – alert triggering	
Requirement	The Extended Airport Safety Nets shall trigger an alert if Aircraft A and Aircraft B are cleared to TAKE-OFF and their air trajectories (SIDs) are converging inside a predefined volume.	
Status	<in progress=""></in>	
	The predefined volume could consist on different shapes; for instance, a cylinder. This predefined volume should ensure that the minimum separation between the two aircrafts is achieved (according to DOC4444).	
Rationale	The system should predict if the trajectories will converge in the predefined area at the same time according to SID information.	
	Aircraft A and B can be in the same or different runways.	
	TAKE-OFF clearances are received by the Controller HMI.	
Category	<functional></functional>	

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0013
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-06b_A-SMGCS incorporating the function that detects Conflicting ATC Clearances (CATC) on the entire airport surface
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)





<ALLOCATED_TO>

<Function>

Raise CATC Alert (Runway Related)

4.2.4 Updated CMAC alerts

[REQ]

Identifier	REQ-02-W2-21.1-TS-CM01.0020	
Title	Stand occupied – alert triggering	
Requirement	The Extended Airport Safety Nets shall trigger an alert if a stand for an arriving flight is occupied by another aircraft, according to local rules.	
Status	<in progress=""></in>	
Rationale	Local rules may determine how far in advance the alert is triggered with respect to the arrival progress. For instance an alert can be triggered if the arrival stand is occupied upon touchdown of the incoming aircraft; or if the stand is occupied and the arrival at the targeted stand is foreseen in less than 'x' minutes (where x is a configurable threshold).	
Category	<functional></functional>	

[REQ Trace]

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02-W2-21.1-SPRINTEROP-CM01.0001
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-07b_A-SMGCS incorporating the function that provides an advanced set of Conformance Monitoring Alerts for Controllers (CMAC) on the movement are
<allocated_to></allocated_to>	<functional block=""></functional>	Conformance Monitoring (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise CMAC Conflict Alert (extended set) Detect CMAC Conflict Alert (extended set)

4.2.5 RMCA/CMAC vs ATC Clearance alerts





Identifier	REQ-02-W2-21.1-TS-CA01.0062
Title	RMCA Alert versus ATC clearance Alert – line-up
Requirement	The Extended Airport Safety Nets shall trigger an alert if it receives from the Controller HMI a LINE-UP clearance for an aircraft while a RMCA alert is active on the same runway.
Status	<in progress=""></in>
Rationale	To prevent the Controller from clearing an aircraft to LINE UP when a RMCA alert is active in the runway, which would be unsafe.
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0014
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-115_A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise RMCA/CMAC vs ATC Clearance Alert

Identifier	REQ-02-W2-21.1-TS-CA01.0063
Title	RMCA Alert versus ATC clearance Alert – take-off
Requirement	The Extended Airport Safety Nets shall trigger an alert if it receives a TAKE-OFF clearance for an Aircraft A when a RMCA alert is active on the same runway.
Status	<in progress=""></in>
Rationale	To prevent the Controller from clearing an aircraft to TAKE-OFF when a RMCA alert is active in the runway, which would be unsafe.
Category	<functional></functional>





Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0014
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-115_A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise RMCA/CMAC vs ATC Clearance Alert

[REQ]

Identifier	REQ-02-W2-21.1-TS-CA01.0064
Title	RMCA Alert versus ATC clearance Alert – cross
Requirement	The Extended Airport Safety Nets shall trigger an alert if it receives a CROSS clearance for an Aircraft A when a RMCA alert is active on the same runway.
Status	<in progress=""></in>
Rationale	To prevent the Controller from clearing an aircraft to CROSS when a RMCA alert is active in the runway, which would be unsafe.
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0014
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-115_A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise RMCA/CMAC vs ATC Clearance Alert





Identifier	REQ-02-W2-21.1-TS-CA01.0065
Title	RMCA Alert versus ATC clearance Alert – enter
Requirement	The Extended Airport Safety Nets shall trigger an alert if it receives a ENTER clearance for an Aircraft A when a RMCA alert is active on the same runway.
Status	<in progress=""></in>
Rationale	The Extended Airport Safety Nets needs to warn when it would be unsafe to clear an aircraft to ENTER if a conflict in the runway has been detected.
Category	<functional></functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0014
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-115_A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise RMCA/CMAC vs ATC Clearance Alert

Identifier	REQ-02-W2-21.1-TS-CA01.0066
Title	RMCA Alert versus ATC clearance Alert – landing
Requirement	The Extended Airport Safety Nets shall trigger an alert if it receives a LANDING clearance for an Aircraft A when a RMCA alert is active on the same runway.
Status	<in progress=""></in>
Rationale	To prevent the Controller from clearing an aircraft to LAND when a RMCA alert is active in the runway, which would be unsafe.
Category	<functional></functional>





Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0014
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-115_A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise RMCA/CMAC vs ATC Clearance Alert

[REQ]

Identifier	REQ-02-W2-21.1-TS-CA01.0110
Title	Runway Incursion (CMAC) vs ATC clearance Alert - line-up
Requirement	The Extended Airport Safety Nets shall trigger an alert if it receives a LINE-UP clearance for an Aircraft A when a Runway Incursion (CMAC) alert is active on the same runway.
Status	<in progress=""></in>
Rationale	The Extended Airport Safety Nets needs to warn the ATCO when it would be unsafe to clear an aircraft to LINE-UP on a runway where a CMAC alert is active, e.g., an intruder has been detected in the RPA of the same runway.
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0015
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-115_A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise RMCA/CMAC vs ATC Clearance Alert





Identifier	REQ-02-W2-21.1-TS-CA01.0120
Title	Runway Incursion (CMAC) vs ATC clearance Alert - take-off
Requirement	The Extended Airport Safety Nets shall trigger an alert if it receives a TAKE-OFF clearance for an Aircraft A when a Runway Incursion (CMAC) alert is active on the same runway.
Status	<in progress=""></in>
Rationale	The Extended Airport Safety Nets needs to warn the ATCO when it would be unsafe to clear an aircraft to TAKE-OFF on a runway where a CMAC alert is active, e.g., an intruder has been detected in the RPA of the same runway.
Category	<functional></functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0015
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-115_A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise RMCA/CMAC vs ATC Clearance Alert

Identifier	REQ-02-W2-21.1-TS-CA01.0130
Title	Runway Incursion (CMAC) vs ATC clearance Alert - landing
Requirement	The Extended Airport Safety Nets shall trigger an alert if it receives a LANDING clearance for an Aircraft A when a Runway Incursion (CMAC) alert is active on the same runway.
Status	<in progress=""></in>





Rationale	The Extended Airport Safety Nets needs to warn the ATCO when it would be unsafe to clear an aircraft to LAND on a runway where a CMAC alert is active, e.g., an intruder has been detected in the RPA of the same runway.
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0015
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-115_A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise RMCA/CMAC vs ATC Clearance Alert

[REQ]

Identifier	REQ-02-W2-21.1-TS-CA01.0140
Title	Runway Incursion (CMAC) vs ATC clearance Alert - cross
Requirement	The Extended Airport Safety Nets shall trigger an alert if it receives a CROSS clearance for an Aircraft A when a Runway Incursion (CMAC) alert is active on the same runway.
Status	<in progress=""></in>
Rationale	The Extended Airport Safety Nets needs to warn the ATCO when it would be unsafe to clear an aircraft to CROSS on a runway where a CMAC alert is active, e.g., an intruder has been detected in the RPA of the same runway.
Category	<functional></functional>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1





<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0015
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-115_A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise RMCA/CMAC vs ATC Clearance Alert

Identifier	REQ-02-W2-21.1-TS-CA01.0150
Title	Runway Incursion (CMAC) vs ATC clearance Alert - enter
Requirement	The Extended Airport Safety Nets shall trigger an alert if it receives a ENTER clearance for an Aircraft A when a Runway Incursion (CMAC) alert is active on the same runway.
Status	<in progress=""></in>
Rationale	The Extended Airport Safety Nets needs to warn the ATCO when it would be unsafe to clear an aircraft to ENTER on a runway where a CMAC alert is active, e.g., an intruder has been detected in the RPA of the same runway.
Category	<functional></functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02.W2.21.1-SPRINTEROP-CA01.0015
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-115_A-SMGCS incorporating the function that provides RMCA/CMAC vs ATC Clearance alerts
<allocated_to></allocated_to>	<functional block=""></functional>	Aerodrome Safety Nets (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise RMCA/CMAC vs ATC Clearance Alert

4.2.6 Safety Requirements





Identifier	REQ-02-W2-21.1-TS-SAFE.0002
Title	System certified and maintained
Requirement	The system deploying the Extended Airport Safety Nets shall be certified and correctly maintained.
Status	<in progress=""></in>
Rationale	To ensure the correct behaviour during the operation. Note: requirement derived from the OSED Part II – Safety Assessment Report activities.
Category	<safety></safety>

Relationship	Linked Element Type	Identifier
<allocated_to></allocated_to>	<sesar solution=""></sesar>	PJ.02-W2-21.1
<satisfies></satisfies>	< ATMS Requirement>	REQ-02-W2-21.1-SPRINTEROP-CM01.0001
<allocated_to></allocated_to>	<enabler></enabler>	AERODROME-ATC-07b_A-SMGCS incorporating the function that provides an advanced set of Conformance Monitoring Alerts for Controllers (CMAC) on the movement are
<allocated_to></allocated_to>	<functional block=""></functional>	Conformance Monitoring (PJ.02-W2-21.1)
<allocated_to></allocated_to>	<function></function>	Raise CMAC Conflict Alert (extended set) Detect CMAC Conflict Alert (extended set)





5 Recommendation for Implementation

For the industrialisation and deployment of the concept, it is recommended to confirm that the current standards for A-SMGCS systems, such as EUROCONTROL-SPEC-171 and EUROCAE ED-87E, are sufficient to support the PJ.02-W2-21.1 Solution.





6 Assumptions

It is assumed that the A-SMGCS service (including Routing and Planning (Solution #22)) and Safety Support Tools (Solution #02) is available at the airport where the Solution PJ.02-w2-21.1 is intended to be deployed.

As a result of the Safety Assessment activities [42], it has been determined that the system must allow the ATCO to cancel a clearance and record the change in the HMI. It is assumed that this functionality is already available in the system, therefore it is not necessary to create a new specific Functional requirement concerning this concept.

Besides, a Safety Requirement at ATS Service level was created in order to make sure that the ATCO shall record clearances in the ATC system. This is considered also as an Assumption rather than as a requirement.





7 References and Applicable Documents

7.1 Applicable Documents

Content Integration

- [1] D5.11: PJ19: EATMA Guidance Material and Report (2019) (edition 01.00.01)
- [2] EATMA Community pages
- [3] SESAR ATM Lexicon

Content Development

[4] D2.5: SESAR 2020 Concept of Operations (edition 01.00.00) [29/10/2020]

System and Service Development

- [5] 08.01.01 D52: SWIM Foundation v2
- [6] 08.01.01 D49: SWIM Compliance Criteria
- [7] 08.01.03 D47: AIRM v4.1.0
- [8] 08.03.10 D45: ISRM Foundation v00.08.00
- [9] B.04.03 D102 SESAR Working Method on Services
- [10]B.04.03 D128 ADD SESAR1
- [11]B.04.05 Common Service Foundation Method
- [12]SESAR 2020 Process Handbook for ensuring consistency between EATMA and AIRM for Information Elements

Performance Management

[13]D4.0.30 S2020 Common Assumptions (edition 01.00.00)

[14]D4.7: PJ19.04: Performance Framework (2019) (edition 01.00.01) [29/10/2020]

[15]D110: C.02-D110 Updated D02 after MP Campaign (edition 00.01.01)

Validation

[16]03.00 D16 WP3 Engineering methodology

[17]D2.6: PJ19: VALS (2019) (edition 00.01.00)

[18]EUROCONTROL. E-OCVM Version 3.0 – Volume I - European Operational Concept Validation Methodology. 2010.





[19]EUROCONTROL. E-OCVM Version 3.0 – Volume I - European Operational Concept Validation Methodology. 2010.

System Engineering

[20] SESAR 2020 Requirements and Validation Guidelines Wave 2 (edition 00.02.01) [29/10/2020]

Safety

[21] D4.0.060: SESAR Safety Reference Material (edition 00.04.01)

[22] D4.0.050: Guidance to Apply SESAR Safety Reference Material (edition 00.03.01)

[23] D04: Resilience Engineering Guidance Final Deliverable (edition 00.00.12)

Human Performance

- [24] 16.006.05 D27 SESAR Human Performance Assessment Process V1 to V3 including VLDs
- [25] D4.0.070: SESAR Human Performance Assessment Process V1 to V3 including VLD (edition 00.03.01)

Environment Assessment

[26] D4.0.080 SESAR Environment Assessment Process (edition 04.00.00)

Security

[27]SecRAM 2.0 Security Risk Assessment methodology for SESAR 2020 (edition 02.00.00)

7.2 Reference Documents

- [28]ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.⁴
- [29]SESAR Solution PJ.02-W2-21.1 D6.1.002 SPR/INTEROP OSED for V3 Part I, Edition 00.02.02, 24 May 2023.
- [30]SESAR 1, 12.03.02-D64- Technical Specifications- Final Report, Edition 00.02.00.
- [31]SESAR 1, 12.05.04-D93- Final System Requirements, Edition 00.03.00.

[32]SESAR 2020 PJ03B Solution 01 TS/IRS V2, Edition 01.00.00

⁴ The EUROCAE ED-78A has been used as an initial guidance material. ED-78A is useful, but is not an applicable document, because it mostly addresses the V4-V5 phases, whilst the SESAR R&D programme is focussed on development (V1-V2-V3, and because of its partial compliance with safety regulatory requirements).





- [33]EUROCAE ED-87D "Minimum Aviation System Performance Specification (MASPS) for Advanced Surface Movement Guidance and Control Systems (A-SMGCS)", June 2019.
- [34]EUROCONTROL Specification for Advanced-Surface Movement Guidance and Control System (A-SMGCS) Services – Specification, Edition 2.0, Dated 22 April 2020, EUROCONTROL-SPEC-171.
- [35]ICAO Advanced Surface Movement Control and Guidance Systems (A-SMGCS) Manual, Doc 9830 AN/452, First Edition, Canada 2004.
- [36]EUROCAE ED-87 Rev. D, 01/07/2019
- [37]SESAR D32 P06.07.01 Final OSED for Conflicting ATC Clearances and Conformance Monitoring Alerts for Controllers, V00.01.01 Dated 10/11/2016.
- [38]SESAR Solution PJ.02-W2-21.2-21.3-21.4-21.6 TS IRS for V3
- [39]ICAO Doc 4444 Procedures for Air Navigation Services -Air Traffic Management 16th Edition, 2016.
- [40] "Project Handbook", Edition: 01.00.01 FINAL, 27th April 2017.
- [41]SESAR Solution PJ.02-W2-21.1 D6.1.002 SPR-INTEROP/OSED for V3 Part II-SAR, Edition 00.01.02, 24 May 2023.





Appendix A Service Description Document (SDD)

N/A, since no new Services have been created within the Solution framework.





-END OF DOCUMENT-

Beneficiaries contributing to Solution PJ.02-W2-21.1









