INDUSTRIAL RESEARCH

sesar JOINT UNDERTAKING

[SESAR Solution PJ.02-W2-25.1 SPR-INTEROP/OSED (FINAL) for V3 - Part I]

Deliverable ID:	**D7.1.002**
Dissemination Level:	**PU**
Project Acronym:	**PJ.02-W2-AART**
Grant:	**874477**
Call:	**H2020-SESAR-2019-1**
Topic:	**Airport Airside and Runway Throughput**
Consortium Coordinator:	**EUROCONTROL**
Edition Date:	**28 April 2023**
Edition:	**00.03.02**
Template Edition:	**02.00.06**

EUROPEAN PARTNERSHIP

Co-funded by the European Union

Authoring & Approval

Authors of the document

Beneficiary	Date
UNIWARSAW (PANSA(B4))	29/4/2020
Microstep-MIS (PANSA(B4))	21/5/2020
AIRBUS	21/5/2020
Dassault	21/5/2020
Airbus	11/9/2020
Airbus	16/10/2020
Microstep-MIS (PANSA (B4))	27/10/2020
Airbus	17/2/2021
Dassault	4/3/2021
AIRBUS	4/3/2021
Microstep-MIS (PANSA(B4))	23/4/2021

Reviewers internal to the project

Beneficiary	Date
PANSA (B4)	24/6/2020
EUROCONTROL	9/12/2020

Reviewers external to the project

Beneficiary	Date
Oro Navigacija (B4)	20/11/2020
EUROCONTROL	20/11/2020

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

Beneficiary	Date
PANSA and its LTPs	09/03/2023
Dassault	10/03/2023
Airbus	10/03/2023

Rejected By - Representatives of beneficiaries involved in the project

Beneficiary	Date

Document History

Edition	Date	Status	Beneficiary	Justification
00.00.01	29/4/2020	Draft	UNIWARSAW (PANSA(B4))	Initial draft
00.00.02	21/5/2020	Draft	UNIWARSAW (PANSA(B4)) Microstep-MIS (PANSA(B4)) AIRBUS Dassault	Initial V2 content review
00.00.03	15/6/2020	Draft	UNIWARSAW (PANSA(B4)) AIRBUS Dassault	Initial OSED release for review
00.01.00	27/6/2020	Initial Release	UNIWARSAW (PANSA(B4))	Initial OSED release following internal SOL 25 review
00.01.01	24/7/2020	Draft	UNIWARSAW (PANSA(B4)) Microstep-MIS (PANSA(B4)) AIRBUS Dassault	Use cases overhaul and improved definition of GRF operating method.
00.01.03	23/9/2020	Draft	UNIWARSAW (PANSA(B4)) Microstep-MIS (PANSA(B4)) AIRBUS	Production of initial EATMA content drafts for new use cases, updates to existing system requirements and BIM
00.01.04	16/10/2020	Draft	UNIWARSAW (PANSA(B4)) Dassault AIRBUS	Updates of draft EATMA content, technical environment specification, BIM updates.
00.01.05	27/10/2020	Draft	UNIWARSAW (PANSA(B4)) Dassault AIRBUS Microstep-MIS (PANSA(B4))	Finish requirements, update of use cases.
00.01.06	13/11/2020	Draft	UNIWARSAW (PANSA(B4))	Draft interim version for internal review

			Dassault AIRBUS Microstep-MIS (PANSA(B4))	
00.01.07	8/12/2020	Draft	UNIWARSAW (PANSA(B4)) AIRBUS Dassault	Draft interim version for external review
00.02.00	21/1/2020	Interim version	UNIWARSAW (PANSA(B4)) AIRBUS Dassault	Interim OSED for submission to SJU.
00.02.01	27/1/2021	Draft	UNIWARSAW (PANSA(B4))	First draft of independent PJ.02-W2-25.1 document
00.02.02	17/2/2021	Draft	UNIWARSAW (PANSA(B4)) AIRBUS	Update of Section 3 content in line with Solution PJ.02-W2-25.1 definition
00.02.03	16/3/2021	Draft	UNIWARSAW (PANSA(B4)) AIRBUS Dassault	Update NOV diagrams, update of other element of section 3.
00.02.04	23/4/2021	Draft	UNIWARSAW (PANSA(B4)) AIRBUS Microstep-MIS (PANSA(B4)) Microstep-MIS (PANSA(B4))	Candidate interim version (split from SOL PJ.02-W2-25.2 document) for internal/external review.
00.03.00	10/6/2021	Interim version	UNIWARSAW (PANSA(B4))	Interim version of the independent PJ.02-W2-25.1 document.
00.03.01	10/2/2023	Final version	UNIWARSAW (PANSA(B4))	Final version of the independent PJ.02-W2-25.1 document.
00.03.02	28/04/2023	Final Version	PANSA	Final update after Maturity Gate

Copyright Statement

PJ.02-W2 AART

ENHANCED RUNWAY CONDITION AWARENESS FOR RUNWAY EXCURSION PREVENTION

This final version of the independent PJ.02-W2-25.1 document is part of a project that has received funding from the SESAR3 Joint Undertaking under grant agreement No 87447 under European Union's Horizon 2020 research and innovation programme.

Abstract

Solution PJ.02-W2-25.1 "Enhanced runway condition awareness for runway excursion prevention" addresses a safety issue, which was initially covered in SESAR 2020 W1 in solution PJ.03b-06, i.e. the risk of runway excursions during take-off and landing. Runway excursions are the most frequent type of runway safety accident (25% of all accidents over the 2015-2019 period according to 2019 IATA Safety Report [30]). The aim is to focus on how the risk of runway excursion can be mitigated by on-board and ground systems that help to determine and disseminate runway condition to flight crew, controllers and airport operator when appropriate. This solution in addition to safety, can improve the runway capacity resilience in adverse weather situation through a better management of runway inspections and decontamination operations.

This document defines the operational environment for solution PJ.02-W2-25.1. This definition includes the identification of the stakeholders, their expectations, description of the change in their working methods and equipment they use. Except for this, the document contains a set of operational requirements related to the OI step in the scope of PJ.02-W2-25.1 AO-0216 "Enhanced Runway Condition Awareness".

Solution PJ.02-W2-25.1 is built of two cooperating systems that together aim to provide continuous awareness of the current and predicted runway condition:

- Runway Condition Awareness and Monitoring System (RCAMS) is a ground-based system operated by the Airport Operator. It performs a continuous assessment of current runway surface condition and provides a short-term forecast of runway conditions. Under Airport Operator control it disseminates this information to other stakeholders.
- On-board Braking Action Computation System (OBACS) is an airborne system generating reports of runway surface condition as sensed by the braking aircraft.

The V3 phase validation activities focused on the following operational issues:

- Precise RCAMS working method definition including in non-nominal or failure cases.
- Validation of the combined solution (RCAMS with OBACS) operational impact.

The results show that RCAMS and OBACS systems allow better Runway Condition awareness, which should help improving Airport Safety by better preventing runway excursions.

Table of Contents

List of Tables

EUROPEAN PARTNERSHIP

Co-funded by the European Union

List of Figures

1 Executive Summary

A runway excursion is defined as “an event in which an aircraft veers off or overruns the runway surface during either take-off or landing”. The risk of a runway excursion is increased by wet and contaminated runways, in combination with gusts or strong cross or tailwinds.

The most straightforward way to prevent such events is to give to Flight Crews clear and objective information for them to make the right decisions in the preparation and execution of take-off, approach, and landing phases. While the main focus of services provided by solution PJ.02-W2-25.1 is to prevent overruns caused by the wrong estimation of runway surface condition it may also contribute to the prevention of other types of excursions by increasing the awareness of all involved actors.

The solution is compatible with the GRF [17][25][27][37] which uses the Runway Condition Assessment Matrix (RCAM) matrix and resulting Runway Condition Code (RWYCC) as a mean to uniformly communicate the runway condition to all stakeholders. Solution PJ.02-W2-25.1 is built of two[1][2] cooperating systems that together aim to provide continuous awareness of the Current RWYCC as well as the Predicted RWYCC (a short term RWYCC forecast):

- RCAMS is a ground-based system operated by the Airport Operator. It performs a continuous assessment of current runway surface condition and provides a short-term forecast of runway conditions. Under Airport Operator control it disseminates this information to other stakeholders.

- OBACS is an airborne system generating reports of runway surface condition as sensed by the braking aircraft. The reports are in line with GRF.

The solution is designed to be implementable in all airport operating environments regardless of their complexity and layout.

Solution PJ.02-W2-25.1 mainly addresses runway overruns and is continuation of PJ.03b-06 solution which was part of SESAR IR wave 1. Initial maturity level is V2. As a result, Solution PJ.02-W2-25.1 is in V3 maturity phase which was supported by a set of validation activities. This document uses some of the validation results in improving the quality and reliability of its content on the operational level as well as to update the status of operational requirements. The results are described in more detail in the PJ.03b-06 V2 VALR [35]

[1] PJ.03b-06 has been comprised of four systems. It also validated ROAAS to V2 level. However, following the development in wave 1 DASSAULT has developed the system outside of SESAR. It is expected to mature independently to V3+ maturity (certified system ready in operational deployment). Moreover, this new instance of ROAAS is able to work with all RWYCC as opposed to dry/wet of PJ.03b-06. This is in line with PJ.03b-06 recommendations. As a result, ROAAS is now considered a part of working method but it is not developed in wave 2.

[2] The last missing system - TOMS has been moved to solution PJ.02-W2-25.2 due to low maturity level. However, TOMS is still considered a means to optionally increase solution PJ.02-W2-25.1 benefit once it has been developed. As a result, it is also modelled in this document.

EUROPEAN PARTNERSHIP

Co-funded by the European Union

2 Introduction

2.1 Purpose of the document

This document provides the requirements specification, covering operational, safety, performance and interoperability requirements related to SESAR Solution PJ.02-W2-25.1.

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

The SPR-INTEROP/OSED is composed of different parts:

Part I of this document provides the Safety and Performance Requirements (SPR) and Interoperability Requirements (INTEROP). They are presented in the context of the Operational Service and Environment Definition (OSED) which describes the environment, assumptions, etc. that are applicable to the SPR and INTEROP requirements.

These requirements will cover safety, performance, operational aspects as well as the interoperability aspects (related to a specific technology to support the SESAR Solution).

The document is completed by appendices including:

- The Benefit Incurring Mechanisms and preliminary cost catalogue, showing how the SESAR Solution elements contribute (positively or negatively) to the delivery of performance benefits and the costs.

Parts II to V provide the series of assessments performed at SESAR Solution level that justify the SPR and INTEROP requirements:

- Part II: The Safety Assessment Report describes the results of the safety assessment work for the SESAR Solution.
- Part III: The Environmental Assessment Report describes the results of the environmental assessment work within SESAR Solution.
- Part IV: The Human Performance Assessment Report describes the results of the Human Performance assessment work for the SESAR Solution.
- Part V: the Performance Assessment Report (PAR) that consolidates the performance results obtained in different validation activities at SESAR Solution level.
  Security assessment was performed as well.

2.2 Scope

This document is the SPR-INTEROP/OSED for Solution PJ.02-W2-25.1: “Enhanced runway condition awareness for runway excursion prevention” for V3 phase. It is the final version of the document preceding the completion of all solution V3 validation activities.

The operational requirements present in this document cover safety, performance, operational aspects as well as the interoperability aspects related to the change in the operational environment aimed to support SESAR Solution PJ. 02-W2-25.1.

2.3 Intended readership

This SPR-INTEROP/OSED is written so as to provide useful information to the following audience:

- Project PJ.02-W2 AART – as the solution is contributing to the project.
- Project PJ.04-W2 TAM (Total Airport Management), as PJ.02-W2-25.1 developments can be interesting for this project
- Project PJ.19-W2 CI (Content Integration, Performance Management and Business Case Development) responsible for managing the content integration process to ensure the needed coherency (in terms of operational concept, architecture) between the different SESAR 2020 projects,
- Project PJ.20-W2 AMPLE (Master Planning) responsible for ATM Master Plan maintenance.

Except for the above SESAR IR wave 2 projects the document in its final form is designed to support any future industrialisation activities related to the concept beyond V3 maturity.

2.4 Background

First edition of European Action Plan for the Prevention of Runway Excursions (EAPPRE) - Edition 1.0 - EUROCONTROL - January 2013 [13] aimed at suggesting recommendations to avoid and prevent runway excursions, and second edition is currently under achievement. The subject of runway excursions has already been studied during the work of the United States FAA Takeoff and Landing Performance Assessment (TALPA) Aviation Rulemaking Committee (ARC) activity that occurred in 2008 and 2009. In this activity, six of the major manufacturers worked with the FAA, aircraft operators, business jet operators, airport operators, and other industry interest groups to recommend a standard terminology for reporting and evaluating runways conditions and criteria for manufacturers to use when computing the airplane's performance information for take-off and landing.

TALPA ARC recommendations pertaining to aircraft performance data for non-dry runways have been issued by the FAA in two Advisory Circulars, AC 25-31 for takeoff and AC25-32 for landing, as rulemaking activities were not possible at the time. This allows flexibility for manufacturers regarding whether or how to implement this new performance information. Some manufacturers have created operational data using terminology and standards consistent with the TALPA ARC recommendations.

In parallel and as part of the overall implementation of the TALPA recommendations, ICAO has developed Document 10064 "Airplane Performance Manual" to combine guidelines on certification and operational requirements regarding airplane performance. It was developed in the context of the Friction Task Force of the Aerodrome Operations and Services Working Group on the basis of existing and proposed national regulations and the TALPA ARC proposals. This new harmonization of the runway surface condition assessment and reporting throughout the world is named Global Reporting Format (GRF).

To translate the ICAO Standards into European regulation, EASA launched Rule making task RMT.0296, which resulted in the publication in 2016 of NPA (Notice for Proposed Amendment) 2016-11 proposing appropriate amendments to the operational regulation, revised airworthiness standards for take-off

performance on contaminated runways and new in-flight landing performance computation at time of arrival. The proposed changes are expected to increase the current level of safety in relation to airplane performance, to improve harmonization with FAA rules and to ensure alignment with ICAO Opinion 02/2019 containing the proposed new EASA regulation was adopted by the European Commission.

In 2019, FAA tasked the ARAC (Aviation Rulemaking Advisory Committee) with a review on implementing TALPA ARC recommendations as a new airworthiness standard instead of advisory material, in order to incentivize manufacturers to implement this new performance information. This proposal is currently being discussed by the FAA Flight Test Harmonization Working Group (FTHWG).

In the meantime, for existing designs, the data provided by manufacturers should allow flight crew to determine takeoff and landing performance for any runway surface condition as reportable via a Runway Condition Report (RCR) standardized by ICAO Annex 15. The use of standard terminology facilitates the mapping of the data to the reported condition.

2.5 Structure of the document

- **Section 1** contains an executive summary usable as-is for communication purposes,
- **Section 2** (this chapter) introduces the document and provides general information,
- **Section 3** is devoted to the Operational Service and Environment Definition, including the Detailed Operational Environment, and the Detailed Operating method,
- **Section 4** lists the Safety, Performance and Interoperability Requirements with their description and traceability,
- **Section 5** contains the References and Applicable Documents,
- **Appendix A** exposes the Cost and Benefit Mechanisms involved in the concept, as well as stakeholders' expectations.

2.6 Glossary of terms

Term	Definition	Source of the definition
Activities	EATMA definition: A logical process, specified independently of how the process is carried out	[38]
Advanced Surface Movement Guidance and Control System (A-SMGCS)	A system providing routing, guidance and surveillance for the control of aircraft and vehicles in order to maintain the declared surface movement rate under all weather conditions within the aerodrome visibility operational level (AVOL) while maintaining the required level of safety.	[16]
AIR-REPORT	A report from an aircraft in flight prepared in conformity with requirements for position, and operational and/or meteorological reporting.	[17]

Co-funded by the European Union

Term	Definition	Source of the definition
AIS	Aeronautical Information	[27]
Braking Action BA	A term used by pilots to characterize the deceleration associated with the wheel braking effort and directional controllability of the aircraft.	[22]
Computed Braking Action Computed BA	Braking Action value resulting from On-board and Aircraft based computation system (OBACS), and reported using the standardized scale of runway condition code	New
Computed Current RWYCC	Current RWYCC computed by RCAMS	New
Computed Current Runway Condition	Current Runway Condition computed by RCAMS	New
Computed Predicted RWYCC	Predicted RWYCC computed by RCAMS	New
Contaminated runway	'Contaminated runway' means a runway of which a significant portion of the runway surface area (whether in isolated areas or not) within the length and width being used is covered by one or more of the substances listed under the runway surface condition descriptors.	[15]
Current Runway Condition (RWY Condition)	Current RWYCC for each third of the runway, type, coverage and depth of the contaminants present on each third of the runway.	New
Current Runway Condition Code (Current RWYCC)	The Runway Condition Code observed or validated computed RWYCC for a given Runway at the present time.	New
Decontaminated runway	'Decontaminated runway' means a runway whose surface has been treated with de-icers to prevent bonds from forming between snow and ice and moisture in the pavement, or to break those bonds once formed.	New
Dry runway	'Dry runway' means a runway whose surface is free of visible moisture and not contaminated within the area intended to be used.	[15]
Measured Surface Friction	A term used by ground staff for SNOWTAM reporting purposes to characterize the slipperiness of the runway surface due to presence of	[22]

Term	Definition	Source of the definition
	contaminants and prevailing weather conditions (μ).	
Flight crew	The team of individuals who operate and manage an aircraft during a flight. The flight crew typically includes a captain, first officer (also called co-pilot), and flight engineer (on older aircraft models).	
Freezing Point	The freezing point is the temperature at which a liquid changes to a solid[3].	
In-flight Landing distance	Landing distance computed on board prior to any landing, taking into account updated parameters regarding the aircraft status (weight, configuration, etc.…) and airfield status (latest weather data, runway slope and any eventual contamination, etc.), to be compared with Landing Distance Available (LDA) on destination runway.	New
LDA	Landing Distance Available	New
LDR	Landing Distance Requested	New
Node	EATMA definition: A logical entity that performs Activities. Note: nodes are specified independently of any physical realisation	[1]
Non-stabilized approach	A Stabilised Approach is an approach operation satisfying a set of conditions defined by company manuals that allow Flight Crew to continue the operation. Non-stabilised approach is an approach operation violating those conditions. One of the consequences of a non-stabilised approach is the runway excursion.	New
Predicted RWYCC	The Runway Condition Code computed for a given Runway for a near future time.	New

[3] 0° for pure water at sea level, lower value may be induced by chemical treatment previously applied on the surface.

Term	Definition	Source of the definition
Predicted Runway Condition	Predicted RWYCC for each third of the runway, type, coverage and depth of the contaminants present on each third of the runway.	New
RCAMS	The Runway Condition Awareness and Monitoring System	New
Reference RWYCC	The Runway Condition Code presented to the RCAMS as a reference value having precedence over computation. RCAMS should take into account the reference values in subsequent computation following any input of new reference value. Reference is generally a result of manual inspection.	New
Runway Condition Code RWYCC	Runway condition code (RWYCC) means a number describing the runway surface condition to be used in the runway condition report. See **Table 12** for definitions of possible RWYCC. Note: the purpose of the runway condition code is to permit an operational aeroplane performance calculation by the flight crew.	[15]
Runway Condition Report	Runway condition report (RCR) means a comprehensive standardised report initiated by Airport Operator means relating to runway surface conditions and their effect on the aeroplane landing and take-off performance.	[15]
Runway Freezing Point	The freezing point of the substance covering the runway at the predefined location where this measurement is performed. The contaminated and decontaminated runway have different Freezing points.	New
Runway Friction Status	Current Runway Condition + Predicted Runway Condition	New
Runway Surface condition	Current RWYCC for each third of the runway + Predicted RWYCC for each third of the runway. Runway Surface condition is characterised by the state of the surface of the runway, either dry, wet or contaminated. Runway surface condition(s) means a description of the condition(s) of the runway surface used in the runway condition report which establishes the basis for the determination of the runway condition code for aeroplane performance purposes.	[15], [22] completed regarding predicted RWYCC

Term	Definition	Source of the definition
	Note 1: the runway surface conditions used in the runway condition report establish the performance requirements among the aerodrome operator, aeroplane manufacturer and aeroplane operator. **Note 2:** aircraft de-icing chemicals and other contaminants are also reported but are not included in the list of runway surface condition descriptors because their effect on runway surface friction characteristics and the runway condition code cannot be evaluated in a standardised manner.	
Runway surface condition descriptors	'Runway surface condition descriptors' means one of the following elements on the surface of the runway (note: the descriptions under (a) to (h) below are used solely in the context of the runway condition report and are not intended to supersede or replace any existing World Meteorological Organization (WMO) definitions): (a) 'Compacted snow': snow that has been compacted into a solid mass such that aeroplane tires, at operating pressures and loadings, will run on the surface without significant further compaction or rutting of the surface. (b) 'Dry snow': snow from which a snowball cannot readily be made. (c) 'Frost': ice crystals formed from airborne moisture on a surface whose temperature is below freezing[4]; frost differs from ice in that the frost crystals grow independently and, therefore, have a more granular texture[5]. (d) 'Ice': water that has frozen or compacted snow that has transitioned into ice, in cold and dry conditions.	[15]

[4] "Below freezing" refers to air temperature equal to or lower than the freezing point of water (0 °C or less if chemical treatment of surface was used).

[5] Under certain conditions, frost can cause the surface to become very slippery, and it is then reported appropriately as 'reduced braking action'.

Co-funded by the European Union

Term	Definition	Source of the definition
	(e) 'Slush': snow that is so water-saturated that water will drain from it when a handful is picked up or will splatter if stepped on forcefully. (f) 'Standing[6] water': water of depth greater than 3 mm. (g) 'Wet ice': ice with water on top of it or ice that is melting[7]. (h) 'Wet snow': snow that contains enough water to be able to make a well-compacted, solid snowball, but water will not squeeze out.	
Surface Condition Sensor	Sensor installed on each third of each runway of an airport able to continuously measure some basic environmental parameters (e.g. air and ground temperature, freezing point). The advanced version of those sensors provides continuous estimate of the type and depth of surface contaminant	New

Table 1: Glossary of terms

2.7 List of Acronyms

Acronym	Definition
A	Scheduled Airline Operations / Organisation
A/C	Aircraft
AART	Airside, Airport and Runway Throughput
A-BRK	Autobrake A/C
AC	Advisory Circulars
ACARS	Aircraft Communications Addressing and Reporting System
ACC	Area Control Centre

[6] Running water of depth greater than 3 mm is reported as 'standing water' by convention.

[7] Freezing precipitation can lead to runway conditions associated with wet ice from an aeroplane performance point of view. Wet ice can cause the surface to become very slippery. It is then reported appropriately as 'reduced braking action'.

EUROPEAN PARTNERSHIP

Co-funded by the European Union

ACTMS	AirCraft Trajectory Monitoring System
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-B APT	ADS-B Airport Surface Surveillance
AIM	Accident Incident Model
AIMS	Airplane Information Management System
AIREP	AIRcraft REPort (Automatic air report)
AIREP	Air-Report
AIRM	The ATM Information Reference Model
AIS	Aeronautical information services
AMPLE	ATM Master Plan Maintenance
ANSP	Air Navigation Service Provider
AO	Aircraft operator
AOC	Airline Operations and Control Centre
AOP	Airport Operations Plan
ApDO	Airport Duty Officer (w innych miejscach jest jako DO)
APOC	Airport Operations Centre
APP	Approach Control
ARAC	Aviation Rulemaking Advisory Committee
ARC	Aviation Rulemaking Committee (FAA)
A-SMGCS	Advanced Surface Movement Guidance and Control System
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATCT	Air Traffic Control Tower
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATS	Air Traffic Services
ATSB	The Australian Transport Safety Bureau
ATSU	Air Traffic Service Unit
AU	Airspace User
AVOL	Aerodrome Visibility Operational Level
AWACS	Airborne Warning and Control System
AWOS	Automated Weather Observing System
BA	Braking Action

Co-funded by the European Union

BA	Business Aviation Operations / Organisation
BACF	Braking Action Computation Function
BIM	Benefit Impact Mechanism
CAP	Capacity
CAT	Commercial Air Transportation
CDM	Collaborative Decision Making
CEF	Cost Efficiency KPA
CFME	Continuous Friction Measuring Equipment: a device designed to produce continuous measurement of runway friction values
CI	Content Integration, Performance Management and Business Case Development
CNS	Communication Navigation & Surveillance
CONOPS	Concept of Operations
CORSAIR	COntaminated Runway State Automatic Identification and Reporting: AIRBUS project aiming to provide on-board airplane based computed braking action.
CR	Change Request
CWP	Controller Working Position
D-ATIS	Data Link-Automatic Terminal Information Service
DH	Decision Height
DO	Duty Officer
EAP	Enhanced Approach Procedures
EAPPRE	European Action Plan for the Prevention of Runway Excursions
EAPPRI	European Action Plans for the Prevention of Runway Incursion
EASA	European Aviation Safety Agency
EATMA	European ATM Architecture
ECAC	European Civil Aviation Conference
EOC	Essential Operational Change
E-OCVM	European Operational Concept Validation Methodology
ES	Extended Squitter
ESF	Estimated (runway) Surface Friction
FA	Focus Area
FAA	Federal Aviation Administration (US)
FC	Flight Crew

FICON	FIeld CONdition (US equivalent of SNOWTAM)
FLC	Flight Crew
FOC	Flight Operational Control / Flight Operations Centre
FOD	Foreign Object Debris
FTHWG	FAA Flight Test Harmonization Working Group
GA	General Aviation
GRF	Global Report Format
HLOR	High Level Concept of Operations Requirement
HMI	Human Machine Interface
HP –	Human Performance
HPAR	Human Performance Assessment Report
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
INTEROP	Interoperability Requirements
KPA	Key Performance Area
KPI	Key Performance Indicator
LDA	Landing Distance Available
MA	Missed Approach
MA	Military Aviation Operations / Organisation
MASPS	Minimum Aviation System Performance Standards
MET	Meteorological
METAR	METeorological Aerodrome Report
NOTAM	Notice To Airmen
NPA	Notice of Proposed Amendment (EASA)
NWP	Numerical Weather Prediction
OBACS	On-board Braking Action Computation System
OI	Operational Improvement
OPS	Operations
OSED	Operational Service and Environment Definition
PANS	Procedures for Air Navigation Services
PAR	Performance Assessment Report
PBC	Performance-Based Communication
PBN	Performance-Based Navigation

Co-funded by the European Union

PBS	Performance-based Surveillance
PI	Performance Indicator
PIREP	PIlot REPort (Pilot air report)
R/T	Radio-Telephony
RCAM	Runway Condition Assessment Matrix
RCAMS	Runway Condition Awareness and Monitoring System
RCC-Dis	RWYCC Dissemination Function
RCR	Runway Condition Report
RE	Runway Excursion
REQ	Requirement
RES	Resilience
RMT	Rule Making Task
RNAV	Area Navigation
ROAAS	Runway Overrun Awareness and Alerting System[1]
ROT	Runway Occupancy Time
RPAS	Remotely Piloted Aircraft System
RWIS	Runway Weather Information Systems
RWY	Runway
RWYCC	Runway Condition Code
SAF	Safety
SAFE	Safer Airports and Flights for Europe (SESAR W1 Project PJ.03B)
SAR	Safety Assessment Report
SATVOICE	Satellite Voice Communications
SESAR	Single European Sky ATM Research Programme
SJU	SESAR Joint Undertaking
SNOWTAM	Snow-related NOTAM
SO	Safety Objective
SPR	Safety and Performance Requirements
SR	Safety Requirement
SWIM	System Wide Information Model
TAF	Terminal Aerodrome Forecast
TALPA	Take-off And Landing Performance Assessment

Co-funded by the European Union

TALPA ARC	FAA Takeoff and Landing Performance Assessment (TALPA) Aviation Rulemaking Committee (ARC)
TAM	Total Airport Management
TCP/IP	Transmission Control Protocol/Internet Protocol
TOMS	Take-off Monitoring System
TS	Technical Specification
TWR	Aerodrome control tower or aerodrome control
UAS	Unmanned Aircraft System
VALR	Validation Report
VHF	Very-High Frequency (radio spectrum band)
WG	Working Group
WMO	World Meteorological Organization
WS	Winter Services
Wx	Weather
WXXM	The Weather Information Exchange Model

Table 2: List of acronyms

EUROPEAN PARTNERSHIP

Co-funded by the European Union

3 Operational Service and Environment Definition

3.1 SESAR Solution PJ.02-W2-25.1: a summary

The European Action Plan for the Prevention of Runway Excursions (EAPPRE) [26] provides practical recommendations with guidance material to reduce the number of runway excursions. Runway safety remains one of the three major safety priorities at Air Transport System (ATS) level. Between 2015 and 2019, taxiway and runway excursions were accounting for 25% of accidents worldwide (15% in Europe)[30]. Survivability of these accidents is high with less than 2% of fatalities over this period. Although the occurrence rate of aircraft landing on contaminated runways remains low, the number of runway excursions on wet or contaminated runways remains high (33% of occurrences). Considering all the non-fatal aircraft accidents over the 2015-2019 period, 8% of them involved poor braking action related to a contaminated runway. Inaccurate knowledge of the actual runway status at landing contributed to several accidents that occurred in the past (Southwest at Chicago Midway in 2005 is one example) [32].

The Solution will contribute to mitigating runway excursion events, by providing a consolidated real-time assessment of runway condition based on multiple inputs available at airports (MET sensors, runway weather sensors). The assessment of runway condition will be delivered directly to Airport Operations. In addition to ground part associated with Airport , the solution also includes an airborne system designed to objectively measure and rapidly disseminate computed aircraft braking action. Performance assessment on the V2 maturity level indicates that the solution could provide mitigation to at least 22% and up to 41% of runway excursions that occurred in ECAC area in 2017 and 2018.

In addition to providing current runway condition estimation PJ.02-W2-25.1 proposes introduction of very near term forecast of runway condition in the airport – ANSP – aircraft information loop. This is intended to increase planning capabilities of various stakeholders, improve runway condition deterioration response quality and further benefit the situational awareness of all critical stakeholders during landing and take-off.

The introduction of above changes is expected to, in line with Validation Targets for SESAR Solution PJ.02-W2-25.1 (see [39]), bring benefit in terms of safety, resilience and human performance (especially for Duty Officer).

SESAR Solution PJ.02-W2-25.1 contributes to High-performing Airport Operations Key Feature and Airport and TMA Performance EOC (Essential Operational Change) through Runway Excursion Avoidance and Surface Condition Awareness Capabilities.

The present document identifies the Operational Improvement steps associated to SESAR Solution PJ.02-W2-25.1, as described in data set 23 of the EATMA with subsequent change requests.

Runway friction deterioration not considered by the solution

The runway / tyre friction of runway pavement deteriorates over time due to a number of factors, the two predominant ones being mechanical wear and polishing action from aircraft tyres rolling or

braking on the pavement, and the accumulation of contaminants, mostly rubber, on the pavement surface. The effect of these factors is directly dependent upon the volume and type of aircraft traffic.

Other influences on the rate of deterioration are local weather conditions, the type of pavement, the materials used in original construction, any subsequent surface treatment and airport maintenance practices.

Structural pavement failure such as rutting, cracking, joint failure, settling, or other indicators of distressed pavement can also contribute to runway friction losses. It is important that runway inspections identify any changes in surface condition so that appropriate and timely remedial action can be undertaken and avoid potential FOD risk.

Contaminants, such as rubber deposits, jet fuel, oil spillage, moss, de-icing liquids, earthworms, algae, water, snow, ice, and slush, all cause friction loss on runway pavement surfaces. The most persistent contaminant problem is deposit of rubber from tyres of landing aircraft. This happens predominately at the touchdown areas on runways and can be quite extensive. Heavy rubber deposits can completely cover the pavement surface texture causing loss of aircraft braking capability and directional control, particularly when runways are wet.

SESAR Solution ID	SESAR Solution Title	OI Steps ID	OI Steps Title	Enabler ID	Enabler Title	OI Step/Enabler Coverage
PJ.02-W2-25.1	Enhanced runway condition awareness for runway excursion prevention	AO-0216	Enhanced runway condition awareness for runway excursion prevention	AIRPORT-57	Runway condition awareness management system based on manual assessment, weather information and runway sensors + PIREP + machine-learning based RWY condition model and predictions	Full coverage Required/Developed
PJ.02-W2-25.1	Enhanced runway condition awareness for runway excursion	AO-0216	Enhanced runway condition awareness for runway	AIRPORT-59 (STD-090)	RCAMS system function to integrate aircraft observed runway	Full coverage Optional/Developed

	prevention d		excursion prevention		braking action into runway condition information	
PJ.02-W2-25.1	Enhanced runway condition awareness for runway excursion prevention	AO-0216	Enhanced runway condition awareness for runway excursion prevention	A/C-84b	Braking action computation function in on-board braking action computation system (OBACS) for business jet	Full coverage Optional/Developed
PJ.02-W2-25.1	Enhanced runway condition awareness for runway excursion prevention	AO-0216	Enhanced runway condition awareness for runway excursion prevention	A/C-84a	Braking action computation function in on-board braking action computation system (OBACS) for airlines	Full coverage Optional/ Used
PJ.02-W2-25.1	Enhanced runway condition awareness for runway excursion prevention	AO-0216	Enhanced runway condition awareness for runway excursion prevention	A/C-64	Data transmission means supporting downlinked observed runway surface condition (aircraft side)	Full coverage Optional/used
PJ.02-W2-25.1	Enhanced runway condition awareness for runway excursion prevention	AO-0216	Enhanced runway condition awareness for runway excursion prevention	SVC-071	Runway Braking Action service	Full coverage Optional/Used

Co-funded by the European Union

PJ.02-W2-25.1	Enhanced runway condition awareness for runway excursion prevention	AO-0216	Enhanced runway condition awareness for runway excursion prevention	SVC-061	Runway condition report service	Full coverage Optional/developed

Table 3: SESAR Solution PJ.02-W2-25.1 Scope and related OI steps/enablers

High Level Concept of Operations Requirement ID	High Level Concept of Operations Requirement	Reference to relevant Concept of Operations Sections e.g. Operational Scenario applicable to the SESAR Solution
S25.1-HLOR-01	Safety support for Approach ,Landing and Take-off Operations shall: • Reduce the risk of RWY excursions to obtain: • increased airport safety by : • providing a continuous and objective evaluation of the runway condition • improving the collaborative use of the runway capacities through a shared view of the current situation while : • using data from ground-based and airborne sources • sharing this information among the main airport stakeholders • satisfying the new regulatory requirements (GRF)	3.2.2 – Operational Requirements PJ 02 2.4.3 – Airport Safety Nets

Table 4: Link to Concept of Operations

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

OI Step Code	OI Step title	Deviation

AO-0216	Enhanced Runway Condition Awareness	• CR-06702 (A/C-84) • CR-05918 (A/C-84) • CR-04776 (A/C-84) • CR-05684 (AIRPORT-57) • CR-05683 (AIRPORT-59) • CR-04963 (SVC-071) • CR-07233 (A/C-84a) • CR-07234 (A/C-84a) • CR07235 (A/C-84a) • CR-07249 (A/C-84b) • CR-07236 (A/c-64) • CR-07237 (AIRPORT-57) • CR-07238 (AIRPORT-59) • CR-07239 (SVC-061) • CR-07250 (SVC-061) • CR-07240 (SVC-071)

Table 5: Deviation per OI

3.2 Detailed Operational Environment

3.2.1 Operational Characteristics

Operational interactions per context (NOV-2)	Operating Environment
[NOV-2] Runway Friction Status Elaboration	Airport;
Comment	
The solution is designed to be implementable in all airport operating environments regardless of their complexity and layout.	

Table 6: Operational environment for context (NOV-2) Runway Friction Status Elaboration

Operational interactions per context (NOV-2)	Operating Environment
[NOV-2] Runway Friction Status Utilisation	Airport;
Comment	
The solution is designed to be implementable in all airport operating environments regardless of their complexity and layout.	

Table 7: Operational environment for context (NOV-2) Runway Friction Status Utilisation

The operational processes described in this part of OSED are intended for application at all airports, with low, medium or high traffic levels, whatever the layout (simple or complex). There are many categories of airports within the ECAC area and the SESAR concept of “Safety support tools” must be adaptable to suit local circumstances. Runway sensors are foreseen to be built in each third of the runway to be aligned with GRF (reporting separately for each third of the runway); for airports with a very long runway to increase runway prediction accuracy a pair/ or more runway sensors might be used.

EUROPEAN PARTNERSHIP

Co-funded by the European Union

This Solution is focusing on providing Safety support tools in specific weather conditions which lead to the contamination of runway surface by different types of contaminant (e.g. snow, slush, ice, water etc.) which might increase runway slipperiness, downgrade runway friction and therefore generate more risks of runway excursions than in good (not adverse) weather conditions.

These tools are intended to function both in good and adverse weather conditions; however their usefulness will be greatest in case of transition from good/neutral to adverse weather conditions. The knowledge of expected impact of short term tactical (lead time at least 60 min) runway conditions will positively impact safety and is crucial to manage an optimal traffic flow. Moreover, the Solution aims at reducing the impact of adverse weather conditions on runway operations by increasing the capacity resilience to bad weather events through the real-time runway conditions assessment.

3.2.2 Roles and Responsibilities

Node	Responsibilities
Aerodrome ATS	Performs all the aerodrome ATS operations. [RELATED ACTORS/ROLES] Tower controller, ground controller, etc.
Aeronautical Information Service Provision	Responsible for the timely collection, processing, storing, integration, exchange and delivery of quality-assured aeronautical data and aeronautical information within the air traffic management (ATM) system.
Airport Ops Support	Perform all the airport ops support activities, including analysis of airport resources, long term planning of infrastructures, coordination of airport slots, management of airport resources on the day of operation (gates, vehicles, stands, de-icing...), information sharing and CDM, etc. [RELATED ACTORS/ROLES] Airport Operator, Airport Slot Negotiator
Airspace User Operations	Airspace User Operations represent all the activities undertaken by those organisations and individuals who have access to and operate in the airspace which is managed for ATM purposes in accordance with ICAO and national procedures. For the purpose of this document only those actors directly involved in ATM operations are described. The main types of civil Airspace User Operations are: · Scheduled Airline Operations / Organisation (A). The most extensive organization for Airspace User Operations is run by Airlines with a worldwide network. The daily operations of these Airlines, with up to thousands of flights per day all over the world, require a lot of flexibility. In order to give the best possible service to their passengers, maintaining punctuality and a high quality of service, Airlines have to run and to maintain

	a complex organization. This category regroups Cargo, Regional, Network, Charter and Low cost operators. · Business Aviation Operations / Organisation (BA). Another important segment of Airspace Users is Business Aviation, which concerns the operation or use of aircraft by companies for the carriage of passengers or goods as an aid to the conduct of their business. · Military Aviation Operations / (MA). Determined by strategic objectives dealing with National and International security and defence policies and commitments, the operation or use of military/State aircraft (combat aircraft, military air transport aircraft, tankers, AWACS, training aircraft, helicopters…) concern Air defence and policing flights, Search and rescue, instructional and training flights, combined air operations as part of complex scenarios and UAS operations for which special use of airspace may be needed. · General Aviation Operations / Organisation (GA), which operates civilian aircraft for purposes other than commercial passenger transport, including personal, business, and instructional flying, represents another type of Airspace Users. Depending on the size and organization of the Airspace User, the roles and tasks defined in this document may move from one actor to another, or may be consolidated into one actor, depending on the actually existing actors within the Airspace User organization. As an extreme example, the subset of General Aviation focused on personal transport does not normally have any organization except the pilot, so this actor will be responsible for all the tasks related to this/her individual flight. On the other hand General Aviation does not have to deal with many tasks which are important for the operations of other Airspace Users.
Flight Deck	Performs all the on-board AU operations including flight execution/monitoring according to agreed trajectory, compliance with ATC clearances/instructions, etc. [RELATED ACTORS/ROLES] Flight Crew
Meteorological Service Provision	Provides at least the minimum weather data as laid down by ICAO in Annex 3 - Meteorological Service for International Air Navigation to ensure safe ATM operations. In most instances a weather provider will provide a wider scope of weather data relevant to the ATM stakeholders/ATM community.

Table 8: Description of nodes affected by the Solution and their associated responsibilities.

Operational interactions per context (NOV-2)	Operating Environment

[NOV-2] Runway Friction Status Elaboration		Airport;
Node	Node instance	Node instance description
Aerodrome ATS	Aerodrome ATS	In this case, the Tower is also a critical communication node as it advises the flight crews of any last-minute RWY condition changes. Tower Controller or Ground Controller may receive Braking Action report (AIREP or PIREP) from Flight Crew of a just landed aircraft. And then forward this information to Airport Operation for runway condition update. Control Tower may also be requested for runway closure by Airport Operations, for runway inspection or runway treatment purpose. Airport Ground Surveillance contributes to runway surface condition assessment by providing data for analysis of landing aircraft trajectories (deceleration profiles and 2D trajectory on the runway).
Airport Ops Support	Airport Operations	The Airport Operator is the legal entity responsible for safe operations at the airport. It is responsible for compliance with the conditions of the airport operation laid down by the National and Super-national bodies. Airport Operations are responsible for the physical conditions on the manoeuvring area, apron and in the environs of the aerodrome. This includes assurance that the scale of equipment and facilities provided are adequate for the flying activities which are expected to take place at that Airport. Airport Operations responsibilities to consider are mainly: · Identification, assessment and reporting of airport (particularly runway) contaminants, · Management of the airport airside surfaces (snow removal, runway cleaning, lighting system etc.) in coordination with the Tower Supervisor where appropriate, · Crisis management on the day of operation, · Dissemination of relevant airport information, · Trigger additional runway inspections in case of contaminant suspicion, suspected Foreign Object Debris (FOD) or unexpected pollution of the runway surface, · Information sharing between the airport's partners (ATS, AOCs, Network Management, and aircraft) even in case of communication interruption (using baseline R/T methods or phones) Airport Operations are carried out by Airport Duty Officers whose main responsibilities related to the runway condition are: · Initiating airport-related aeronautical publications and information including runway condition assessment reporting, · Monitoring airport equipment under his responsibility, and information delivered,

Co-funded by the European Union

		· Managing the implementing of the Airport snow and ice clearance plan. Airport Operator is also responsible for maintenance and supervision of infrastructure supporting the operations. Runway Sensors are a part of this infrastructure providing essential information to Airport Operations. The Winter Service team, under the command of the airport duty officer is in charge of clearing runways and taxiways from any winter contaminant.
Flight Deck	Flight Deck	Flight Deck performs all the on-board AU operations including flight execution/monitoring according to agreed trajectory, compliance with ATC clearances/instructions, etc. When experienced situation at landing was worse than expected, Flight Deck can report to Control Tower Braking Action. In addition properly equipped aircraft might send an automatic braking action message.
Meteorological Service Provision	Meteorological Service Provision	Meteorological Service Provision provide all airport stakeholders with weather observation and short term forecast (at least the minimum weather data as laid down by ICAO in Annex 3 - Meteorological Service for International Air Navigation to ensure safe ATM operations). Specifically some automatically measured meteorological parameters are critical to continuous automatic supervision of the runway. In the absence of those parameters availability from Meteorological Service Provision setting up dedicated measuring devices falls to Airport Operator.

Table 9: Nodes associated with context (NOV-2) Runway Friction Status Elaboration and their description associated to PJ.02-W2-25.1

Operational interactions per context (NOV-2)		Operating Environment
[NOV-2] Runway Friction Status Utilisation		Airport;
Node	Node instance	Node instance description
Aerodrome ATS	Aerodrome ATS	Control Tower provides departing and arriving aircraft with runway condition.
Aeronautical Information Service Provision	Aeronautical Information Service Provision	RCR equivalent reception using SWIM for further SNOWTAM dissemination (not modelled here). In case of RCR/SNOWTAM dissemination failure via SWIM, other means of communication shall be used.
Airport Ops Support	Airport Operations	The Airport Operator is the legal entity responsible for safe operations at the airport. It is responsible for compliance with the conditions of the airport operation laid down by the National and Super-national bodies. Airport Operations provide runway surface condition on request of ATS (Control Tower or En-Route/Approach ATS), arriving or departing aircraft (Flight Deck can also request the information

		to the Controller whom it is under responsibility) or Airspace User Operations. Airport Operator is obliged to generate RCR for local use and share relevant RCR with AIS. In addition, each RCR is automatically brought to attention of local Control Tower. In case of failure of automatic dissemination to Control Tower, baseline R/T methods or phones shall be used to share RCR with Control Tower. On runway condition degradation, Airport Operations will coordinate with Tower Control to proceed to runway treatment whenever required. The Winter maintenance staff is considered a subdivision of airport operations. Under the command of the airport duty officer, winter maintenance is responsible for treatment of runways, taxiways and aprons. That encompasses snow removal and chemical de-icing application.
Airspace User Operations	Airspace User Operations	A person, organization or enterprise engaged in or offering to engage in an aircraft operation (from ICAO 4444 PANS). An Airspace User can be equipped or not equipped with a Flight Operations Centre (FOC) or Airline Operations and Control Centre (AOC), which is hosting for the airline the roles of Flight Dispatch, Slot Management and Strategic & CDM Management thereby managing the operations of the Airline and implementing the flight programme. The overall responsibility of the FOC / AOC is to maintain the integrity of the scheduled Flight Programme and to take in real time the necessary decisions in order to manage all the flights within the airline network. The main tasks of the FOC / AOC concern the late planning phase (i.e. short term) and the execution phase of flights. The AOC is the point of contact within Airspace User Operations for all subjects related to CDM. FOC / AOC dispatch can learn of deteriorating or already deteriorated conditions from SNOWTAM or by direct request to the Airport Operations.
Airport Ops Support	APOC	A platform / operational structure which pro-actively manages the performance of present and short-term airport operations, giving relevant airport stakeholders a common operational overview of the airport, and allowing them to communicate, coordinate and collaboratively decide on their progress.
Flight Deck	Arriving Aircraft	Flight deck of arriving aircraft need runway condition information for their landing performance assessment. Runway condition is retrieved from Airspace User Operations or from ATS (from En-Route, Approach and Tower Control on request or in the ATC clearance). Flight deck is assisted by automatic monitoring of approach stability and braking performance. The effectiveness of the latter part of this function is dependent on the quality and timeliness of runway condition data delivery to the Flight Deck.

Flight Deck	Departing Aircraft	Flight deck of departing aircraft need runway condition information for their take-off performance assessment.

Table 10: Nodes associated with context (NOV-2) Runway Friction Status Utilisation and their description associated to PJ.02-W2-25.1

3.2.3 CNS/ATS description:

Technical constraint	description
Aerodrome ATS	- To maximize benefit the information from RCAMS system should be provided to ATCO e.g by ATIS-RCAMS integration (it's out of the sol 25.1 scope)
Aircraft equipage	- (required AO-0216) The minimum capability for the secondary surveillance transponder shall be Mode S Level 2 with Extended Squitter (ES) ADS-B protocol in accordance with the formats specified in ICAO document 9871. - (optional AO-0216) When TOMS achieves required maturity aircraft should be equipped with a Take-off monitoring system intended to propose an additional protection in order to reduce the risk of runway excursion during take-off by providing a timely and distinctive alert to the flight crew when the airplane is at risk of not being able to take-off safely on the runway and taking into account runway contamination information. - (optional AO-0216) For optimal utilisation of the runway condition information the aircraft should be equipped with ROAAS allowing for extra safety layer in degraded conditions. - (optional AO-0216) Some part of the operating traffic should be equipped (OBACS) to report automatic objective Braking Action to directly raise all stakeholders' awareness and possibly realign RCAMS indications.
Airport	- (required AO-0216) To deploy RCAMS system the runway must be equipped with a built-in sensor suite measuring meteorological parameters as well as some properties of existing contamination on the runway. Sensors able to determine at least approximately the contaminant type and depth are preferred. Those sensors should cover the entire runway and provide data at least for each third of the runway. For airports with a very long runway to increase runway condition prediction more runway sensors might be used. - (required AO-0216) To deploy RCAMS a housing for a RCAMS server is necessary. The housing should be equipped with high-reliability power supply and reliable network connections allowing access to RCAMS inputs. The networking to DO working positions should exist. - (required AO-0216) Airport should be equipped with AWOS installation (at least AWOS III P configuration, preferred AWOS IV Z). RCAMS server should have access to AWOS data in real time or near-real time (no more than 3 min. delay).

Co-funded by the European Union

	- (required AO-0216) Airport should be able to obtain local weather forecast in numerical form the forecast should at all times be valid for next 3 hours. - (optional AO-0216) Airport should be able to obtain local weather radar data. RCAMS server should have access to weather radar data in real time or near-real time (maximal delay is not possible to determine due to variance in scanning times). Alternatively RCAMS can be supplied with precipitation nowcast. - (optional AO-0216) Airport should be connected to a service distributing OBACS originating RWYCC measurements in real time or near-real time (no more than 2 min. delay).

Table 5: CNS/ATS description

3.2.3.1 Technical environment characteristics for Airport and ANSP

In general, an established means of data exchange are in place between airport and ANSP providing Tower ATS and Approach ATS. This means allow for reliable, low latency and secure data exchange (e. g. through the TCP/IP) between both stakeholders. Other assumptions regarding the existing services are described below.

3.2.3.1.1 Aerodrome ATS

To achieve ATCO benefit RCR should be automatically provided to ATCO e.g by RCAMS – ATIS integration. RCAMS -ATIS exchange of information is out of sol 25.1 scope.

3.2.3.1.2 Airport

- (required AO-0216) To deploy RCAMS system the runway must be equipped with a built-in sensor suite measuring meteorological parameters as well as some properties of existing contamination on the runway. Sensors able to determine at least approximately the contaminant type and depth are preferred. Those sensors should cover the entire runway and provide data at least for each third of the runway.
- (required AO-0216) To deploy RCAMS a housing for a RCAMS server is necessary. The housing should be equipped with high-reliability power supply and reliable network connections allowing access to RCAMS inputs. The networking to DO working positions should exist.
- (required AO-0216) Airport should be equipped with AWOS installation (at least AWOS III P configuration, preferred AWOS IV Z[8]). RCAMS server should have access to AWOS data in real time or near-real time (no more than 3 min. delay).
- (required AO-0216) Airport should be able to obtain local weather forecast in numerical form the forecast should at all times be valid for next 3 hours.
- (optional AO-0216) Airport should be able to obtain local weather radar data. RCAMS server should have access to weather radar data in real time or near-real time (maximal delay is not possible to determine due to variance in scanning times). Alternatively RCAMS can be supplied with precipitation nowcast.

[8] As defined in 8260.19H - Flight Procedures and Airspace – Document Information,

- (optional AO-0216) Airport should be connected to a service distributing OBACS originating RWYCC measurements in real time or near-real time (no more than 2 min. delay).

3.2.3.2 Aircraft equipage

- (required AO-0216) The minimum capability for the secondary surveillance transponder shall be Mode S Level 2 with Extended Squitter (ES) ADS-B protocol in accordance with the formats specified in ICAO document 9871.
- (optional AO-0216) When TOMS achieves required maturity aircraft should be equipped with a Take-off monitoring system intended to propose an additional protection in order to reduce the risk of runway excursion during take-off by providing a timely and distinctive alert to the flight crew when the airplane is at risk of not being able to take-off safely on the runway.
- (optional AO-0216) For optimal utilisation of the runway condition information the aircraft should be equipped with ROAAS allowing for extra safety layer in degraded conditions.
- (optional AO-0216) Some part of the operating traffic should be equipped (OBACS) to report automatic objective Braking Action to directly raise all stakeholders' awareness and possibly realign RCAMS indications.
  Validation tests demonstrated that approximately 5% of traffic equipped with OBACS is sufficient.

3.2.4 Applicable standards and regulations

This section identifies the list of standards and regulations that are applicable to the SESAR Solution PJ.02-W2-25.1.

RCAMS developed in current SESAR Solution is expected to be a support for the airport authority to comply with the new requirements of the Global Reporting Format, transcript in EASA Notice of Proposed Amendment (NPA) 2018-14 [37]. EUROCAE working group (WG109 – Runway Weather Information Systems - RWIS) conducted a standardization activity to draw up a MASPS (Minimum Aviation System Performance Standards) that defines the performances expected from the runway weather information systems and the way of verifying that the latter reach them – EUROCAE ED-292. RCAMS developed in current SESAR Solution meets minimum performance requirements from that MASPS.

Standard Name	Standard Description	Standard Enabler	Comment
Use Case (NOV-5)	[NOV-5] Failure of local RCR dissemination via RCAMS		
Use Case (NOV-5)	[NOV-5] Failure of Runway Condition Inference Function without Loss of Tower Communication / Issue with Input Quality / Data Source Loss		
Use Case (NOV-5)	[NOV-5] Transition from GRF to Solution Working Method		
Use Case (NOV-5)	[NOV-5] Elaborate Runway Condition Report		
Use Case (NOV-5)	[NOV-5] Decontamination execution		
Use Case (NOV-5)	[NOV-5] Runway Condition Dissemination		

EUROPEAN PARTNERSHIP

Co-funded by the European Union

Standard Name	Standard Description	Standard Enabler	Comment
Use Case (NOV-5)[9]	[NOV-5]Runway Condition Report Elaboration		
EASA Notice of Proposed Amendment (NPA) 2018-14	The objective of this NPA is to mitigate the safety risks associated with runway safety, from an aerodrome's perspective, focusing mainly on the prevention of runway excursions and on runway surface condition assessment and reporting, but also addressing issues such as ground collisions, runway confusion, foreign object debris (FOD) related occurrences as well as runway pavements'' maintenance. This NPA proposes changes to existing operational requirements of Regulation (EU) No 139/2014, as well as the introduction of new ones, which are based on ICAO provisions and recommendations contained in the European Action Plans for the Prevention of Runway Incursions and Excursions (EAPPRI, EAPPRE) as well as safety recommendations addressed to EASA by the Accident Investigation Boards of Norway and Sweden. It also provides for alignment with the International Civil Aviation Organization (ICAO) State Letters AN 4/1.2.26-16/19, AN 4/27-16/28 and AN 13/2.1 — 16/54, as regards runway surface condition assessment and reporting which will be applicable worldwide by November 2020.		
ICAO Annex 14 Vol1	Aerodromes – Aerodrome Design and Operations (8th ed., 2018) This Annex contains Standards and Recommended Practices (specifications) that prescribe the physical characteristics and obstacle limitation surfaces to be provided for at aerodromes, and certain	AIMS-STD-01 STD-015	

[9] Another document to consider: ICAO Doc 10064 – Aeroplane performance manual

	facilities and technical services normally provided at an aerodrome. It also contains specifications dealing with obstacles outside those limitation surfaces. It is not intended that these specifications limit or regulate the operation of an aircraft. From the Solution perspective, important part of the document is: • Chapter 1.1 Definitions (including definition of Runway condition assessment matrix, Runway condition code, Runway condition report and Runway surface conditions) • Attachment A.6 Runway condition report for reporting runway surface condition [Applicable 5 November 2020]		
ICAO Doc 9981	Procedures for Air Navigation Services (PANS) Aerodromes, 2nd ed., 2016 (related to Annex 14, Vol. I) From the Solution perspective, important part of the document is: Part II Aerodrome Operational Management		
ICAO Circular 355	Assessment, Measurement and Reporting of Runway Surface Conditions		
ICAO Annex 6, Part I	Operation of Aircraft – International Commercial Air Transport - Aeroplanes		
ICAO Annex 6, Part II	Operation of Aircraft – International General Aviation - Aeroplanes		
ICAO Annex 6, Part III	Operation of Aircraft – International Operations - Helicopters		
ICAO Annex 8	Airworthiness of Aircraft		
EUROCAE ED-292	Minimum Aviation System Performance Standards (MASPS) for Runway Weather Information System The minimum performance requirements specified in this MASPS have the scope to support airports implement the relevant ICAO Standards and Recommended Practices and EASA regulation related to the GRF.		
Use Case (NOV-5)	[NOV-5]Runway Condition dissemination		
EASA Notice of Proposed Amendment (NPA) 2018-14	The objective of this NPA is to mitigate the safety risks associated with runway safety, from an aerodrome's perspective, focusing mainly on		

	the prevention of runway excursions and on runway surface condition assessment and reporting, but also addressing issues such as ground collisions, runway confusion, foreign object debris (FOD) related occurrences as well as runway pavements'' maintenance. This NPA proposes changes to existing operational requirements of Regulation (EU) No 139/2014, as well as the introduction of new ones, which are based on ICAO provisions and recommendations contained in the European Action Plans for the Prevention of Runway Incursions and Excursions (EAPPRI, EAPPRE) as well as safety recommendations addressed to EASA by the Accident Investigation Boards of Norway and Sweden. It also provides for alignment with the International Civil Aviation Organization (ICAO) State Letters AN 4/1.2.26-16/19, AN 4/27-16/28 and AN 13/2.1 — 16/54, as regards runway surface condition assessment and reporting which will be applicable worldwide by November 2020.		
EASA Notice of Proposed Amendment (NPA) 2016-11	This NPA proposes standards for runway surface condition reporting, airworthiness standards for landing performance computation at time of arrival and an in-flight assessment of landing performance at time of arrival. The proposed changes are expected to increase the current level of safety in relation to aeroplane performance, to improve harmonisation with the corresponding Federal Aviation Administration (FAA) rules, to ensure alignment with (ICAO), and to allow for flexibility and proportionality for certain CAT operations. This NPA was followed by Rule Making Task RMT.0296 who published Opinion 02/2019 containing the proposed new EASA regulation for runway surface condition reporting and airworthiness standards for landing performance computation at time of arrival		
ICAO Annex 14 Vol1	Aerodromes – Aerodrome Design and Operations (8th ed., 2018) This Annex contains Standards and Recommended Practices (specifications) that prescribe the physical characteristics and obstacle limitation surfaces to be provided for at aerodromes, and certain	AIMS-STD-01 STD-015	

	facilities and technical services normally provided at an aerodrome. It also contains specifications dealing with obstacles outside those limitation surfaces. It is not intended that these specifications limit or regulate the operation of an aircraft. From the Solution perspective, important part of the document is: • Chapter 1.1 Definitions (including definition of Runway condition assessment matrix, Runway condition code, Runway condition report and Runway surface conditions) Attachment A.6 Runway condition report for reporting runway surface condition [Applicable 5 November 2020]		
ICAO Doc 9981	Procedures for Air Navigation Services (PANS) Aerodromes, 2nd ed., 2016 (related to Annex 14, Vol. I) From the Solution perspective, important part of the document is: Part II Aerodrome Operational Management		
ICAO Circular 355	Assessment, Measurement and Reporting of Runway Surface Conditions		
ICAO Annex 15	Aeronautical Information Services (16th ed., 2018) The object of the aeronautical information service (AIS) is to ensure the flow of aeronautical data and aeronautical information necessary for global air traffic management (ATM) system safety, regularity, economy and efficiency in an environmentally sustainable manner. The role and importance of aeronautical data and aeronautical information changed significantly with the implementation of area navigation (RNAV), performance-based navigation (PBN), airborne computer-based navigation systems, performance-based communication (PBC), performance-based surveillance (PBS), data link systems and satellite voice communications (SATVOICE). Corrupt, erroneous, late or missing aeronautical data and aeronautical information can potentially affect the safety of air navigation		

EASA Notice of Proposed Amendment (NPA) 2018-12	The objective of this NPA is to address the safety issue of runway excursions that occur during landings. This NPA proposes to require the installation of a runway overrun awareness and alerting system on new large aeroplane designs (CS-25), and on certain new large aeroplanes operated in commercial air transportation (CAT), and manufactured after a predetermined date (Part-26/CS-26). The proposed regulatory changes are expected to increase safety by supporting the flight crew during the landing phase in identifying and managing the risk of a runway excursion. This should reduce the number of runway excursions that occur during landings.		
EUROCAE ED-250	ED-250 Minimum Operational Performance Specification (MOPS) for a Runway Overrun Awareness and Alerting System.		
ICAO Doc 10066	Aeronautical Information Management (1st ed., 2018) Harmonization of AIS/AIM procedures; and SNOWTAM format From the Solution perspective, important part of the document is: Appendix 4. SNOWTAM format		
ICAO EUR NAT	Guidance on the Issuance of SNOWTAM (1st. ed., 2020)		
ICAO Annex 6, Part I	Operation of Aircraft – International Commercial Air Transport - Aeroplanes		
ICAO Annex 6, Part II	Operation of Aircraft – International General Aviation - Aeroplanes		
ICAO Annex 6, Part III	Operation of Aircraft – International Operations - Helicopters		
ICAO Annex 8	Airworthiness of Aircraft		
ICAO Doc 4444	Air Traffic Management	AGDLS-STD-01 BTNAV-STD-02 STD-002	
ICAO Doc 9881	Guidelines for Electronic Terrain, Obstacle and Aerodrome Mapping Information		
ICAO Doc 10064	This manual was developed to combine guidelines on certification and operational requirements regarding aeroplane performance. It was		

	developed in the context of the Friction Task Force of the Aerodrome Operations and Services Working Group on the basis of existing and proposed national regulations, Annex 6 Attachment C and the proposals of the FAA Take-off and Landing Performance Aviation Rulemaking Committee (TALPA ARC).		
Use Case (NOV-5)	[NOV-5]Decontamination execution		
EASA Notice of Proposed Amendment (NPA) 2018-14	The objective of this NPA is to mitigate the safety risks associated with runway safety, from an aerodrome's perspective, focusing mainly on the prevention of runway excursions and on runway surface condition assessment and reporting, but also addressing issues such as ground collisions, runway confusion, foreign object debris (FOD) related occurrences as well as runway pavements'' maintenance. This NPA proposes changes to existing operational requirements of Regulation (EU) No 139/2014, as well as the introduction of new ones, which are based on ICAO provisions and recommendations contained in the European Action Plans for the Prevention of Runway Incursions and Excursions (EAPPRI, EAPPRE) as well as safety recommendations addressed to EASA by the Accident Investigation Boards of Norway and Sweden. It also provides for alignment with the International Civil Aviation Organization (ICAO) State Letters AN 4/1.2.26-16/19, AN 4/27-16/28 and AN 13/2.1 — 16/54, as regards runway surface condition assessment and reporting which will be applicable worldwide by November 2020.		
EASA Notice of Proposed Amendment (NPA) 2016-11	This NPA proposes standards for runway surface condition reporting, airworthiness standards for landing performance computation at time of arrival and an in-flight assessment of landing performance at time of arrival. The proposed changes are expected to increase the current level of safety in relation to aeroplane performance, to improve harmonisation with the corresponding Federal Aviation Administration (FAA) rules, to ensure alignment with (ICAO), and to allow for flexibility and proportionality for certain CAT operations.		

	This NPA was followed by Rule Making Task RMT.0296 who published Opinion 02/2019 containing the proposed new EASA regulation for runway surface condition reporting and airworthiness standards for landing performance computation at time of arrival		
ICAO Annex 14 Vol1	Aerodromes – Aerodrome Design and Operations (8th ed., 2018) This Annex contains Standards and Recommended Practices (specifications) that prescribe the physical characteristics and obstacle limitation surfaces to be provided for at aerodromes, and certain facilities and technical services normally provided at an aerodrome. It also contains specifications dealing with obstacles outside those limitation surfaces. It is not intended that these specifications limit or regulate the operation of an aircraft. From the Solution perspective, important part of the document is: • Chapter 1.1 Definitions (including definition of Runway condition assessment matrix, Runway condition code, Runway condition report and Runway surface conditions) Attachment A.6 Runway condition report for reporting runway surface condition [Applicable 5 November 2020]	AIMS-STD-01 STD-015	
ICAO Doc 9981	Procedures for Air Navigation Services (PANS) Aerodromes, 2nd ed., 2016 (related to Annex 14, Vol. I) From the Solution perspective, important part of the document is: Part II Aerodrome Operational Management		
ICAO Circular 355	Assessment, Measurement and Reporting of Runway Surface Conditions		
EUROCAE ED-250	ED-250 Minimum Operational Performance Specification (MOPS) for a Runway Overrun Awareness and Alerting System.		
Use Case (NOV-5)	[NOV-5]Failure of Runway Condition inference function without loss of Tower communication / Persistent issue with input quality / Data source loss		

EASA Notice of Proposed Amendment (NPA) 2018-14	The objective of this NPA is to mitigate the safety risks associated with runway safety, from an aerodrome's perspective, focusing mainly on the prevention of runway excursions and on runway surface condition assessment and reporting, but also addressing issues such as ground collisions, runway confusion, foreign object debris (FOD) related occurrences as well as runway pavements'' maintenance. This NPA proposes changes to existing operational requirements of Regulation (EU) No 139/2014, as well as the introduction of new ones, which are based on ICAO provisions and recommendations contained in the European Action Plans for the Prevention of Runway Incursions and Excursions (EAPPRI, EAPPRE) as well as safety recommendations addressed to EASA by the Accident Investigation Boards of Norway and Sweden. It also provides for alignment with the International Civil Aviation Organization (ICAO) State Letters AN 4/1.2.26-16/19, AN 4/27-16/28 and AN 13/2.1 — 16/54, as regards runway surface condition assessment and reporting which will be applicable worldwide by November 2020.		
EASA Notice of Proposed Amendment (NPA) 2016-11	This NPA proposes standards for runway surface condition reporting, airworthiness standards for landing performance computation at time of arrival and an in-flight assessment of landing performance at time of arrival. The proposed changes are expected to increase the current level of safety in relation to aeroplane performance, to improve harmonisation with the corresponding Federal Aviation Administration (FAA) rules, to ensure alignment with (ICAO), and to allow for flexibility and proportionality for certain CAT operations. This NPA was followed by Rule Making Task RMT.0296 who published Opinion 02/2019 containing the proposed new EASA regulation for runway surface condition reporting and airworthiness standards for landing performance computation at time of arrival		

ICAO Annex 14 Vol1	Aerodromes – Aerodrome Design and Operations (8th ed., 2018) This Annex contains Standards and Recommended Practices (specifications) that prescribe the physical characteristics and obstacle limitation surfaces to be provided for at aerodromes, and certain facilities and technical services normally provided at an aerodrome. It also contains specifications dealing with obstacles outside those limitation surfaces. It is not intended that these specifications limit or regulate the operation of an aircraft. From the Solution perspective, important part of the document is: • Chapter 1.1 Definitions (including definition of Runway condition assessment matrix, Runway condition code, Runway condition report and Runway surface conditions) Attachment A.6 Runway condition report for reporting runway surface condition [Applicable 5 November 2020]	AIMS-STD-01 STD-015	
ICAO Doc 9981	Procedures for Air Navigation Services (PANS) Aerodromes, 2nd ed., 2016 (related to Annex 14, Vol. I) From the Solution perspective, important part of the document is: Part II Aerodrome Operational Management		
ICAO Circular 355	Assessment, Measurement and Reporting of Runway Surface Conditions		
EUROCAE ED-250	ED-250 Minimum Operational Performance Specification (MOPS) for a Runway Overrun Awareness and Alerting System.		
ICAO Doc 4444	Air Traffic Management	AGDLS-STD-01 BTNAV-STD-02 STD-002	
Use Case (NOV-5)	[NOV-5]General failure of RCAMS to provide service		
EASA Notice of Proposed Amendment (NPA) 2018-14	The objective of this NPA is to mitigate the safety risks associated with runway safety, from an aerodrome's perspective, focusing mainly on		

	the prevention of runway excursions and on runway surface condition assessment and reporting, but also addressing issues such as ground collisions, runway confusion, foreign object debris (FOD) related occurrences as well as runway pavements'' maintenance. This NPA proposes changes to existing operational requirements of Regulation (EU) No 139/2014, as well as the introduction of new ones, which are based on ICAO provisions and recommendations contained in the European Action Plans for the Prevention of Runway Incursions and Excursions (EAPPRI, EAPPRE) as well as safety recommendations addressed to EASA by the Accident Investigation Boards of Norway and Sweden. It also provides for alignment with the International Civil Aviation Organization (ICAO) State Letters AN 4/1.2.26-16/19, AN 4/27-16/28 and AN 13/2.1 — 16/54, as regards runway surface condition assessment and reporting which will be applicable worldwide by November 2020.		
EASA Notice of Proposed Amendment (NPA) 2016-11	This NPA proposes standards for runway surface condition reporting, airworthiness standards for landing performance computation at time of arrival and an in-flight assessment of landing performance at time of arrival. The proposed changes are expected to increase the current level of safety in relation to aeroplane performance, to improve harmonisation with the corresponding Federal Aviation Administration (FAA) rules, to ensure alignment with (ICAO), and to allow for flexibility and proportionality for certain CAT operations. This NPA was followed by Rule Making Task RMT.0296 who published Opinion 02/2019 containing the proposed new EASA regulation for runway surface condition reporting and airworthiness standards for landing performance computation at time of arrival		
ICAO Annex 14 Vol1	Aerodromes – Aerodrome Design and Operations (8th ed., 2018) This Annex contains Standards and Recommended Practices (specifications) that prescribe the physical characteristics and obstacle limitation surfaces to be provided for at aerodromes, and certain	AIMS-STD-01 STD-015	

	facilities and technical services normally provided at an aerodrome. It also contains specifications dealing with obstacles outside those limitation surfaces. It is not intended that these specifications limit or regulate the operation of an aircraft. From the Solution perspective, important part of the document is: • Chapter 1.1 Definitions (including definition of Runway condition assessment matrix, Runway condition code, Runway condition report and Runway surface conditions) Attachment A.6 Runway condition report for reporting runway surface condition [Applicable 5 November 2020]		
ICAO Doc 9981	Procedures for Air Navigation Services (PANS) Aerodromes, 2nd ed., 2016 (related to Annex 14, Vol. I) From the Solution perspective, important part of the document is: Part II Aerodrome Operational Management		
ICAO Circular 355	Assessment, Measurement and Reporting of Runway Surface Conditions		
EUROCAE ED-250	ED-250 Minimum Operational Performance Specification (MOPS) for a Runway Overrun Awareness and Alerting System.		
ICAO Doc 4444	Air Traffic Management	AGDLS-STD-01 BTNAV-STD-02 STD-002	
Use Case (NOV-5)	[NOV-5]Transition from GRF to solution working method		
EASA Notice of Proposed Amendment (NPA) 2018-14	The objective of this NPA is to mitigate the safety risks associated with runway safety, from an aerodrome's perspective, focusing mainly on the prevention of runway excursions and on runway surface condition assessment and reporting, but also addressing issues such as ground collisions, runway confusion, foreign object debris (FOD) related occurrences as well as runway pavements'' maintenance.		

	This NPA proposes changes to existing operational requirements of Regulation (EU) No 139/2014, as well as the introduction of new ones, which are based on ICAO provisions and recommendations contained in the European Action Plans for the Prevention of Runway Incursions and Excursions (EAPPRI, EAPPRE) as well as safety recommendations addressed to EASA by the Accident Investigation Boards of Norway and Sweden. It also provides for alignment with the International Civil Aviation Organization (ICAO) State Letters AN 4/1.2.26-16/19, AN 4/27-16/28 and AN 13/2.1 — 16/54, as regards runway surface condition assessment and reporting which will be applicable worldwide by November 2020.		
EASA Notice of Proposed Amendment (NPA) 2016-11	This NPA proposes standards for runway surface condition reporting, airworthiness standards for landing performance computation at time of arrival and an in-flight assessment of landing performance at time of arrival. The proposed changes are expected to increase the current level of safety in relation to aeroplane performance, to improve harmonisation with the corresponding Federal Aviation Administration (FAA) rules, to ensure alignment with (ICAO), and to allow for flexibility and proportionality for certain CAT operations. This NPA was followed by Rule Making Task RMT.0296 who published Opinion 02/2019 containing the proposed new EASA regulation for runway surface condition reporting and airworthiness standards for landing performance computation at time of arrival		
ICAO Annex 14 Vol1	Aerodromes – Aerodrome Design and Operations (8th ed., 2018) This Annex contains Standards and Recommended Practices (specifications) that prescribe the physical characteristics and obstacle limitation surfaces to be provided for at aerodromes, and certain facilities and technical services normally provided at an aerodrome. It also contains specifications dealing with obstacles outside those limitation surfaces. It is not intended that these specifications limit or regulate the operation of an aircraft.	AIMS-STD-01 STD-015	

	From the Solution perspective, important part of the document is: • Chapter 1.1 Definitions (including definition of Runway condition assessment matrix, Runway condition code, Runway condition report and Runway surface conditions) Attachment A.6 Runway condition report for reporting runway surface condition [Applicable 5 November 2020]		
ICAO Doc 9981	Procedures for Air Navigation Services (PANS) Aerodromes, 2nd ed., 2016 (related to Annex 14, Vol. I) From the Solution perspective, important part of the document is: Part II Aerodrome Operational Management		
ICAO Circular 355	Assessment, Measurement and Reporting of Runway Surface Conditions		
EUROCAE ED-250	ED-250 Minimum Operational Performance Specification (MOPS) for a Runway Overrun Awareness and Alerting System.		
ICAO Doc 4444	Air Traffic Management	AGDLS-STD-01 BTNAV-STD-02 STD-002	
Use Case (NOV-5)	[NOV-5]Failure of Local RCR dissemination via RCAMS		
EASA Notice of Proposed Amendment (NPA) 2018-14	The objective of this NPA is to mitigate the safety risks associated with runway safety, from an aerodrome's perspective, focusing mainly on the prevention of runway excursions and on runway surface condition assessment and reporting, but also addressing issues such as ground collisions, runway confusion, foreign object debris (FOD) related occurrences as well as runway pavements'' maintenance. This NPA proposes changes to existing operational requirements of Regulation (EU) No 139/2014, as well as the introduction of new ones, which are based on ICAO provisions and recommendations contained in the European Action Plans for the Prevention of Runway Incursions		

	and Excursions (EAPPRI, EAPPRE) as well as safety recommendations addressed to EASA by the Accident Investigation Boards of Norway and Sweden. It also provides for alignment with the International Civil Aviation Organization (ICAO) State Letters AN 4/1.2.26-16/19, AN 4/27-16/28 and AN 13/2.1 — 16/54, as regards runway surface condition assessment and reporting which will be applicable worldwide by November 2020.		
EASA Notice of Proposed Amendment (NPA) 2016-11	This NPA proposes standards for runway surface condition reporting, airworthiness standards for landing performance computation at time of arrival and an in-flight assessment of landing performance at time of arrival. The proposed changes are expected to increase the current level of safety in relation to aeroplane performance, to improve harmonisation with the corresponding Federal Aviation Administration (FAA) rules, to ensure alignment with (ICAO), and to allow for flexibility and proportionality for certain CAT operations. This NPA was followed by Rule Making Task RMT.0296 who published Opinion 02/2019 containing the proposed new EASA regulation for runway surface condition reporting and airworthiness standards for landing performance computation at time of arrival		
ICAO Annex 14 Vol1	Aerodromes – Aerodrome Design and Operations (8th ed., 2018) This Annex contains Standards and Recommended Practices (specifications) that prescribe the physical characteristics and obstacle limitation surfaces to be provided for at aerodromes, and certain facilities and technical services normally provided at an aerodrome. It also contains specifications dealing with obstacles outside those limitation surfaces. It is not intended that these specifications limit or regulate the operation of an aircraft. From the Solution perspective, important part of the document is:	AIMS-STD-01 STD-015	

	• Chapter 1.1 Definitions (including definition of Runway condition assessment matrix, Runway condition code, Runway condition report and Runway surface conditions) Attachment A.6 Runway condition report for reporting runway surface condition [Applicable 5 November 2020]		
ICAO Doc 9981	Procedures for Air Navigation Services (PANS) Aerodromes, 2nd ed., 2016 (related to Annex 14, Vol. I) From the Solution perspective, important part of the document is: Part II Aerodrome Operational Management		
ICAO Circular 355	Assessment, Measurement and Reporting of Runway Surface Conditions		
EUROCAE ED-250	ED-250 Minimum Operational Performance Specification (MOPS) for a Runway Overrun Awareness and Alerting System.		
ICAO Doc 4444	Air Traffic Management	AGDLS-STD-01 BTNAV-STD-02 STD-002	

Table 11: Applicable standards and regulations by Use Case

EUROPEAN PARTNERSHIP

Co-funded by the European Union

3.3 Detailed Operating Method

The detailed operating method focuses on a method of monitoring runway condition and reporting it in case of potential contamination, applicable to each stakeholder using the runway or being responsible for its status. Moreover, aircraft on final approach and landing phases will be able to warn the Flight Crew when detecting a risk of runway overrun, thanks to ROAAS. Aircraft at pre-flight and take-off phase will be able to warn the Flight Crew when detecting a risk to not take-off safely thanks to take-off monitoring system.

The operating method following maintenance activities is not covered by this document. On a new or resurfaced runway, it is desirable to measure the friction/speed characteristics in order to verify whether the design objective has been achieved. The measurements should be made with a friction-measuring device using self-watering features. But this post-maintenance measurement cannot involve the new concepts (neither computed braking action from airplane, nor decision tool). It has to be noticed nevertheless that cleaning events have to be taken into account in decision tool. Indeed, past data collected might not be applicable anymore in order to take decision on new runway surface.

3.3.1 Previous Operating Method

To ensure a better readability, this chapter is divided into subsections dealing with the roles and behaviour of each involved actor, followed by a general summary. The previous operating method considered here is the reference scenario for solution PJ.02-W2-25.1 – that is operations after introduction of GRF on 5 November 2021 due to the new ICAO regulation [17],[25],[27],[22]. In addition, previous operating method is detailed in EASA Notice of Proposed Amendment (NPA) 2018-14 [37].

3.3.1.1 Actors

3.3.1.1.1 Airport operator

Maintaining the runway and monitoring runway conditions lay within the responsibility of the Airport Operator. Furthermore, the Airport Operator is charged with disseminating accurate information about the runway condition.

Estimated runway surface condition will be characterized by a Runway Condition Code (RWYCC, see **Table 6**), determined for paved runways based on the runway condition assessment matrix (RCAM) presented in **Table 7** below. The operating method complies with GRF related regulation and uses the RCAM to assess runway surface condition.

Primary means of assessment of the RWYCC are runway contaminant type, depth and coverage supplemented with air temperature. Secondary means are Measured Surface Friction, directional control and PIREP, and all complementary information available and related to a possible degradation of the runway surface conditions, which includes the Computed Braking Action. Secondary means have to be used to downgrade the primary means assessment if they are worse than primary; it is not possible to upgrade directly from a secondary means, as a primary means has to be used to confirm an upgrade.

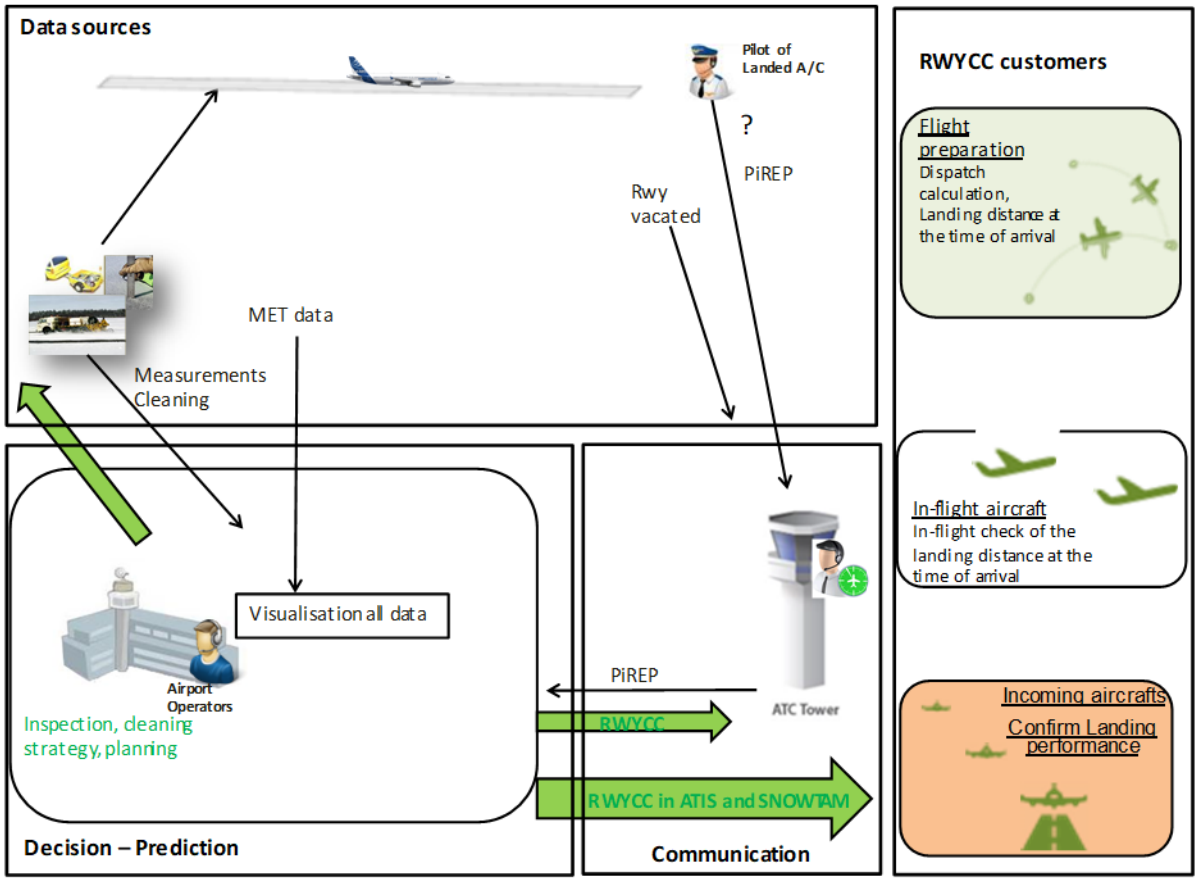
Co-funded by the European Union

Note: PANS-Aerodromes [17] defines an exception to general prohibition of runway condition upgrading based on secondary means. This is for case of RWYCC 1 or 0. However, special care needs to be taken when doing this as well adherence to rules laid out by PANS-Aerodromes. The upgrade may not be more than to RWYCC 3 and cannot be based upon one secondary means method alone. Moreover, maintaining the upgraded runway condition requires constant monitoring.

Only present state of the runway is reported (silently assuming short term conditions persistence).

Code	Runway Condition - Braking Action
6	DRY
5	GOOD
4	GOOD to MEDIUM
3	MEDIUM
2	MEDIUM to POOR
1	POOR
0	LESS THAN POOR

Table 6: Runway Condition Codes and Braking Action reports



Co-funded by the European Union

Figure 1: Previous operating method Runway Condition data sources

Existing data sources for airport operators with previous operating method:

- Inspection, contamination assessment, friction measurements and field condition reports taken by Airport Operator vehicles (Technologies may vary upon airport),
- Runway contamination sensor measurements available at some airports,
- PIREP is transmitted by voice by flight crew to ATC but not specifically towards airport operator (though it could be sometimes the case, if AO is listening to VHF). Therefore this transmission is neither systematic nor automated ,
- Meteorological data.

Reporting with previous operating method:

- Runway Condition Report - a comprehensive standardized report relating to runway surface condition(s) and its effect on the aeroplane landing and take-off performance
- NOTAMS (published by AIS) indicating airport surface conditions (SNOWTAM or FICON in the USA), they include the RCR part,[10]

Runway condition assessment matrix (RCAM)			
Assessment criteria		Downgrade assessment criteria	
RWYCC	**Runway surface description**	**Aeroplane deceleration or directional control observation**	**Pilot report of runway braking action**
6	DRY	-	-
5	FROST WET (The runway surface is covered by any visible dampness or water up to and including 3 mm depth) **Up to and including 3 mm depth:** SLUSH DRY SNOW WET SNOW	Braking deceleration is normal for the wheel braking effort AND directional control is normal	GOOD
4	SPECIALLY PREPARED WINTER RUNWAY **-15°C and lower outside temperature** COMPACTED SNOW	Braking deceleration OR directional control is between good and medium	GOOD TO MEDIUM

[10] It is worth noting here, that only some of RCR result in published SNOWTAM. See ICAO Doc 9981 - PANS Aerodromes, 2nd ed. 2016, Part II, point 1.1.1.8

Co-funded by the European Union

3	SLIPPERY WET DRY SNOW or WET SNOW (any depth) ON TOP OF COMPACTED SNOW **More than 3 mm depth:** DRY SNOW WET SNOW **Higher than -15°C outside air temperature:** COMPACTED SNOW	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced	MEDIUM
2	**More than 3 mm:** STANDING WATER SLUSH	Braking deceleration OR directional control is between medium and poor	MEDIUM TO POOR
1	ICE	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced	POOR
0	WET ICE WATER ON TOP OF COMPACTED SNOW DRY SNOW or WET SNOW ON TOP OF ICE	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain	LESS THAN POOR

Table 7: Runway Condition Assessment Matrix (RCAM) sourced from NPA 2018-14 [37].

3.3.1.1.2 Flight Crew

Flight crew relies on any information (e.g. ATIS, SNOWTAM) disseminated by the Airport Operator and (indirectly) ATC to determine, as accurately as possible, aircraft performance for take-off and landing.

ATIS provides them with the last update of "essential" information, including assessment of the runway condition among others. In case of a sudden change, ATCO can communicate the latest available information.

Flight crew may be asked to issue landing PIREP which (although subjective) is considered a valuable source of information.

After having performed landing and when the braking action was less than reported by Airport Operator the procedure requests the flight crew to report his PIREP to ATCO via R/T. However until now PIREP reporting is not an obligation for the flight crew and therefore not provided systematically. Moreover PIREPs are not officially stored so the access to historical data is extremely limited.

Although flight crew's PIREP is perceived and therefore subjective assessment it is seen by Airport Operator as an additional valuable input. Provided at nearly real-time PIREP contributes to enhance overall runway condition awareness.

No ROAAS is installed on aircraft, which means that the Flight Crew has to manage the final approach, landing and braking under their best judgement, skills, and understanding of the situation.

Co-funded by the European Union

No TOMS is installed on aircraft, which means that the Flight Crew has to manage the take-off under their best judgement, skills, and understanding of the situation.

No A/C trajectory monitoring is installed hence the Flight Crew has to manage aircraft trajectory directly with their direct visual analysis of the external environment (distance of the A/C from the runway/taxiway edges, presence or absence of external collision threat).

No OBACS (or limited number of OBACS equipped A/C) is installed on aircraft, which means that no automatic and objective measurements of braking quality are available flowing the execution of the landing roll.

3.3.1.1.3 Air Traffic Controller (ATCO)

ATCO routinely contributes to the prevention of runway excursions "by providing information required for approach (e.g. wind) and landing (e.g. runway condition). Through the provision of safety "essential" information such as runway surface conditions, ATCO ensures that flight crew have the latest aerodrome information available to enable safe take-offs and landings. Safety "essential" information such as runway surface conditions is disseminated automatically by the ANSP systems (and more especially the ATIS or via R/T). ATCO awareness of runway surface condition is based on RCR delivered by DO.

In adverse weather conditions, when due to water, snow, slush, ice, or frost, significant quick changes in runway surface condition occur, ATCO may decide to communicate via R/T the runway surface condition to the Flight Crew in order to enhance their level of runway condition awareness. This action is additional to regular routine SNOWTAM dissemination.

Furthermore, in practice, in adverse weather conditions generating runway contamination, the Airport Operator may ask ATCO to request PIREP from flight crews who have just landed, for a short period of time (e.g. half an hour). Getting PIREPs from operating flight crews enriches Airport Operator awareness and might be taken into account in runway clearing strategy and decision making process.

ATCO maintains traffic and is reacting to any current ground side disruptions. ATCO also makes sure that flight crew have the most up to date information.

However there is no procedure or tool available for the ATCO to notice, besides RCR and PIREP, that the runway condition is changing or has recently changed, other than by visual means from the control tower.

Tower ATS also provides Automatic Terminal Information Service (ATIS) or Data link-automatic terminal information service (D-ATIS). ATIS can contain significant runway surface conditions and, if appropriate, braking action.

3.3.1.2 Summary

With the previous operating method, there was no technology deployed that could provide standardized and objective means of assessing the runway condition associated to braking performance for all types of actual contaminants. Deployment of CFME on contaminated runways to obtain friction value readings should not be attempted because contaminant drag on the equipment's measuring wheel, amongst other factors, will cause readings to be unreliable.

Different criteria of runway condition reporting could be used as entry points for the determination of the applicable airplane performance level during take-off and landing. These reporting criteria are:

Co-funded by the European Union

- primary observations of contaminant type, coverage and depth, as well as of temperature,
- pilot advisory report of braking action (used only as a secondary criteria for RWYCC degrading),
- estimate of braking action resulting from using a friction measurement device (used only as a secondary criteria for RWYCC degrading).

Primary observations of contaminant type, coverage and depth are obtained by manual runway inspections. Those are supplemented by locally measured air temperature. During runway inspection responsible airport staff assesses contaminant coverage, type, and depth in compliance with RCAM matrix (**Table 15**) and issues Runway Condition Report locally to share situational awareness.

The secondary criteria should be used only for downgrading a braking action category of a runway, which is basically identified via primary criteria. If a friction measurement or reports from flight crews of preceding airplanes via air reports (PIREP) indicate that the friction levels have dropped below those expected for the type of contaminant on the runway, the aerodrome should consider this information in reporting the relevant condition code.

In the previous operating method, there was no on-board assessment by calculating, recording, and conveying the airplane braking ability required and/or available to slow or stop the airplane during the landing roll. The intent is to know the airplane braking capability through flight crew feedback, but it is recognized that the PIREP on braking action is a subjective assessment. The feeling is affected by deceleration means used (reverser use, auto brake mode, speed, airplane configuration). The common use of 6 levels of Braking Action as shown in **Table 12** requires fine differentiation to be reported accurately by the flight crew.

The current system relies on subjective braking action reports by pilots, relayed to the Air Traffic Control Tower (ATCT) and passed on to the airport operator. Notices to Airmen (NOTAM), or SNOWTAM (Snow-related NOTAM) are issued, and the information is disseminated throughout the system. AOC can learn of deteriorating or already deteriorated conditions through the SNOWTAM, or a phone call from ATCT or the airport authority, or sometimes by listening in to the ATCT radio frequency and hearing the report in real time.

When such a report reaches AOC dispatch, the information may have to be immediately relayed to the next flights sequenced for that airport. ATCO is doing the same. “Braking Action <Braking Action value in **Table 14**> by a <Aircraft Type> at <UTC time>” may be the report, but the information being provided that way is rather poor.

For runway surface friction initial testing, the assessment of friction can be carried out under conditions of self-wetting using a CFME. There is no proven correlation to aircraft braking performance. There are certain contaminant conditions under which friction testing should not be attempted because it may lead to erroneous friction readings.

3.3.2 New SESAR Operating Method

The formal EATMA design is developed in the following sub-sections. This chapter looks specifically at the impact of runway condition reporting and its impact on the airfield performance and provides a programmatic way to help all involved actors to asses, disseminate and acknowledge the runway condition and the short term prediction of runway condition and contamination.

EUROPEAN PARTNERSHIP

Co-funded by the European Union

As for preceding chapter, this chapter is divided into subsections dealing with the roles and behaviour of each involved actor, followed by a summary and the developed use-cases.

3.3.2.1 RCAM System

RCAM System (RCAMS) supports the Airport Operator in the monitoring of runway surface conditions. RCAMS computes data from runway sensors and other available data sources (AWOS, weather radar, METAR, MET forecast etc.) contaminant type, depth and coverage, which is translated using Runway Condition Assessment Matrix (RCAM) into Runway Condition Code (RWYCC ranging from 0 to 6). Besides, short term prediction of runway condition is also provided. RCAMS displays relevant runway condition data to Airport Operator and triggers an alert in case of significant change in runway condition (current or predicted) is computed by the system. RCAMS enables Airport User to compose a Runway Code Report (RCR) based on data computed by the system, validated and eventually edited by Airport Operator. The RCR is subsequently disseminated to other stakeholders to inform them about runway surface conditions.

Runway condition monitoring is performed in RCAMS by a set of surface sensors. Depending on the type of the sensors (active/passive), runway surface and subsurface temperature, freezing point, water film and conditions in general (e.g., dry, wet, snow, ice etc.) can be measured.

All measured information from runway sensors and other data sources (AWOS, weather radar, METAR, MET forecast etc.) is collected in RCAM server where a calculation and prediction of runway conditions, respective alerts and further distribution to Airport Operator HMI is performed.

For the runway condition prediction, the RCAMS includes interfaces to the Numerical Weather Prediction model or imports the TAF / TREND forecasts and the RCAMS built-in runway condition model provides the nowcasts (1 - 3 hour forecasts) and 12-hour predictions of the air and runway temperature and runway conditions for all system locations (i.e. thirds of the runway).

3.3.2.2 Actors and identified on-board systems

3.3.2.2.1 Airport operator

The Airport Operator is responsible for identifying and reporting hazardous conditions on local runways. The new operating method aims at satisfying the Airport Operator's need to have a real-time update and short term trend awareness of the runway condition. Dependent on circumstances this extended awareness can either serve to manage runway condition assessment better or reduce the effort needed to produce RCR and to communicate up to date and reliable information to the ANSP and any other stakeholders, which enhances common awareness about operations safety.

The fundamental changes introduced to the Airport Operator operational environment are as follows:

- Maintain real-time, continuous awareness of the runway condition based on automatic objective measurements,
- Provide short term forecast of the runway condition that will allow for better tactical planning of maintenance, traffic and inspections, and better prediction of aircraft behaviour during the landing phase.

In addition to local data sources, the system will be able to work with automatic braking action of the just landed aircraft delivered by OBACS. This will be done automatically and information will be brought to the attention of Duty Officers.

Co-funded by the European Union

RCAMS compiles all data and calculates a consolidated RWYCC easily usable for all stakeholders. RCAMS is engaged continuously in processing the incoming inputs to provide the Airport Operator with the current RWYCC as well as its variability over at least next 60 min (Predicted RWYCC).

The Airport Operator is the operator of RCAMS. The Airport Operator is provided with automated RWYCC assessment for dissemination to relevant stakeholders following validation. Additionally, a short term forecast is generated which will allow for optimized runway related actions. Information is delivered to AO in form of alerts and warnings overlaid on current published RCR/SNOWTAM content. AO, after necessary validation, decides whether to update the published runway condition.

In order to maintain output quality RCAMS will be able to self-adjust given the proper adjustment inputs are available. Few possibilities for such inputs exist: recording of published RCR made by Duty Officers based on runway inspections, OBACS, which uses the whole aircraft as a measurement device or even PIREP (although this must be considered carefully due to subjective nature of information). Other sources for this self-adjustment may be also considered.

3.3.2.2.2 Flight Crew

The implementation of TALPA-ARC proposals in ICAO provisions fully recognizes the importance of Flight crew Reports of Braking Action as a means to obtain the latest information when the runway condition is degrading. It is mandatory for flight crew to report to ATCO observations of worse than expected Braking Action and is mandatory for ATCO to pass this information to the following airplanes, and also to the airport operator

Flight Crew will directly benefit from the more accurate RWYCC in their flight preparation, and in their process of assessing necessary take-off and landing associated distances to be checked with the available ones using tables from the aircraft designer.

3.3.2.2.2.1 Flight Crew of ROAAS equipped aircraft

ROAAS installation on aircraft provides an increase in terms of safety during landing phase, regarding the risk of runway overrun. ROAAS is composed of the ROAAS software, a Database with Runway characteristics, a minimum set of sensors interfaces, and a mean to interact with flight crew in order to emit alerts.

Before the activation, Flight crew has to set up ROAAS in order to adapt the computation of the function to the current conditions of the landing as the runway condition (provided by the Tower Ground Controller), the type of approach (nominal or steep), etc. A means for the Flight crew to inhibit – if needed – the function is also available.

3.3.2.2.2.2 OBACS equipped aircraft

The OBACS is a new system initially developed by Airbus as CORSAIR project (now deployed as BACF: Braking Action Computation Function). It consists of on-board assessment of braking action i.e. Braking Action Computation. So far, it consists in software hosted in ATSU for Airbus Single Aisle / A330 Aircraft, as an on-board aircraft based computation of Braking Action, which uses the aircraft as a runway condition assessment means.

For solution PJ.02-W2-25.1, OBACS benefit for bizjet aircrafts has been assessed by evaluating dedicated OBACS prototype fitted on Dassault Flight test aircraft.

The solution permits using data measured by the aircraft during the landing rollout to identify the Braking Action the aircraft experienced on the runway. This Braking Action can be reported using the standardized scale shown in **Table 12** and now harmonized internationally.

Each code is associated with an aircraft performance level, that is to say a tire-runway friction coefficient that will contribute to the estimated stopping distance. In normal operations under contaminated runway conditions, the ATC will transmit the current runway condition assessment. With this information, the flight crew may use tools provided by the aircraft manufacturer (e.g. paper charts or Electronic Flight Bags), to estimate their stopping distance necessary based on the current conditions.

Conditions that affect the stopping distance include the following:

- Aircraft mass,
- Outside air temperature,
- Wind,
- Approach speed,
- Slat/flap settings,
- Pressure altitude of the runway,
- Runway slope,
- Autobrake setting,
- Thrust reverser use,
- Runway condition.

The runway condition is one of the principal components affecting the stopping distance of the aircraft. For example for an Airbus A320, the difference in stopping distance on a 1-POOR runway may be three times longer than on a 6-DRY runway.

The new technology works by reversing the landing distance calculation process. Whereas above, the flight crew would enter a runway state and retrieve an estimated stopping distance, the new technology measures the actual amount of runway used during the landing and estimates the most appropriate corresponding runway condition.

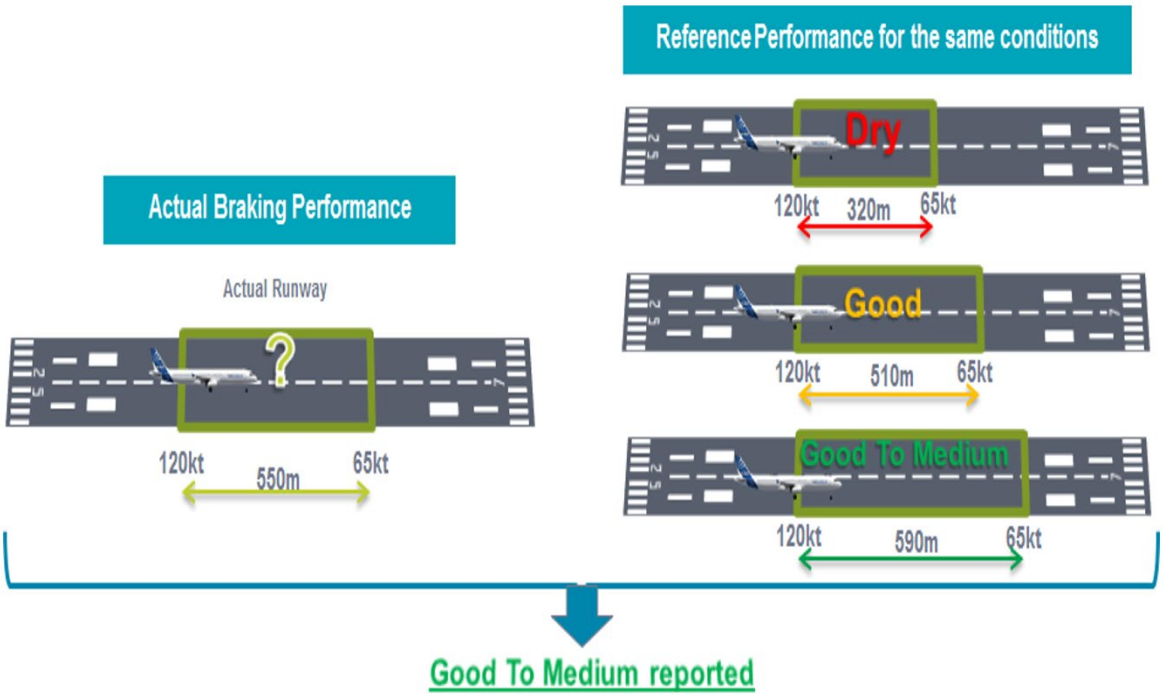


Figure 2: Technology used for identifying the runway condition encountered during landing

As the new technology has access on-board to all the parameters affecting the aircraft performance, which are recorded during the landing, a simulation of the conditions at landing is made. Using the recorded parameters, and accessing dedicated aircraft models, the aerodynamic and thrust forces acting on the aircraft can be reconstructed in order to determine the contribution of the aircraft wheels and brakes to the aircraft deceleration during a particular landing, and thus the contribution of the runway state.

Using matching algorithms, the software can choose the runway condition(s) which best matches the reality experienced by the landing aircraft.

The function aims at determining the Braking action encountered during landing.

The accurate Braking Action analysis can be performed only when the anti-skid system is regulating the brake pressure. Indeed, when the anti-skid system regulates the pressure, the aircraft braking capability is limited by the runway friction.

If not anti-skid limited, it is possible to assess the braking Action achieved. Potentially higher braking action may be achieved with higher braking demand. It can be interesting to know that the runway is at least 5-Good or 4-Good to Medium. Rolling Landing or landing with low braking force applied do not bring knowledge on runway friction.

The limitations of this technology are that identification can only be made on portions of the runway where the aircraft was adequately braking. Thus the calculated braking action may not be representative of the entire runway length; there may be portions with worse braking action, or better. In addition, depending on local runway conditions or simply on how the flight crew manages the brake application e.g. autobrake and pedal braking, there is the possibility of several identification zones, with gaps in between them. Computed Braking Action result has thus to be used in combination of other complementary means to have the view on the entire length and width of the runway.

Co-funded by the European Union

For example, during the flare up to touchdown, no assessment can be made. Consequently, it is probable that the first 500 to 700m of the runway will remain unidentified. Once braking begins, the aircraft will then decelerate down to a safe taxi speed after which the flight crew may disconnect the autobrake in order to roll towards the runway exit. In this case, the runway portions after the aircraft reaches taxi speed and began rolling would not be identified. The end result in this case is 500-700m of runway condition identification. On a runway that may be 2000m or longer, this represents approximately 1/3 of the runway.

The on-board software combined with existing avionic datalink connections permits seamless routing of runway condition messages. Using the existing ACARS network and data distribution network, messages can be routed to AIRBUS-NAVBLUE ground based servers in near-real time; and a data distribution service can be built in order to exchange data with stakeholders.

The on-board software combined with existing on-board HMI will display to flight crew the computed braking action. It will help the flight crew to decide Braking Action to report (PIREP).

In the example shown in Figure 3 below, the runway is covered by snow and the flight crew has selected A-BRK MED during approach OBACS function principle during landing phase:

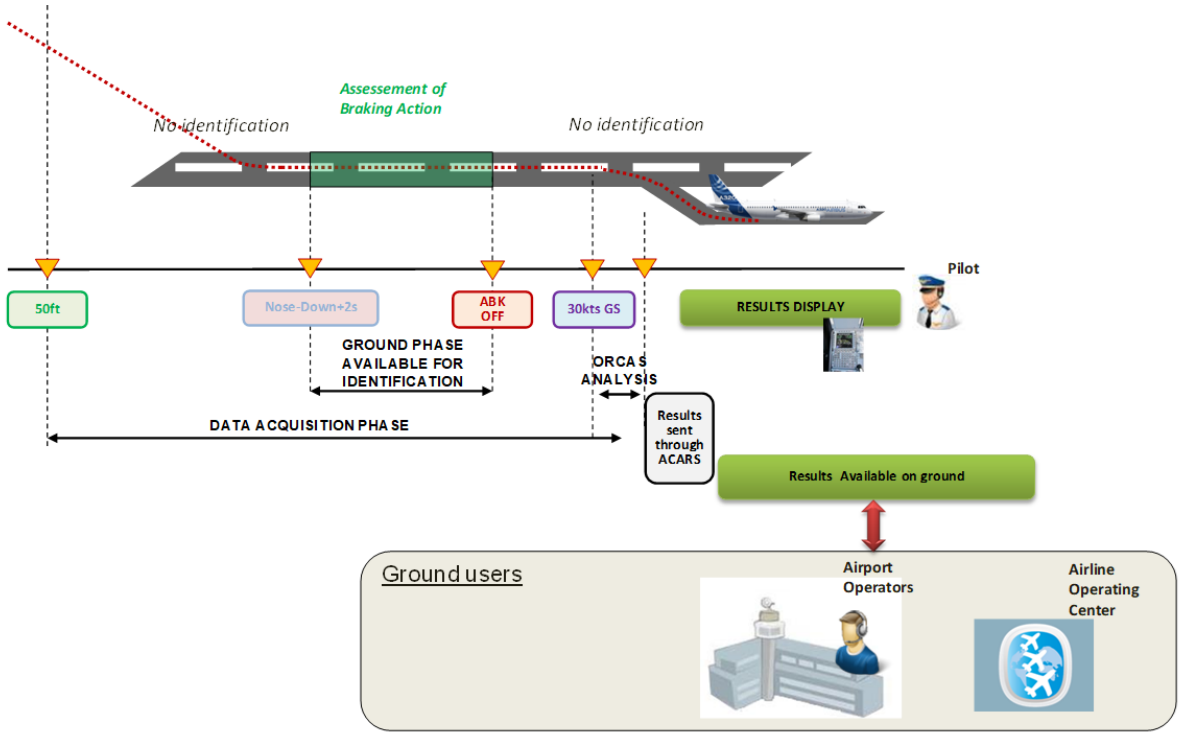


Figure 3: OBACS function principle during landing phase

3.3.2.2.2.3 Flight Crew of Take-off monitoring system (TOMS) equipped aircraft

Take-off monitoring system installation on aircraft provides an increase in terms of safety during take-off phase, regarding the risk of runway overrun and tail strike. Take-off monitoring system is composed of the Take-off monitoring system software, a Database with Runway characteristics, a minimum set

EUROPEAN PARTNERSHIP
Co-funded by the European Union

of sensors interfaces, and a mean to interact with flight crew in order to emit alerts. An alert is triggered by take-off monitoring system when a risk of safe take-off failure is detected.

Take-off monitoring system is automatically activated before and during take-off phase without any specific pilot action, independently from the runway contamination level.

3.3.2.2.3 Air Traffic Controller (ATCO)

Compared to previous operating method role and responsibilities of ATCO do not change. The data provided by RCAMS is expected to be automatically treated / processed / transmitted by the ANSP systems (and more especially the ATIS), though this is not covered by this solution

3.3.2.3 Summary

The new operating method will comply with ICAO regulations related to runway condition reporting (Global Reporting Format - RWYCC) according to RCAM [17],[25],[27],[22].

The new operating method developed in this OSED is based on integrating new data sources and assistances to provide Current RWYCC and Predicted RWYCC usable by Flight Crew to prevent a runway overrun:

- New runway sensors (surface and subsurface temperature, freezing point, water film height, runway state - dry, damp, wet, freezing wet, snow, ice[11], etc.),
- On-board HMI assistance to help flight crew deciding PIREP on Braking Action,
- Automatically Computed Braking Action transmitted on-ground and disseminated to Airport Operator,
- Airport Operator HMI to display the status of data sources (sensors/measurement/computed braking action). It gathers all the measurements relative to runway condition,
- Decision support tool for the Airport Operator to collect, integrate various inputs and use a data-driven modelling based on past results to propose Runway Condition code per third,

The new method will optimize usage of previously existing methods (e.g. vehicle which measures runway friction before the introduction of GRF) and also support runway maintenance. RCAMS will ensure continuous monitoring of runway condition, using built-in runway sensors, on-board computed braking action when available, as well as short term forecast computed by model, together integrated into one value, which is presented to Airport Operator or, indirectly, to any interested stakeholder (dispatcher, MET office, NOTAM office etc.).

Forecast of runway condition supplements the current runway condition awareness. Therefore usability of measurement of runway friction will last longer and can be better planned, which is helpful especially when runway is going to be used for landing/take off. The reliability of runway condition

[11] It may not be possible to measure all of the listed surface conditions with majority of the sensors.

forecast is enhanced by utilization of dedicated forecasts and nowcasting for airport (from AWOS), artificial intelligence tools, integration of new sensors into a forecast model.

ROAAS equipped aircraft Flight Crew either manually input the RWYCC or it is automatically transmitted to aircraft. ROAAS then raises an on-board alert if the approach or landing phase may end in a runway overrun, which makes the pilot in command take appropriate measures to avoid it.

TOMS equipped aircraft Flight Crew either manually input the runway contamination information or it is automatically transmitted to aircraft. TOMS can then raise on-board alert if the take-of phase is unsafe, which makes the pilot in command take appropriate measures to avoid it.

Despite this automated digital broadcast, current procedures are maintained. Airport Operator still keeps notifying RWYCC via RCR. ATC will keep publishing ATIS and AIS will publish SNOWTAM as well. To reduce ATCO workload further works on RCAMS-ATIS integration are recommended.

RCAMS provides Airport Operator automatically and seamlessly with reliable and objective information about runway condition.

RCAMS could raise awareness about runway condition among different stakeholders such as airport operator, TWR controllers, pilots and AOC by sharing updated information seamlessly. This service is particularly valuable in situations when both adverse weather conditions and runway surface condition have been evolving and/or downgraded quickly. However, even during stable weather condition or in weather condition which does not lead to significant downgrade of runway conditions (e.g. drizzle on dry runway, which can cause degrading RWYCC from 6 to 5), continuous, non-disruptive, monitoring of runway state by RCAMS fed with built-in Surface Condition sensors information may reduce the number of runway inspections.

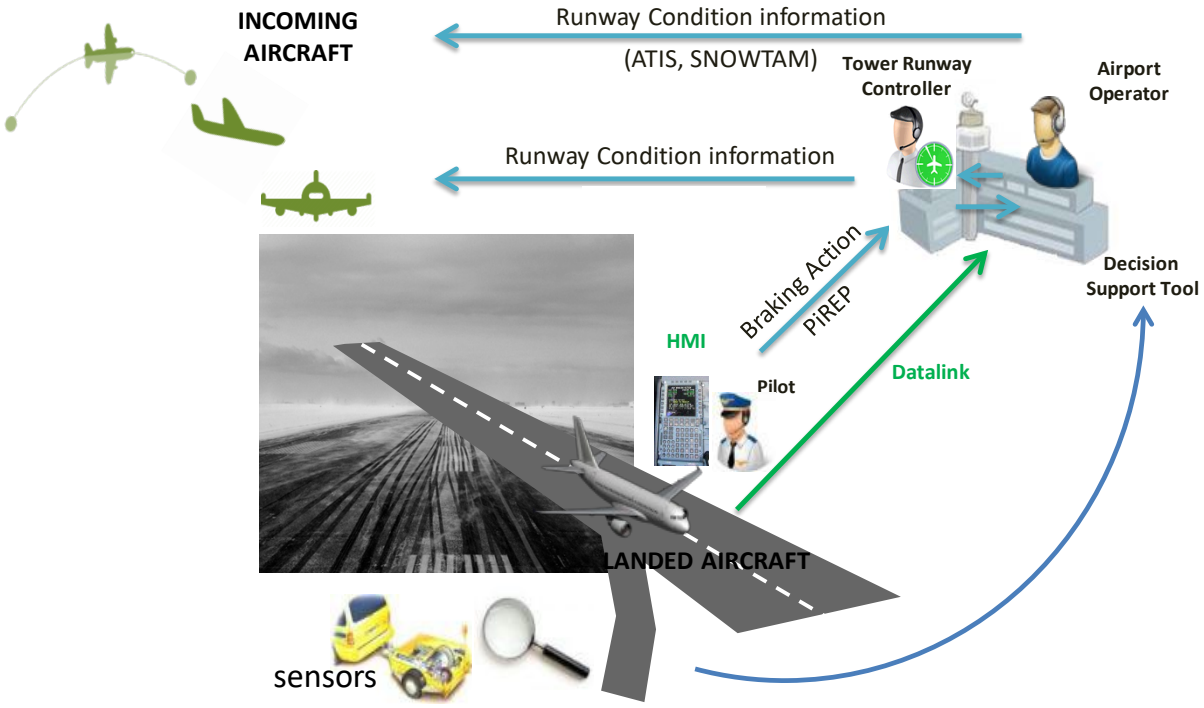


Figure 4: View of OBACS integration at Airport level

Co-funded by the European Union

Furthermore, depending on the traffic density and the complexity of the approach, it may assist flight crews with the go-around / landing decision making process by providing the latest changes to the runway condition, which is subject to the equipment being set up to allow this data to be sent to the flight crew automatically.

RCAMS will provide the Airport Operator with automatic runway condition assessment.

Together with the present assessment of the Current RWYCC, a short term forecast of Predicted RWYCC (using NWP based runway condition model) is provided which, when disseminated among stakeholders, may be of great assistance in planning the maintenance actions, managing the weather impact and sequencing the incoming traffic (especially in high density environment and short distance flights).

3.3.2.4 Use Cases

3.3.2.4.1 Use Cases for [NOV-2]Runway Condition Report Elaboration

This node view summarizes the information exchanges used when elaborating the runway status in the Use Case PJ.02-W2-25-1: Runway surface condition and RWYCC assessment

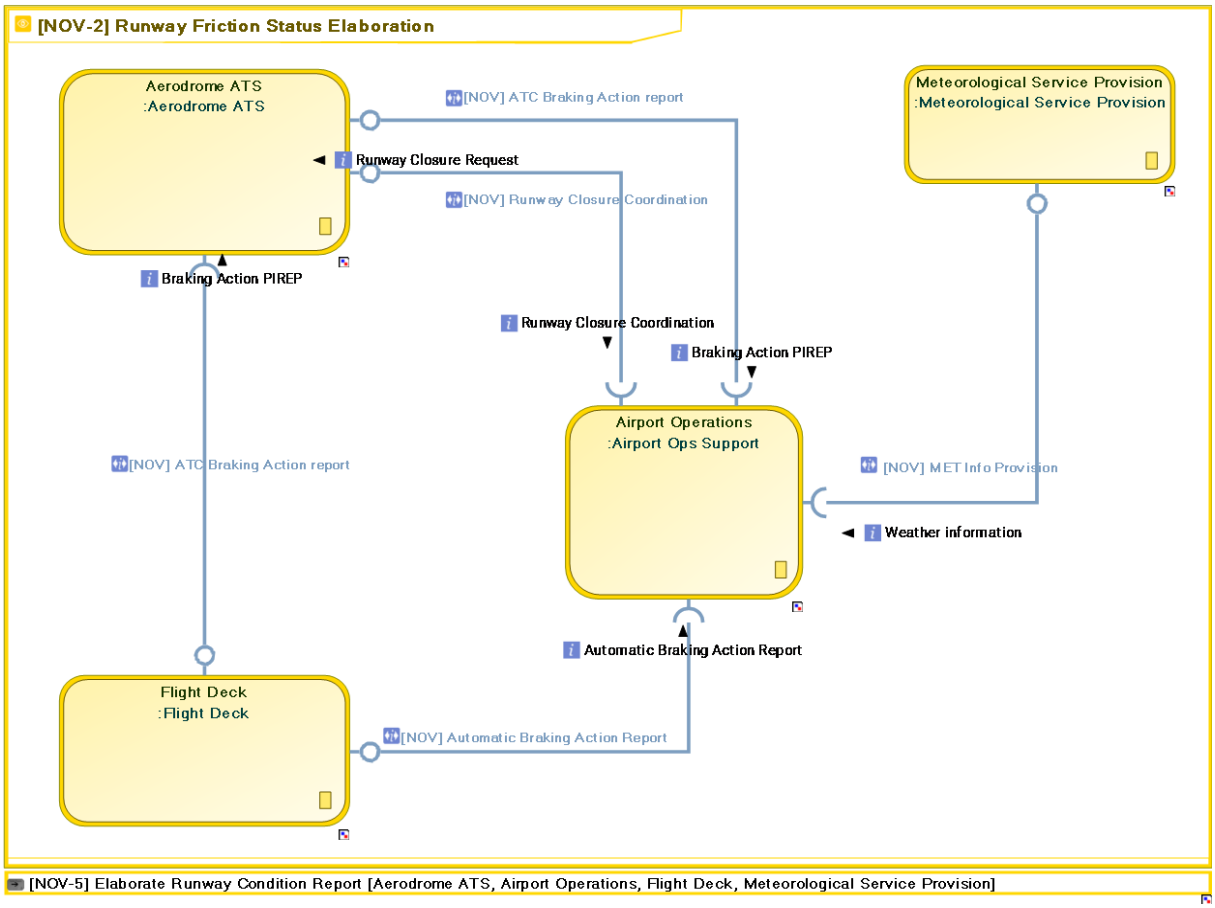


Figure 5: [NOV-2]Runway Friction Status Elaboration

Click on http://webprisme.cfmu.eurocontrol.int/oneportal_working_validation/data/diagrams/A1FDC19859F143A8 for zooming.

3.3.2.4.1.1 Use Case PJ.02-W2-25-1: Elaborate Runway Condition Report

This view describes the Use Case PJ.02-W2-25-1

Use case	[NOV-5]Elaborate Runway Condition Report

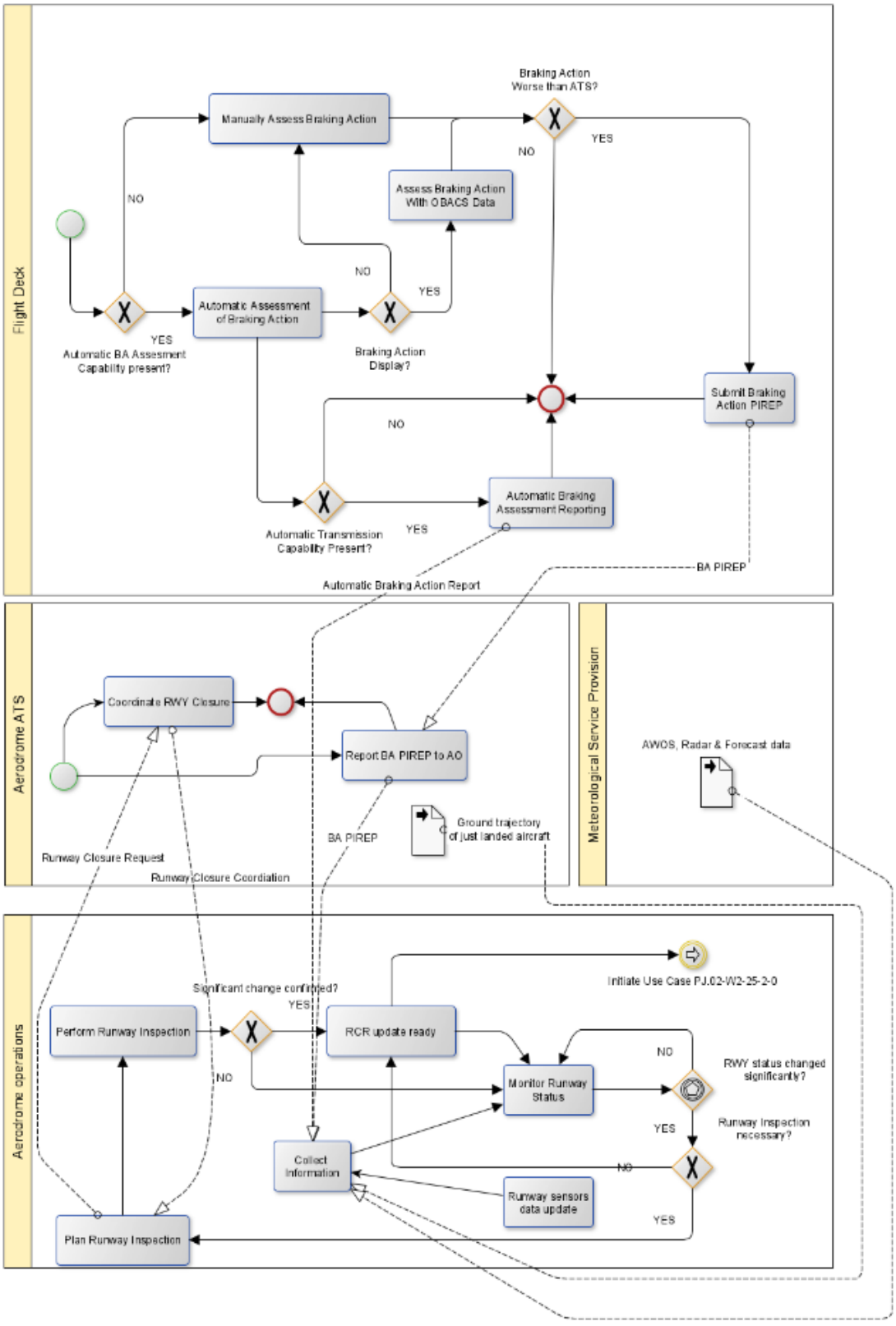


Figure 6: [NOV-5]Elaborate Runway Condition Report

Activity	Description
Coordinate Runway Closure	Any runway inspection or maintenance operation needs runway to be closed. Airport Operations request is sent to Control Tower, which manage departing and arrival traffic to allow runway closure.
RCR update ready	Only the airport Duty Officer role is allowed to update the RCAMS assessed runway condition and publish updated RCR. In case either RWYCC, runway contaminant type, depth or coverage changes significantly a new RCR issuance is mandatory.
Collect Information	Input collection for runway surface condition assessment by Airport Operations. Inputs will be based on MET data, completed by ground data (on Airport Operator's side, embedded runway sensors, mobile sensors, etc.), on-board data (on Aircraft's side, OBACS to assess experienced braking action when anti-skid activated during landing roll, etc.), and PIREP (Flight Crew's braking action assessment reported on demand or when runway condition was worse than expected).
Manually Assess Braking Action	Braking Action observed at landing is assessed by Flight Crew without any use of avionics.
Automatic Assessment of Braking Action	Braking Action is measured by on-board sensors without any specific action from the crew. When relevant to assist PIREP, it is reported to the flight crew. Optionally, it can be automatically disseminated to other stakeholders (like AO)
Assess Braking Action with OBACS Data	Braking Action observed at landing is assessed by Flight Crew with assistance of Computed Braking Action provided by OBACS.
Automatic Braking Assessment Reporting	The automatically assessed braking action from OBACS is automatically reported to the Airport Operator. This activity does not require any interaction with the Flight Crew.
Submit Braking Action PIREP	When the Braking Action perceived by the Flight Crew, potentially consolidated with OBACS data, is worse than expected, the Flight Crew reports the Braking Action to the Tower Runway Controller in form of a PIREP.
Monitor Runway Status	Airport Operation is responsible of runway maintenance. Runway condition assessment of contaminant type, depth, coverage and RWYCC per third of each runway is displayed to Airport Operation teams on RCAMS AO HMI. AO is warned whenever Runway Condition is expected to change (result of calculating Predicted Runway Condition) or in case when any portion of current RCR data is expected to have lost validity(result of calculating Current Runway condition). Monitoring of runway condition will trigger appropriate Airport Operation actions (e.g. runway inspection, decontamination activities).
Perform Runway Inspection	Airport Operations is responsible of runway maintenance. Airport Operations need to perform a minimum set of periodic runway inspections for safety purpose. More runway inspections may be needed as a means of validation of runway condition contaminant

	type, depth and coverage per runway third (e.g. during adverse weather event, when runway status could degrade or upgrade; and/or after 1 or several pilot report assessing a worse Braking Action situation than expected). Measurements and observations are used as inputs for runway condition assessment.
Plan Runway Inspection	Airport Operations is responsible of runway maintenance. Airport Operations need to perform a minimum set of periodic runway inspections for safety purpose. Other on-demand runway inspection may be needed to confirm the assessed runway condition contaminant type, depth and coverage per runway third (e.g. during adverse weather event, when runway status could degrade or upgrade; and/or after 1 or several pilot report assessing a worse Braking Action situation than expected). Measures and observations are used as inputs for runway condition assessment. Runway inspection is a basic activity for maintaining runway condition awareness
Report Braking Action PIREP to Airport Operator	When Control Tower ATCO received a PIREP from a Flight Crew who experienced a worse runway status than expected, ATCO shall report to Airport Operations, for the runway condition to be degraded (by applying RCAM matrix). The decision to degrade RWYCC belongs to DO.
Runway Sensors Data Update	Automatic Runway built-in sensors perform measurement of a set of runway surface parameters and make it available to Airport Operations.

Table 8: Activity items description for view (NOV-5) Elaborate Runway Friction Status

Issuer	Info Flow	Addressee	Info Element	Info Entity
Flight Deck Landed Aircraft	Automatic Braking Action Reporting o--> Collect Information	RWY Airport Operations	Automatic Braking Action Report	RunwayBrakingActionObservation
Flight Deck Landed Aircraft	Submit Braking Action PIREP o--> Report Braking Action PIREP to Airport Operator	Aerodrome ATS Ground Control	Braking Action PIREP	RunwayBrakingActionObservation
Control Tower Aerodrome ATS	Report Braking Action PIREP to Airport Operator o--> Collect Information	RWY Airport Operations	Transmitted Braking Action PIREP	RunwayBrakingActionObservation
Aerodrome ATS	Aerodrome ATS o--> Collect Information	RWY Airport Operations	Ground trajectory of just landed aircraft	SystemTrack
RWY Airport Operations	Plan Runway Inspection o--> Coordinate Runway Closure	Aerodrome ATS Ground Control	Runway Closure Request	

EUROPEAN PARTNERSHIP

Co-funded by the European Union

Issuer	Info Flow	Addressee	Info Element	Info Entity
Aerodrome ATS	Coordinate Runway Closure o--> Plan Runway Inspection	RWY Airport Operations	Runway Closure coordination	RunwayClosureStartEnd Times
Meteorological Service Provision	Meteorological Service Provision o--> Collect Information	RWY Airport Operations	AWOS, Radar $ Forecast Data	AWOSdata METradarData ForecastData

Table 9: Information Exchange description for view (NOV-5) Elaborate Runway Friction Status

3.3.2.4.1.1.1 Abstract

This use case describes the sequence of events occurring when contamination of the runway changes significantly[12] whatever the initial condition.

Automatic runway surface condition assessment performed continuously uses various data sources: automatic Surface Condition Sensors entries, weather data and forecast from MET Services. The aim of continuous runway surface condition assessment is to compute a Current RWYCC and a Predicted RWYCC. Surface Condition. This serves to maintain a degree of the runway condition awareness in-between two visual observations. It also permits to trigger a new visual inspection if condition change or are about to change shortly. Broadcasted Computed Braking Action is presented separately to the DO whenever available. In the following description, Current RWYCC and Predicted RWYCC are computed by RCAMS, which mainly covers AO-0216 of the PJ.02-W2-25.1 Solution.

The DO always has to validate the computed Current RWYCC and Predicted RWYCC, based on manual inspection or other significant information, before further dissemination.

3.3.2.4.1.1.2 Actors

- Airport Operator,
- Flight Crew (several),
- Tower Runway Controller,
- Tower Ground Controller.

3.3.2.4.1.1.3 Assumptions / pre-conditions

Assumptions:

- RCAMS offers a means for Local ATS (Tower) and Airport Operator to share runway condition information.

[12] According to [17] significant change is one of the following: change of RWYCC, change of reportable contaminant coverage, change of contaminant type or change of reportable contaminant depth or any other information accepted locally as significant (e.g. braking action PIREP)..

- The Flight Crew may be assisted by an on-board system providing Braking Action assessment (OBACS).

Pre-conditions:

- Current RWYCC and Predicted RWYCC values exist

Triggering events:

- New ground data (Runway contaminant type and depth) is measured or observed:

  a. Originating from calibrated, accurate built-in runway sensors (AIRPORT-57), if such sensors are available on the runway,
  b. Or through visual inspection and measurement. Visual measurement can be used in case of unavailability of entries from such sensors.

  Note: Runway contaminant nature and depth shall be periodically assessed by the Airport Operator and especially in adverse condition. As a result, the following events are a triggering events for this use case:

  c. After a weather event which may have changed the runway condition status,
  d. After decontamination or reopening, as runway condition status shall be re-assessed.

- OBACS output is received (requires A/C-84a, A/C-64, AIRPORT-57).

- MET Weather Short Forecast update is received (AIRPORT-57).

3.3.2.4.1.1.4 Use Case Steps

Nominal Flow

[1] The runway condition is automatically assessed:

- Current Runway Condition is regularly computed,

- Predicted Runway Condition is regularly computed,

Data is continuously provided by automatic Surface Condition sensors AIRPORT-57, AIRPORT-59 or (optionally) by visual inspection from the Airport Operator. MET) is continuously provided.

(optionally) Braking Action is provided:

a. Manually: when a Flight Crew of a just landed aircraft reports Braking Action, the Tower Runway Controller or the Tower Ground Controller report to the Airport Operator who then enters the Braking Action reported in the RCAMS; or controllers may have means to input reported Braking Action directly in RCAMS (using AIRPORT-59).
b. Or automatically: computed braking action provided by equipped aircraft (A/C-84a, A/C-64, AIRPORT-57).
c. .

[2] On any ground data or MET update (AIRPORT-57) or new data given by Weather based RWYCC prediction model, the RCAMS re-evaluates a Predicted RWYCC based on last ground data or Braking Action received, Current RWYCC, and last Predicted RWYCC time series,

Co-funded by the European Union

[3] New computed Runway Condition is compared to currently published RCR. Alerts are raised in case of differences.

[4] Airport Operator can decide on runway inspection. Runway closure is then coordinated with Tower. Runway inspection result is used in this case to validate RCAMS alerts.

[5] In case RCAMS alert is correct, or any other significant discrepancy between the published RCR and current situation on the runway exists, Airport Operator, within its Duty Officer role, initiates the RCR update process. Otherwise, Runway Condition monitoring continues.

Note: this use case only covers determination of the Current and Predicted Runway Condition. Any use and reporting are covered by other use cases.

3.3.2.4.1.1.5 Post-conditions

RCAMS maintains Current RWYCC, current runway condition and Predicted RWYCC, predicted runway condition, Airport Operator's awareness. Runway condition information is instantaneously disseminated and available to any stakeholder local to the airport who is connected directly to the RCAMS system (e.g. Tower Controllers, APOC, etc.).

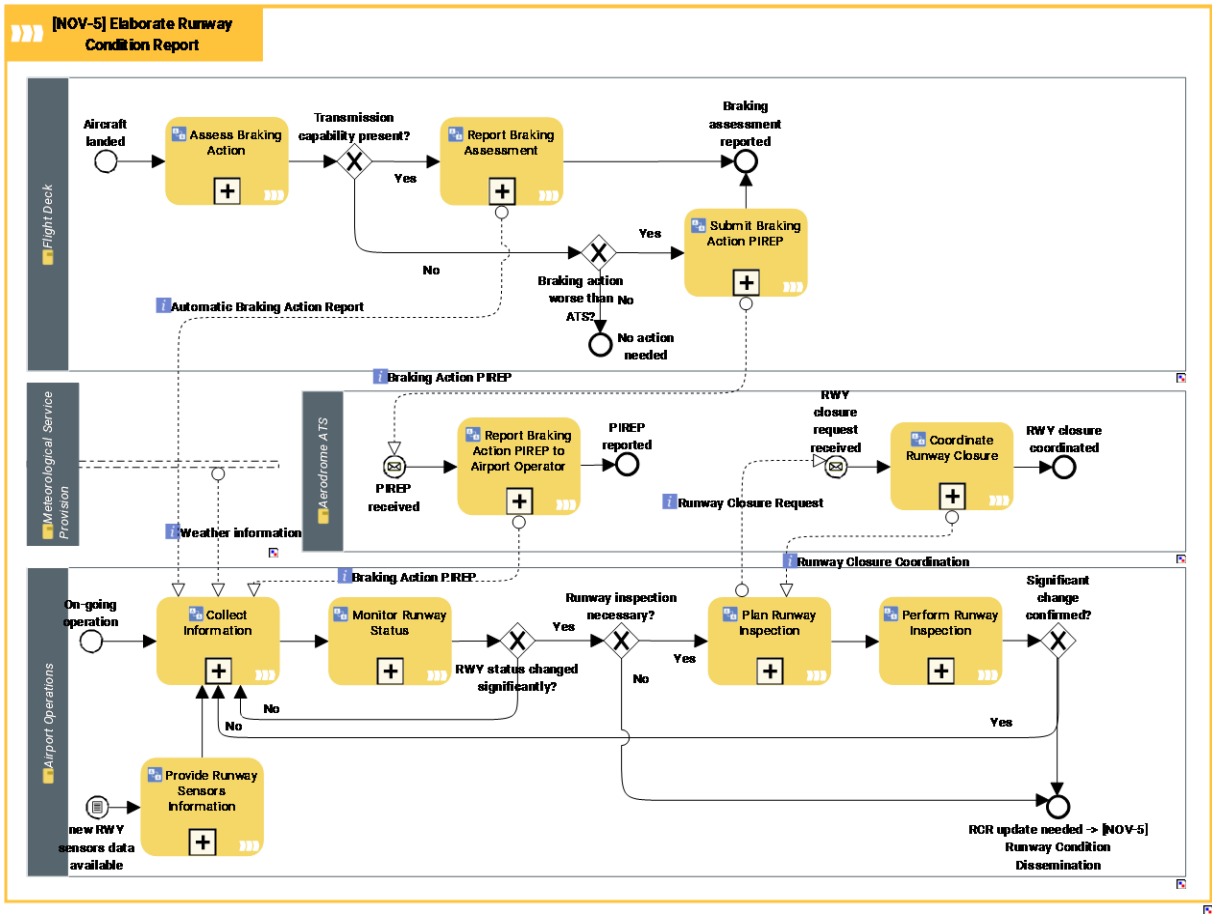


Diagram Id: 661868D060D451A4

Activity	Description
Assess Braking Action	Braking Action observed or measured during landing either: ? by Flight Crew without any use of avionics; ? by on-board sensors without any specific action from the crew. When relevant to assist PIREP, it is reported to the flight crew. Optionally, it can be automatically disseminated to other stakeholders.
Collect Information	Input collection for runway surface condition assessment by Airport Operations. Inputs will be based on MET data, completed by ground data (on Airport Operator's side, embedded runway sensors, mobile sensors, etc.), on-board data (on Aircraft's side, OBACS to assess experienced braking action when anti-skid activated during landing roll, etc.), and PIREP (Flight Crew's braking action assessment reported on demand or when runway condition was worse than expected).
Coordinate Runway Closure	Runway closure is coordinated by Control Tower Supervisor between all stakeholders. For runway inspection: to benefit to Surface Condition Awareness. For runway maintenance: to benefit to Runway Excursion Avoidance.
Monitor Runway Status	Airport Operation is responsible of runway maintenance. Runway condition assessment of contaminant type, depth, coverage and RWYCC per third of each runway is displayed to Airport Operation teams on RCAMS AO HMI. AO is warned whenever Runway Condition is expected to change (result of calculating Predicted Runway Condition) or in case when any portion of current RCR data is expected to have lost validity(result of calculating Current Runway condition). Monitoring of runway condition will trigger appropriate Airport Operation actions (e.g. runway inspection, decontamination activities).
Perform Runway Inspection	Airport Operations is responsible of runway maintenance. Airport Operations need to perform a minimum set of periodic runway inspections for safety purpose. Other on-demand runway inspection may be needed to confirm the assessed runway condition contaminant type, depth and coverage per runway third (during adverse weather event, when runway status could degrade or upgrade, after 1 or several pilot report assessing a worse Braking Action situation than expected). Measures and observations are used as inputs for runway condition assessment.
Plan Runway Inspection	Airport Operations is responsible of runway maintenance. Airport Operations need to perform a minimum set of periodic runway inspections for safety purpose. Other on-demand runway inspection may be needed to confirm the assessed runway condition contaminant type, depth and coverage per runway third (during adverse weather event, when runway status could degrade or upgrade, after 1 or several pilot report assessing a worse Braking Action situation than expected). Measures and observations are used as inputs for runway condition assessment.

Provide Runway Sensors Information	Automatic Runway built-in sensors perform measurement of a set of runway surface parameters and make it available to Airport Operations.
Report Braking Action PIREP to Airport Operator	When Control Tower ATCO received a PIREP from a Flight Crew who experienced a worse runway status than expected, ATCO shall report to Airport Operations, for the runway condition to be degraded (by applying TALPA RCAM).
Report Braking Assessment	The automatically assessed braking action from OBACS is automatically reported to the Airport Operator. This activity does not require any interaction with the Flight Crew.
Submit Braking Action PIREP	When the Braking Action perceived by the Flight Crew, potentially consolidated with OBACS data, is worse than expected, the Flight Crew reports the Braking Action to the Tower Runway Controller in form of a PIREP.

Issuer	Info Flow	Addressee	Info Element	Info Entity
Flight Deck	Report Braking Assessment o--> Collect Information	Airport Operations	Automatic Braking Action Report	RunwayBrakingActionObservation
Airport Operations	Plan Runway Inspection o--> RWY closure request received	Aerodrome ATS	Runway Closure Request	AIRM_Change_Request
Aerodrome ATS	Coordinate Runway Closure o--> Plan Runway Inspection	Airport Operations	Runway Closure Coordination	AIRM_Change_Request
Flight Deck	Submit Braking Action PIREP o--> PIREP received	Aerodrome ATS	Braking Action PIREP	RunwayBrakingActionObservation
Aerodrome ATS	Report Braking Action PIREP to Airport Operator o--> Collect Information	Airport Operations	Braking Action PIREP	RunwayBrakingActionObservation
Meteorological Service Provision	Meteorological Service Provision o--> Collect Information	Airport Operations	Weather information	MeteorologicalReport

Info Element	Description
Automatic Braking Action Report	
Braking Action PIREP	

Co-funded by the European Union

Runway Closure Coordination	Runway closure coordination can be requested by Airport Operations to perform runway inspection or runway maintenance operations.
Runway Closure Request	
Weather information	Description: Digital (preferably in WXXM format) meteorological information forecasting for aviation, enhanced with probability of occurence and describing wind vectors and significant meteorological phenomena such as turbulence, thunderstorms, jet streams, icing, volcanic ash. The forecasts can be distributed in regular time intervals or upon request of the concerned ATM stakeholder.

3.3.2.4.2 Use Cases for [NOV-2]Runway Friction Status Utilisation

This node view summarizes the information exchanges used when disseminating the runway status

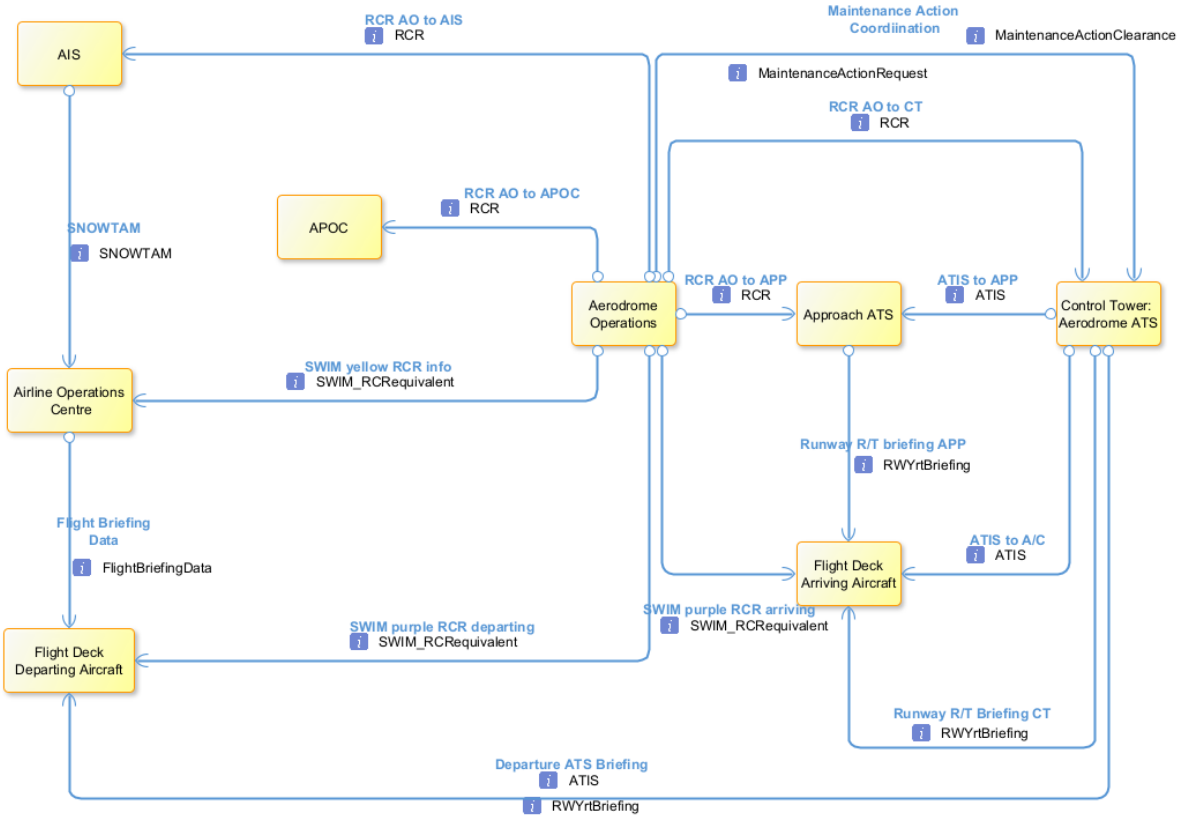


Figure 7: [NOV-2]Runway Friction Status Utilisation

This view covers the Use Cases

- PJ.02-W2-25-2-0: Runway Condition dissemination

- PJ.02-W2-25-2-5: Decontamination execution

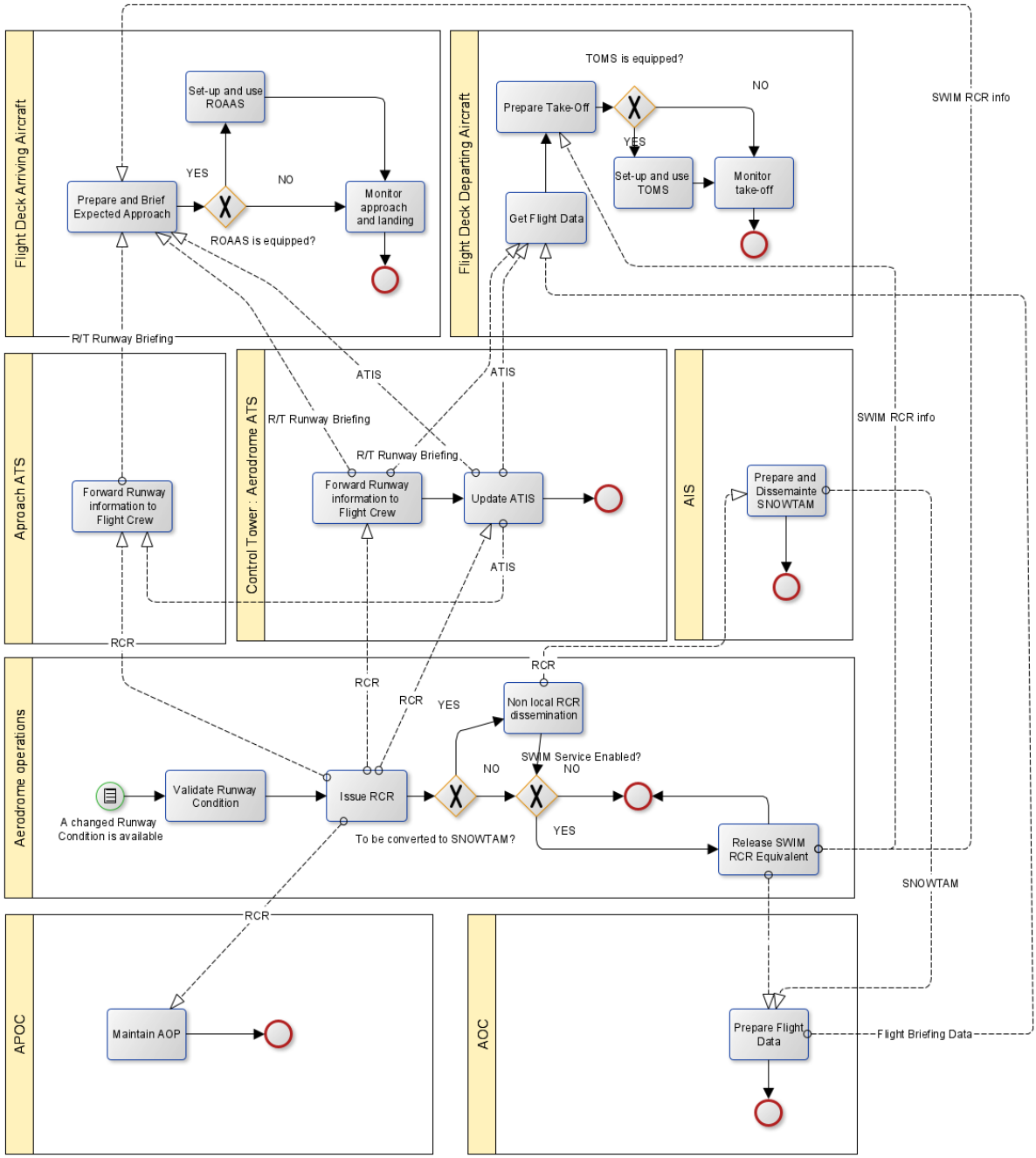


Figure 1: [NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition dissemination

Activity	Description
Update ATIS	ATIS revision by Control Tower based on updated inputs.
Forward Runway information to Flight Crew	The usual source of information for the flight crew on approach is AIS and ATIS. However, in degraded cases approach ATCO will also pass the information to descending aircraft as it is ATS responsibility to monitor changing conditions on the target airport. Additionally this activity can be performed by Tower ATCO during the final approach.
Validate Runway Condition	AO is ultimately responsible for providing other stakeholders with the up to date and accurate information about the runway condition. In order to disseminate the correct data, Duty Officer (AO role) must perform an appropriate validation activity.
Issue RCR	Runway status publication by Airport Operations. Dissemination will at minimum use ICAO RCR (Runway Condition Report) procedure. With the Solution, ICAO RCR may be completed with prediction on runway condition and may be supported by a SWIM service. Dissemination addresses all relevant local and non-local stakeholders: · airspace users: AOC (Airline Operations Centre) for flight preparation and Flight Crews (possibly indirectly via ATCO which will inform departing and arriving flights about runway condition · ATS (Tower and Approach ATC)
Get Flight Data	Flight Crew to retrieve (from a flight preparation entity) or initiate their flight plan data.
Prepare and Brief Expected Approach (PJ.02-W2-25)	The Flight Deck performs the following sub-tasks: 1. obtain weather and landing information for destination and alternate airports 2. check current aircraft approach and landing capabilities against available airport means and weather conditions 3. insert expected arrival and approach procedures into the flight plan and check them against published charts 4. insert relevant performance parameters for approach 6. check/edit relevant performance parameters for go-around 7. check/perform tuning of relevant NAVAIDs 8. perform approach briefing If the airport operates an EAP approach, the Flight Deck also briefs the most likely EAP procedure.
Prepare Flight Data	When available, Airspace User Operations (Flight Operation Center FOC) proceed flight preparation to be provided for Flight Crew.
Prepare Take-Off	Flight Crew to execute take-off briefing. Take-off performance assessment shall consider runway surface condition if RWYCC<6.
Prepare and disseminate SNOWTAM	AIS is responsible for providing information services to airspace users. One of those services is the provision of SNOWTAM. SNOWTAM is created using information obtained from AO.
Non-local RCR dissemination	It is not necessary for AO to publish all RCR via AIS as SNOWTAMs. However, to provide the most up to date information to other stakeholders non local RCR dissemination is necessary. As a minimum AIS should be the target of this non-local dissemination.

EUROPEAN PARTNERSHIP

Co-funded by the European Union

Release SWIM RCR equivalent	In case SWIM is used for dissemination, stakeholders other than AIS can receive the most up to date RCR information.
Maintain AOP	<existing EATMA activity>
Set-up and use ROAAS	The Flight Crew uses the data on the Runway Condition obtained from ground to set-up and prime ROAAS for approach and landing roll.
Set-up and use TOMS	The Flight Crew uses the data obtained on the Runway Condition to set-up and prime TOMS for subsequent use during take-off.
Monitor take-off	Flight Crew monitors Take-Off Runway Excursion risk using all available information (including optional TOMS alerts if available).
Monitor approach and landing	Flight Crew monitors Landing Runway Excursion risk using all available information (including optional ROAAS alerts if available).

Table 10: Activity items description for view (NOV-5) Utilise Runway Friction Status

Issuer	Info Flow	Addressee	Info Element	Info Entity
Airspace User Operations	Prepare Flight Data o--> Get Flight Data	Departing Aircraft	Flight Briefing Data	
Airport Operations	Release SWIM RCR equivalent o--> Prepare and Brief Expected Approach	Arriving Aircraft	Predicted Runway Condition	
Airport Operations	Release SWIM RCR equivalent o--> Prepare and Brief Expected Approach	Arriving Aircraft	Current Runway Condition	
Airport Operations	Release SWIM RCR equivalent o--> Prepare Flight Data	Airspace User Operations	Predicted Runway Condition	
Airport Operations	Release SWIM RCR equivalent o--> Prepare Flight Data	Airspace User Operations	Current Runway Condition	
Airport Operations	Issue RCR o--> Update ATIS	Control Tower	Predicted Runway Condition	
Airport Operations	Issue RCR o--> Update ATIS	Control Tower	Current Runway Condition	
Airport Operations	Issue RCR o--> Forward Runway Information to Flight Crew	Control Tower	Predicted Runway Condition	
Airport Operations	Issue RCR o--> Forward Runway Information to Flight Crew	Control Tower	Current Runway Condition	

EUROPEAN PARTNERSHIP

Co-funded by the European Union

Issuer	Info Flow	Addressee	Info Element	Info Entity
Airport Operations	Issue RCR o--> Forward Runway Information to Flight Crew	Approach ATS	Predicted Runway Condition	
Airport Operations	Issue RCR o--> Forward Runway Information to Flight Crew	Approach ATS	Current Runway Condition	
Airport Operations	Release SWIM RCR equivalent o--> Get Flight Data	Departing Aircraft	Predicted Runway Condition	
Airport Operations	Release SWIM RCR equivalent o--> Get Flight Data	Departing Aircraft	Current Runway Condition	
Control Tower	Disseminate ATIS o--> Prepare and Brief Expected Approach (PJ.03b-06)	Arriving Aircraft	ATIS	ATIS
Control Tower	Disseminate ATIS o--> Get Flight Data	Flight Deck Departing Aircraft	ATIS	ATIS
Control Tower	Disseminate ATIS o--> Prepare Take-Off	Departing Aircraft	ATIS	ATIS
Control Tower	Disseminate ATIS o--> Forward Runway Information to Flight Crew	Approach ATS	ATIS	ATIS
Control Tower	Forward Runway Information to Flight Crew o--> Get Flight Data	Departing Aircraft	Predicted Runway Condition	
Control Tower	Forward Runway Information to Flight Crew o--> Get Flight Data	Departing Aircraft	Current Runway Condition	
Control Tower	Forward Runway Information to Flight Crew o--> Prepare and Brief Expected Approach (PJ.03b-06)	Arriving Aircraft	Predicted Runway Condition	

Issuer	Info Flow	Addressee	Info Element	Info Entity
Control Tower	Forward Runway Information to Flight Crew o--> Prepare and Brief Expected Approach (PJ.03b-06)	Arriving Aircraft	Current Runway Condition	
Approach ATS	Forward Runway Information to Flight Crew o--> Prepare and Brief Expected Approach (PJ.03b-06)	Arriving Aircraft	Predicted Runway Condition	
Approach ATS	Forward Runway Information to Flight Crew o--> Prepare and Brief Expected Approach (PJ.03b-06)	Arriving Aircraft	Current Runway Condition	
Airport Operations	Non-local RCR dissemination o--> Prepare and disseminate SNOWTAM	Aeronautical Information Service Provision	Predicted Runway Condition	
Airport Operations	Non-local RCR dissemination o--> Prepare and disseminate SNOWTAM	Aeronautical Information Service Provision	Current Runway Condition	
Airport Operations	Issue RCR o→ Prepare AOP	APOC	Predicted Runway Condition	
Airport Operations	Issue RCR o→ Prepare AOP	APOC	Current Runway Condition	
Aeronautical Information Service Provision	Prepare and disseminate SNOWTAM o--> Prepare Flight Data	AOC	SNOWTAM	

Table 11: Information Exchange description for view (NOV-5) Utilise Runway Friction Status

Co-funded by the European Union

3.3.2.4.2.1 Use Case PJ.02-W2-25-2-0: Runway Condition dissemination

3.3.2.4.2.1.1 Abstract

This use case describes the actions and behaviour of the Airport Operator, Local ATS and AIS to disseminate runway condition to end users.

Some consideration needs to be given to the issue of SNOWTAM creation based on RCR. The exact roles of Airport Operator and AIS are not always very precisely defined in the regulations and some local differences may arise. Care should be taken in this regard when implementing this solution.

Under Airport Operator control, RCAMS can then transmit the RCR equivalent:

- To the APOC for any update of the AOP (Airport Operation Plan)
- To the local ATS
- To the AIS[13]

At the same time RCR equivalent[14] can be transmitted to:

- To the Flight Crew of the aircraft which is about to start or to arrive at the airport, provided Flight Crew has access to SWIM service
- To ATS other than local
- To the AOC

RCR dissemination function is SWIM compliant and uses Information Service developed in frame of SESAR PJ.18-04b.

3.3.2.4.2.1.2 Actors

- Airport Operator,
- Flight Crew,
- Tower Runway Controller,
- Executive Approach Controller,
- Tower Supervisor,
- APOC,
- AOC.

3.3.2.4.2.1.3 Assumptions / pre-conditions

Assumptions

[13] If RCR is including information about the following contaminant: standing water, snow (wet, compacted or dry), slush, ice, frost.

[14] RCR is not published except locally.

Co-funded by the European Union

- Under Airport Operator control, the RCAMS has computed the Current RWYCC and Predicted RWYCC, and offers means for Airport Operator to share that information.

Pre-conditions

- Runway condition is made available to Airport Operator by RCAMS. Airport Operator has undertaken steps to validate it.

Triggering event

- Runway condition has changed with respect to last published RCR.

3.3.2.4.2.1.4 Use Case Steps

Nominal Flow

[1] Airport Operator, within its Duty Officer responsibilities, verifies contents of RCR and supplements it with any additional information according to RCR definition in (the best reference please).

[2] Airport Operator, within its Duty Officer responsibilities, validates the RCR content and activates the RCR dissemination.

[3] RCAMS disseminates the RCR locally via automatic means, to:

- APOC,
- Tower Control,

In addition, if RCR contains information about snow, slush, standing water, ice or frost it is disseminated to AIS for subsequent SNOWTAM publication. In parallel the RCR is published via SWIM service available via subscriptions to:

- Flight Crew,
- Non local ATS (e.g. Executive Approach Controller),
- AOC.

[4] In case of change, especially sudden or unexpected, new runway condition is highlighted to strengthen Air Traffic Controllers awareness; if necessary, the Airport Operator may contact directly the Tower Runway Controller or the Tower Supervision Controller.

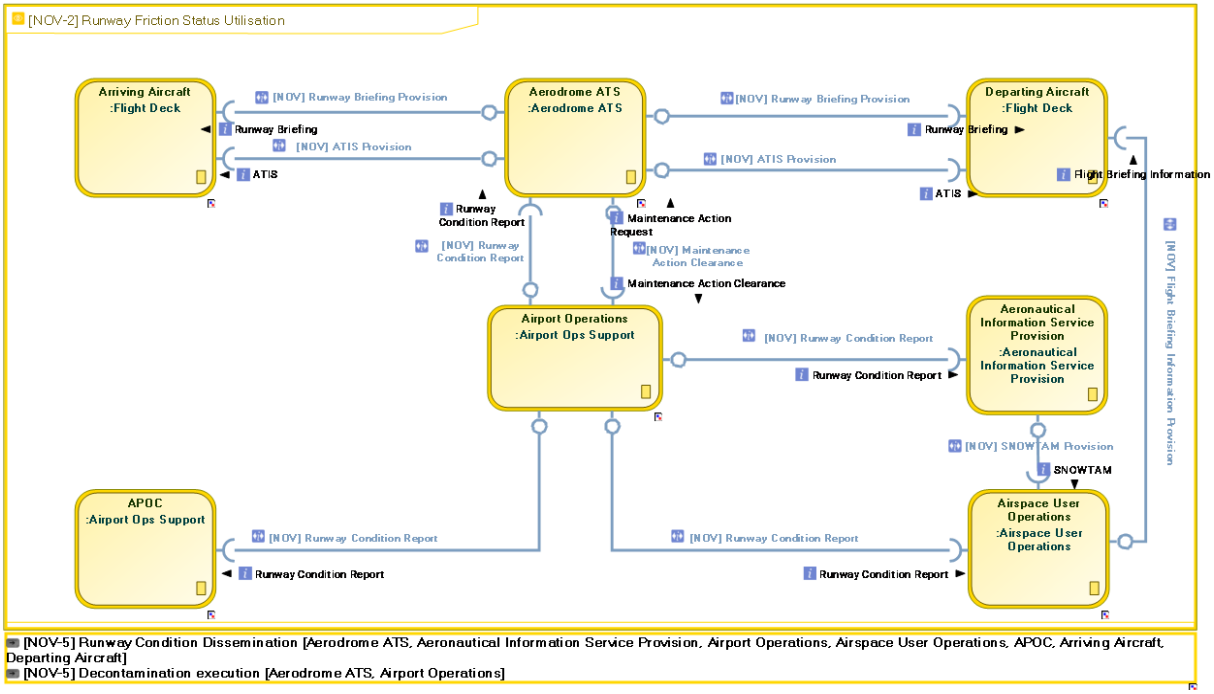
[5] Tower Control broadcasts the information on runway condition via ATIS,.

[6] If necessary, the Tower Control relays the information of the new runway condition to the Executive Approach Controller.

[7] Flight crew retrieves runway condition information and use it to monitor take-off or landing, using ROAAS and TOMS when available.

3.3.2.4.2.1.5 Post-conditions

RCR supplemented with runway condition expected trend information is provided to end users. This action is achieved locally using local RCAMS service and non-locally via dedicated SWIM service developed by PJ.18-04b.



Click on http://webprisme.cfmu.eurocontrol.int/oneportal_working_validation/data/diagrams/B08DB2BF59F05E42 for zooming.

Use case	[NOV-5] Decontamination execution
Use case	[NOV-5] Runway Condition Dissemination

3.3.2.4.2.2 Use Case PJ.02-W2-25-2-5: Decontamination execution

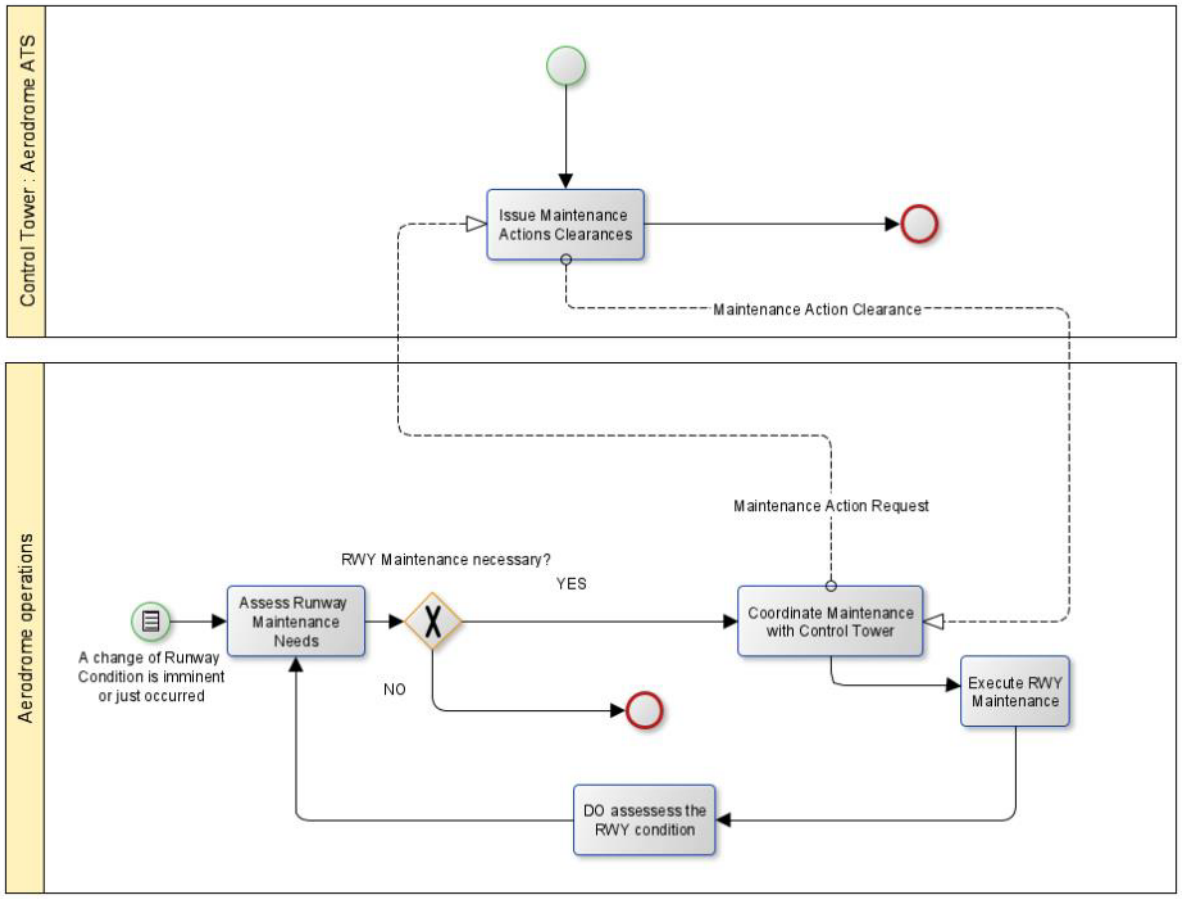


Figure 2: NOV-5 for Use Case PJ.02-W2-25-2-6

Activity	Description
Coordinate Maintenance with Control Tower	Runway closure is coordinated by Control Tower Supervisor between all stakeholders. For runway inspection: to benefit to Surface Condition Awareness. For runway maintenance: to benefit to Runway Excursion Avoidance.
Issue Maintenance Action Clearances	Tower Controller is responsible for maintaining separation on runway and taxiways. This is also valid for any ground vehicle needing to enter the runway.
DO assesses the RWY condition	Following the maintenance actions AO (Duty Officer role) assesses the RWY condition according to Use Case PJ.02-W2-25-1 (i.e. using RCAMS system as an enhanced awareness tool allowing for more optimised inspection) and informs the airport personnel responsible for runway maintenance about the updated Runway Condition.
Assess Runway Maintenance needs	As new runway condition occurs (or is predicted to occur) Airport Operations is responsible for maintaining runway in a state allowing for optimised traffic throughput. In order to achieve this AO is constantly monitoring the conditions and evaluates possible maintenance scenarios.

Co-funded by the European Union

Execute RWY maintenance	Airport Operations is responsible for maintaining the runway in as good condition as possible. As a result, if conditions degrade or are expected to be degraded, maintenance vehicles must enter and occupy the runway. Such action needs coordination with Tower ATCO.

Table 12: Activity items description for view (NOV-5) Decontamination execution

Issuer	Info Flow	Addressee	Info Element	Info Entity
Control Tower	Issue Maintenance Actions Clearance o--> Coordinate maintenance with Control Tower	Airport Operations	Maintenance Actions Clearance	
Airport Operations	Coordinate maintenance with Control Tower o--> Issue Maintenance Actions Clearance	Control Tower	Maintenance Action Request	

3.3.2.4.2.2.1 Abstract

Runway decontamination operation is only changed by the Solution by the RCAMS provision of continuous runway condition and its very short term forecast which can be used to optimize the timing of the operation.

This use case on the operational level is similar to the normal operations. The main change is introduced on the technical level.

3.3.2.4.2.2.2 Actors

- Airport Operator
- Duty Officer
- Winter Services Team
- Control Tower

3.3.2.4.2.2.3 Assumptions / pre-conditions

Assumptions

- DO has an access to RCAMS HMI and can coordinate with Winter Services any maintenance actions.

Pre-conditions

- Under Airport Operator control, the RCAMS has computed the Current RWYCC and Predicted RWYCC.

Triggering event

- A significant negative change in runway condition is imminent or has just occurred.

3.3.2.4.2.2.4 Use Case Steps

Nominal Flow

[1] Using instantaneous information availability DO makes assessment of the (imminent or just occurred) change in runway condition and decides on necessary maintenance actions. Duty Officer may also initiate the maintenance actions by requesting some part of the airport paved surfaces to be cleared.

[2] All agreed maintenance actions requiring runway closure or temporary taxiway unavailability are coordinated with the Control Tower.

[3] Winter Services Team executes maintenance actions.

[4] Duty Officer makes runway condition assessment according to UC PJ.02-W2-25-1

[5] Winter Services team takes into account the information passed by the Duty Officer and assesses the need to repeat maintenance. If the need is assessed positively use case is restarted.

[6] End Use Case.

3.3.2.4.2.2.5 Post-conditions

All maintenance actions are completed. Winter services Team Goes back to runway monitoring.

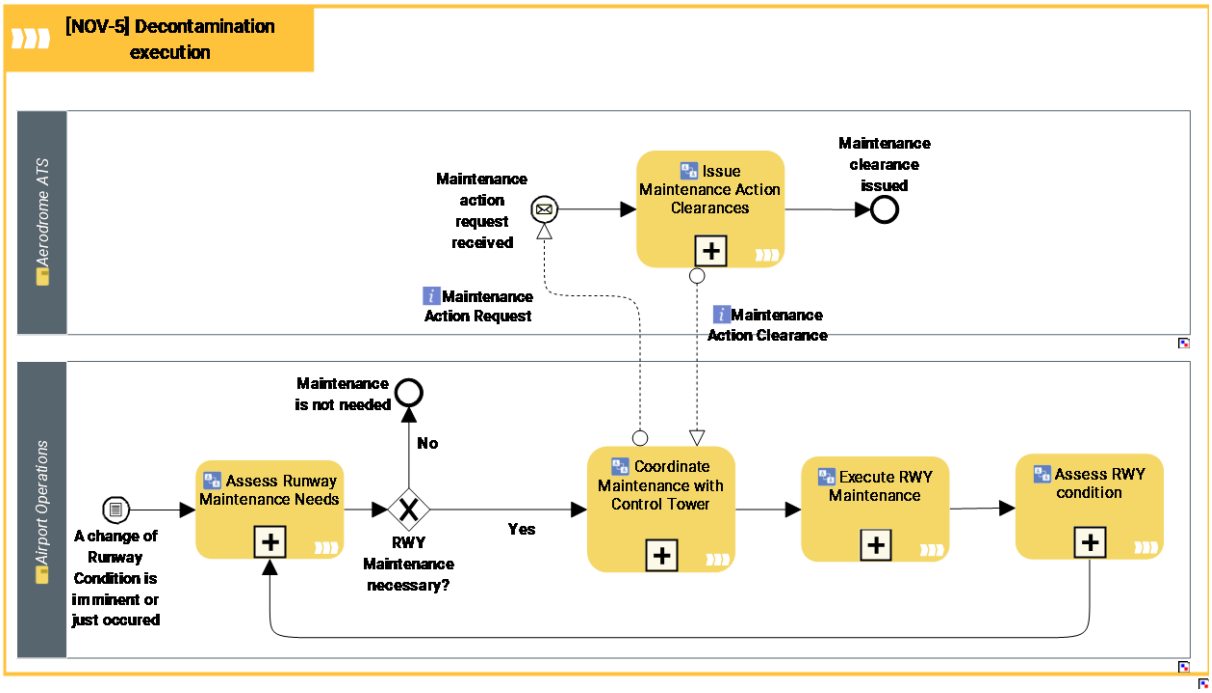


Diagram Id: CE8BEA0460D133B0

Activity	Description
Assess Runway Maintenance Needs	As new runway condition occurs (or is predicted to occur) Airport Operations is responsible for maintaining runway in a state allowing for optimised traffic throughput. In order to achieve this AO is

	constantly monitoring the conditions and evaluates possible maintenance scenarios.
Assess RWY condition	Following the maintenance actions AO (Duty Officer role) assesses the RWY condition according to Use Case PJ.02-W2-25-1 (i.e. using RCAMS system as an enhanced awareness tool allowing for more optimised inspection) and informs the airport personnel responsible for runway maintenance about the updated Runway Condition.
Coordinate Maintenance with Control Tower	Runway closure is coordinated by Control Tower between all stakeholders. For runway inspection: to benefit to Surface Condition Awareness. For runway maintenance: to benefit to Runway Excursion Avoidance.
Execute RWY Maintenance	Airport Operations is responsible for maintaining the runway in as good condition as possible. As a result, if conditions degrade or are expected to be degraded, maintenance vehicles must enter and occupy the runway. Such action needs coordination with Control Tower.
Issue Maintenance Action Clearances	Control Tower is responsible for maintaining separation on runway and taxiways. This is also valid for any ground vehicle needing to enter the runway.

Issuer	Info Flow	Addressee	Info Element	Info Entity
Airport Operations	Coordinate Maintenance with Control Tower o--> Maintenance action request received	Aerodrome ATS	Maintenance Action Request	AIRM_Change_Request
Aerodrome ATS	Issue Maintenance Action Clearances o--> Coordinate Maintenance with Control Tower	Airport Operations	Maintenance Action Clearance	AIRM_Change_Request

3.3.2.4.3 Use Cases for [NOV-2] Non-nominal Cases

Co-funded by the European Union

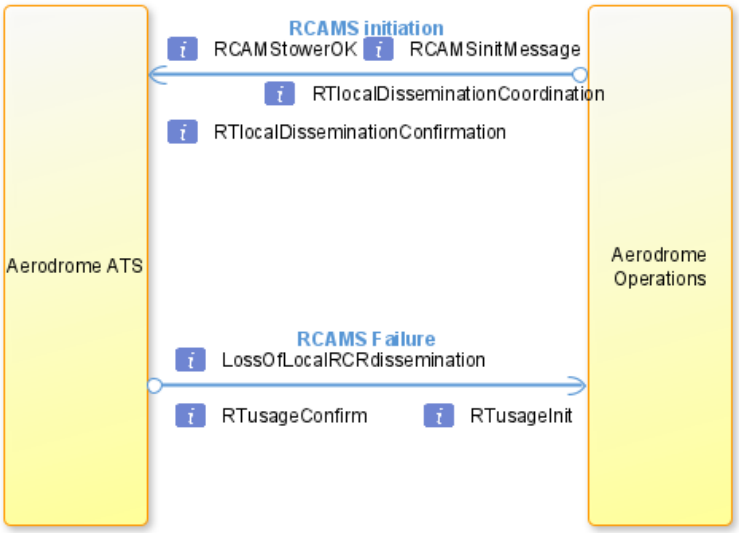


Figure 3: [NOV-2] Non-nominal Cases

3.3.2.4.3.1 Use Case PJ.02-W2-25-3: Failure of Runway Condition inference function without loss of Tower communication/ Persistent issue with input quality / Data source loss

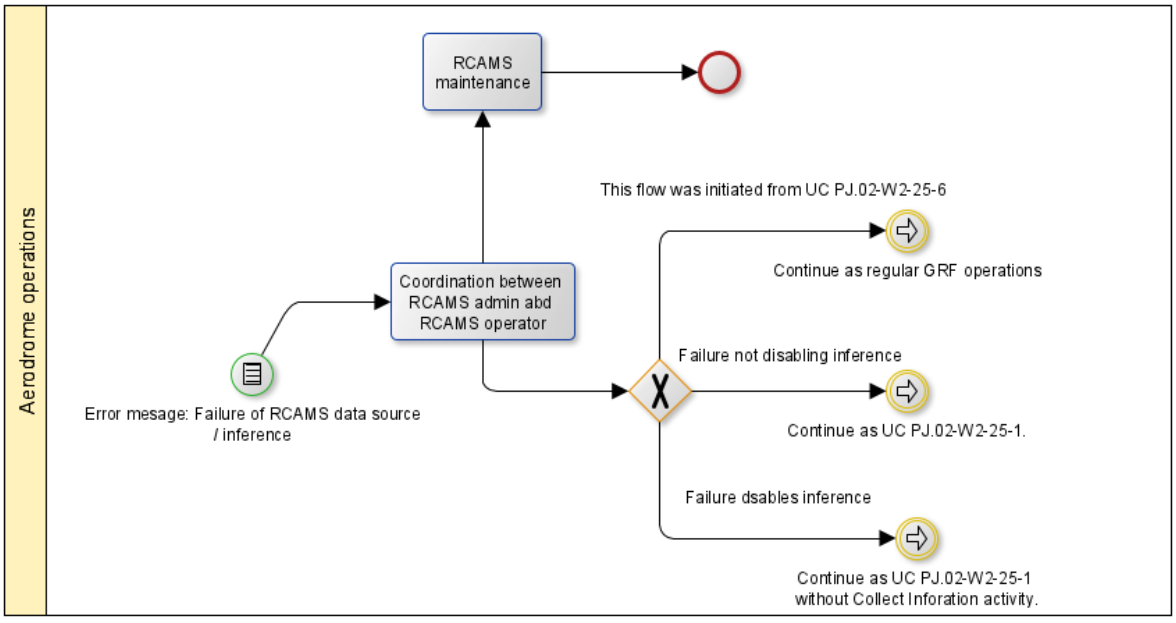


Figure 4: NOV-5 for use case PJ.02-W2-25-3

Coordination between RCAMS admin and RCAMS operator	This is internal Airport Operations coordination that allows Duty Oficer role to assess potential operational impact of further RCAMS usage.
RCAMS maintenance	AO organisation implements the necessary measures to return full RCAMS functionality.

Table 13: Activity items description for view (NOV-5) Failure of a data source connection without significant and consistent impact on RCAMS output quality

Co-funded by the European Union

3.3.2.4.3.1.1 Abstract

This Use Case describes the sequence of events in case one or more of the following non-nominal conditions occur:

- Loss of RCAMS inference function (e.g. due to critical input failure), but dissemination function is active.
- One or more RCAMS data sources are disabled (without significant bearing on the quality of Runway Condition inference)
- An issue with a data quality occurs that is persistent – hence equivalent to data source loss.

3.3.2.4.3.1.2 Actors

- Duty Officer
- RCAMS System Admin
- RCAMS Data Supplier:
    a. OBACS data handler
    b. Local MET Data Provider
    c. Local ANSP

3.3.2.4.3.1.3 Assumptions/pre-conditions

Assumptions

- RCAMS is installed and running on an airport
- The roles of RCAMS System Admin is defined in Airport Operator organisation
- Airport Operator has means to contact any of the Data Suppliers on a short notice

Pre-conditions

- N/A

Triggering-event

- RCAMS detects input data issue (either a connection issue or a QC failure)

3.3.2.4.3.1.4 Use Case Steps

[1] RCAMS informs operator (Duty Officer) of data source failure advising them that the system is still operational.
[2] RCAMS System Administrator is advised of the issue.
[3] RCAMS System Administrator investigates the issue and if necessary contacts RCAMS Data Supplier

Co-funded by the European Union

[4] The operation of the system continues as in Use Case PJ.02-W2-25-1

3.3.2.4.3.1.5 Alternative flow

This alternative flow is used in case when RCAMS main functionality – runway condition inference has been disabled but RCAMS secondary functionality (RCR dissemination) is operational.

[1] RCAMS informs operator (Duty Officer) of primary function failure advising them that the dissemination sub-system is still operational.
[2] RCAMS System Administrator is advised of the issue.
[3] RCAMS System Administrator investigates the issue and if necessary contacts RCAMS Data Supplier
[4] Airport operator continues operation as outlined by GRF but uses RCAMS only for dissemination.

3.3.2.4.3.2 Use Case PJ.02-W2-25-4: General failure of RCAMS system to provide service

In this case the following Use Cases are executed in this order (captured in PJ.02-W2-25-6 NOV-5):

1. PJ.02-W2-25-6
2. PJ.02-W2-25-3

3.3.2.4.3.3 Use Case PJ.02-W2-25-5: Transition from GRF to Solution working method

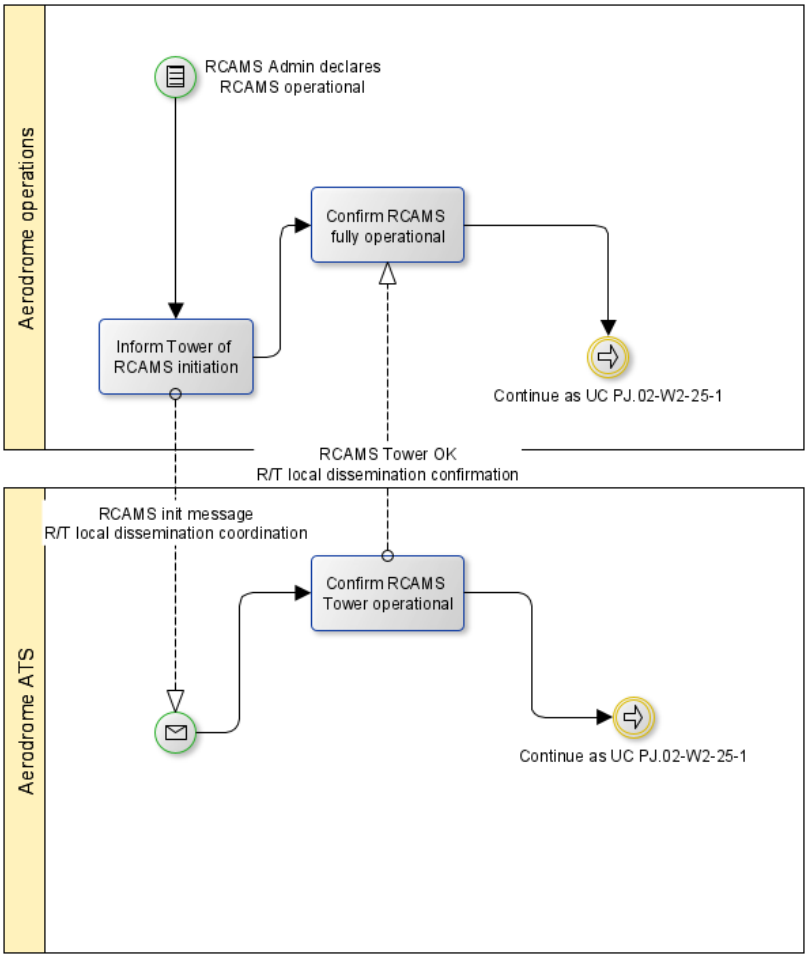


Figure 5: NOV-5 for Use Case PJ.02-W2-25-5

Activity	Description
Inform Tower of RCAMS initiation	When RCAMS is considered operational Duty Officer initiates RCAMS usage as a primary RCR communication tool.
Confirm RCAMS Tower operational	After verifying availability of RCAMS Tower HMI the controller acknowledges RCAMS communication.
Confirm RCAMS fully operational	Airport Operator is now assured that communication via RCAMS can take place and continues using it as a primary local RCR dissemination tool.

Table 14: Activity items description for view (NOV-5) Failure of a data source connection without significant and consistent impact on RCAMS output quality

Issuer	Info Flow	Addressee	Info Element	Info Entity
Airport Operations	Inform Tower of RCAMS initiation o--> <?>	Control Tower	RCAMS init message R/T local dissemination coordination	

Co-funded by the European Union

Issuer	Info Flow	Addressee	Info Element	Info Entity
Control Tower	Confirm RCAMS Tower operational o--> Confirm RCAMS fully operational	Airport Operations	RCAMS Tower OK R/T local dissemination confirmation	

3.3.2.4.3.3.1 Abstract

This Use Case describes the sequence of events occurring in two cases: either when the Solution is first deployed on the airport or final stages of recovery from UC PJ.02-W2-25-4.

3.3.2.4.3.3.2 Actors

- Duty Officer
- RCAMS System Admin
- Tower Controller

3.3.2.4.3.3.3 Assumptions/pre-conditions

Assumptions

- RCAMS is installed on an airport and fully functional
- The roles of RCAMS System Admin is defined in Airport Operator organisation

Pre-conditions

- RCAMS System Admin has completed successfully RCAMS set-up testing and diagnostics procedures

Triggering-event

- RCAMS System Admin notifies Duty Officer that RCAMS is operational and ready to use
- Duty officer acknowledges dedicated RCAMS message via HMI

3.3.2.4.3.3.4 Use Case Steps

[1] Duty Officer notifies Tower Controller that RCAMS is now operational
[2] Tower Controller confirms Tower HMI operability.
[3] Use case ends.

3.3.2.4.3.4 Use Case PJ.02-W2-25-6 Failure of local RCR dissemination via RCAMS.

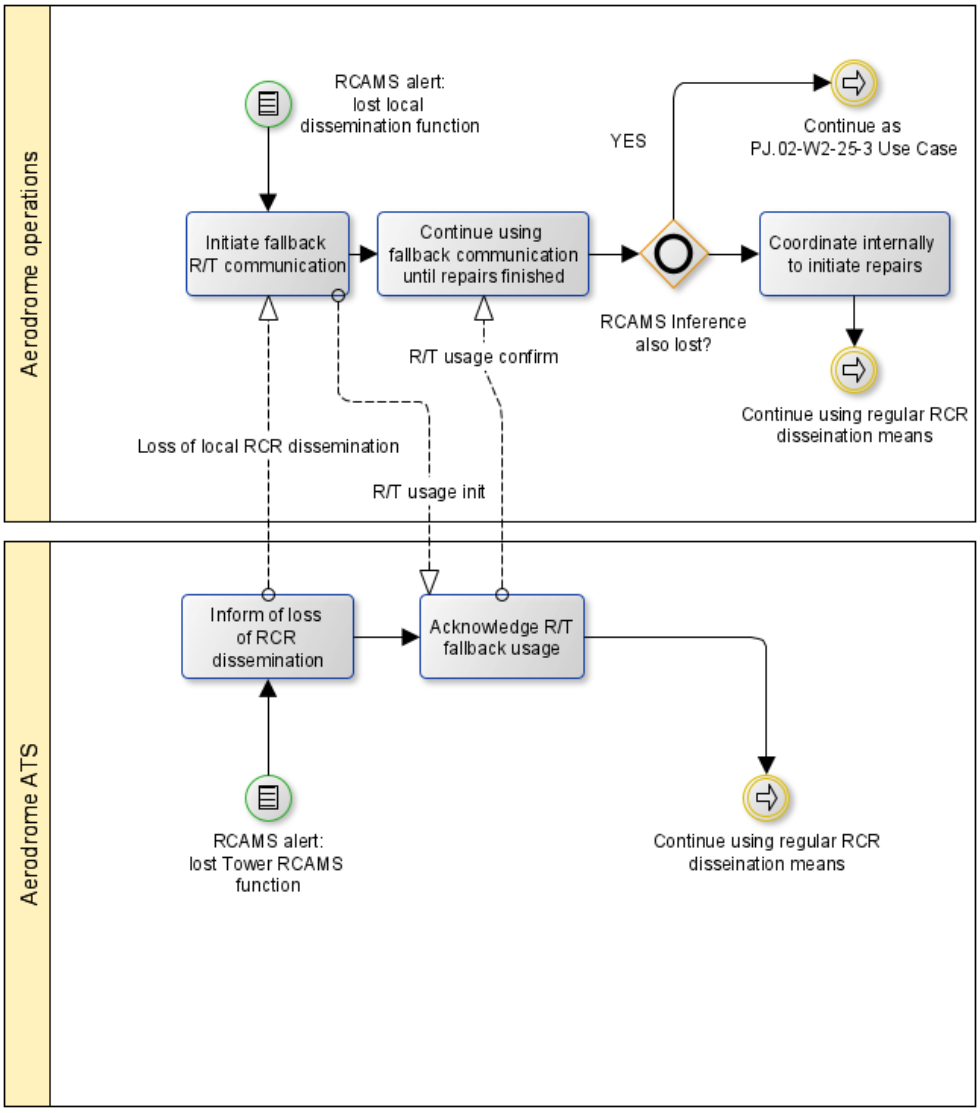


Figure 6: NOV-5 for Use Case PJ.02-W2-25-6

EUROPEAN PARTNERSHIP
Co-funded by the European Union

Activity	Description
Initiate fallback R/T communication	When RCAMS local dissemination is not available, after coordinating with Tower, Airport Operator will fall back to R/T communication of RCR.
Inform of loss of RCR dissemination	Whenever RCAMS Tower HMI displays error message Tower Controller informs DO about loss of runway condition awareness.
Coordinate internally to initiate repairs	Airport Operator is coordinating between Duty Officer and RCAMS Admin roles the repair schedule and RCAMS availability.
Acknowledge R/T fallback usage	Tower ATCO acknowledges falling back to R/T for RCR dissemination
Continue using fallback communication until repairs finished	DO uses the fall back communication means until RCAMS returns to nominal state.

Table 15: Activity items description for view (NOV-5) Failure of a data source connection without significant and consistent impact on RCAMS output quality

Issuer	Info Flow	Addressee	Info Element	Info Entity
Airport Operations	Initiate fallback R/T communication o--> Acknowledge R/T fallback usage	Control Tower	R/T usage init	
Control Tower	Acknowledge R/T fallback usage o--> Continue using fallback communication until repairs finished	Airport Operations	R/T usage confirm	

3.3.2.4.3.4.1 Abstract

This Use Case describes the sequence of events in case the local dissemination function is disrupted. Local dissemination function of RCAMS is responsible for passing information to ATCO and within AO organisation.

3.3.2.4.3.4.2 Actors

- Duty Officer
- Tower Controller
- RCAMS System Admin

3.3.2.4.3.4.3 Assumptions/pre-conditions

Assumptions

- RCAMS is installed and running on an airport
- The roles of RCAMS System Admin is defined in Airport Operator organisation

- Local Tower HMI is included in the RCAMS system.
- The failure affects the local Tower.

Pre-conditions

- N/A

Triggering-event

- RCAMS detects inability to push data to local HMIs

3.3.2.4.3.4.4 Use Case Steps

[1] Affected RCAMS HMIs display appropriate alert and shut down.
[2] RCAMS Tower HMI informs the Tower ATCO of the loss of RCAMS function and after acknowledging the alert by the ATCO HMI shuts down.
[3] ATCO requests fallback to R/T from DO.
[4] An appropriate alert is presented to DO.
[5] DO establishes fall-back R/T communication of RWY condition with ATCO.
[6] Tower ATCO continues operation with runway condition to be communicated via R/T.
[7] RCAMS System Administrator is advised of the issue.
[8] RCAMS System Administrator investigates the issue and proceeds to manage necessary repairs.
[9] Use case ends.

3.3.2.4.3.5 Use Case PJ.02-W2-25-9 Local dissemination/communication established – transition from baseline R/T to RCAMS based dissemination

This use case is operationally identical to UC PJ.02-W2-25-5.

3.3.3 Differences between new and previous Operating Methods

OI Step code – title (OI Step CR)		
AO-0216 - Enhanced Runway Condition Awareness (CR 05918 Update AO-0216 (PJ.02-W2-25.1))		
Activity	Impact	Change
Collect Information	Introduce	
Perform Runway Inspection	Update	Runway inspection teams uses RCAMS as support tool to enter their measures and observations.
Plan Runway Inspection	Update	Runway inspection need can be identified using RCAMS. Runway inspection measures (contaminant type depth coverage on each runway thirds) are used as RCAMS inputs for runway condition assessment.
Report Braking Action PIREP to Airport Operator	Update	Braking Action reported by Flight Crew is used as RCAMS input for runway condition assessment (direct input from Tower Controller who received the information).

Co-funded by the European Union

Table 16: Differences between new and previous Operating Methods

EUROPEAN PARTNERSHIP

Co-funded by the European Union

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

Identifier	Title	Requirement	Status	Rationale	Category	SESAR Solution	High Level Operational Requirement Identifier	Information Exchange ID	Information Flow	Activity	Role	Sub-operating environment	Activity view

EUROPEAN PARTNERSHIP

Co-funded by the European Union

REQ-02.25.1-SPRINTEROP-AIOP.0001	RCAMS computed Current RWYCC	The Airport Operator shall be provided with up to date Computed Current RWYCC for each third of each runway in conformance with ICAO regulations.	<validated>	Current RWYCC is an integer [0..6] for each third of the runway. If input data is old it should be at some point either disregarded or used with less confidence. Tech requirement: data should be time-stamped. Computed Current RWYCC may be different from Current RWYCC which is validated by the Airport Operator before dissemination. The AO can override the Computed Current RWYCC and it is considered valid until next RCAMS calculation. RCAM matrix in ICAO Annex 14 NPA 2018-14 AIR OPS and AC 150/5200-30D Airport Operators rules are used to define Current RWYYC and extrapolated for Predicted RWYCC value. PJ.03b-06 SAF-REQ-22: RCAMS shall be deployed using multiple independent data sources for Runway Condition estimation. The Computed Current RWYCC is estimated using e.g. the following inputs (detailed view is available in TS/IRS): • BA from PIREP • Computed BA from OBACS • • AWOS feed (min. AWOS IIIP) • Runway Surface Condition Sensors	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Assess Current Runway Surface Condition	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report

REQ-02.25.1-SPRINTEROP-AIOP.0002	RCAMS Computed Predicted RWYCC	The Airport Operator should be provided with the Computed Predicted RWYCC for each third of each runway.	< validated >	RCAM matrix in ICAO Annex 14 [47] NPA 2018-14 AIR OPS and AC 150/5200-30D Airport Operators rules are used to define Current RWYYC and extrapolated for Predicted RWYCC value. PJ.03b-06 SAF-REQ-22: RCAMS shall be deployed using multiple independent data sources for Runway Condition estimation. The Computed Predicted RWYCC is estimated using e.g. the following inputs (detailed view is available in TS/IRS): • BA from PIREP • Computed BA from OBACS • • AWOS feed (min. AWOS IIIP) • Runway Surface Condition Sensors • Weather forecast feed • Weather radar feed.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Assess Predicted Runway Surface Condition	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report
REQ-02.25.1-SPRINTEROP-AIOP.0003	Current runway surface contamination computation	The Airport Operator shall be provided with continuous and up to date assessment of current type, coverage and depth of contaminant and measurement of ground temperature, air temperature, freezing and dew point temperature, type and amount of precipitation for each third of each runway .	< validated >	Cover the need to feed RCAMS with • Surface Condition Sensor(s) measurements • Depth and nature of contaminant manual or automatic measures • MET data	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway Status	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report
REQ-02.25.1-SPRINTEROP-AIOP.0004	Predicted runway surface contamination computation	The Airport Operator should be provided with regular estimation of predicted RWYCC	<validated>	Cover the need to feed RCAMS with • Surface Condition Sensor(s) measurements • Depth and nature of contaminant manual or automatic measures • MET data	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway Status	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report

REQ-02.25.1-SPRINTEROP-AIOP.0005	Airport Operator runway surface condition check and correction	The Airport Operator within its Duty Officer role shall have the ability to fix erroneous values by updating RCR with values suggested as Computed Current Runway Condition in the process of validation taking into account relevant and available data (e.g. direct observation, experience).	< validated >	The Airport Operator shall be responsible for the Current RWYCC and Predicted RWYCC assessment and dissemination. RCAMS helps the Airport Operator to assess the runway surface condition by computing Current RWYCC and Predicted RWYCC. Computed values can be corrected. The value of RWYCC should be presented along with a timestamp. PJ.03b-06 HPAR REQ_1_Current_RWYCC_AO_Selection_before_ dissemination PJ.03b-06 HPAR REQ_2_Profile_level_to access_RCAMS	Operational Human Performance	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway Status	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report
REQ-02.25.1-SPRINTEROP-AIOP.0006	Airport Operator timely RCAMS output validation	Airport Operator within its Airport Duty Officer role shall perform the validation of Computed Current Runway Condition in a timely manner upon any significant change.	< validated >	PJ.03b-06 SAF-REQ-01_ in PJ.03b-06 V2 SAR.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01			Validate Runway Condition	[NODE] Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition
REQ-02.25.1-SPRINTEROP-AIOP.0007	Dissemination of validated output on significant runway condition change	The Airport Duty Officer shall issue RCR using RCAMS on validating any significant change of the Current Runway Surface Condition.	< validated >	PJ.03b-06 SAF-REQ-02_ RCAMS shall push the Runway Condition data to RCC-Dis (RWYCC dissemination function) immediately upon each validation by ApDO (Airport Duty Officer). The Airport Operator shall be responsible for the Current RWYCC and Predicted RWYCC assessment and dissemination. Current RWYCC and Predicted RWYCC have been validated by the Airport Operator PJ.03b-06 HPAR REQ_1_Current_RWYCC_AO_Selection_before_ dissemination	<Operational> <Human Performance>	PJ.02-W2-25.1	S25-HLOR-01			Issue RCR	[NODE] Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition dissemination

REQ-02.25.1-SPRINTEROP-AIOP.0008	Dissemination of validated output on significant runway condition change	Following Airport Duty Officer validation of any significant change of the Current Runway Surface Condition, Airport Duty Officer shall issue RCR.	< validated >	ICAO doc 9981 - PANS Aerodromes	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Issue RCR	[NODE] Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition dissemination
REQ-02.25.1-SPRINTEROP-AIOP.0009	Dissemination of Predicted Runway Condition	RCR issuance should be accompanied by dissemination of Predicted Runway Surface Condition unless Airport Operator decides otherwise on a case by case basis.	<in progress>	PJ.03b-06 SAF-REQ-02_ RCAMS shall push the Runway Condition data to RCC-Dis immediately upon each validation by ApDO. The Airport Operator shall be responsible for the Current RWYCC and Predicted RWYCC assessment and dissemination. Current RWYCC and Predicted RWYCC have been validated by the Airport Operator PJ.03b-06 HPAR REQ_1_Current_RWYCC_AO_Selection_before_dissemination	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Issue RCR	[NODE] Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition dissemination
REQ-02.25.1-SPRINTEROP-AIOP.0010	Airport Operator levels of profile to access and use RCAMS	The Airport Operator should be able to define two user profiles in RCAMS corresponding to the following operational functions: o System Administrator – full right in particular for system set-up and supervision o Duty Officer – to control published values displayed by RCAMS o	<validated>	This will have to be most probably moved to TS and replaced with sth like: “Various roles within Airport Operator shall have varying levels of authorisation regarding Runway Condition access and dissemination.” PJ.03b-06 HPAR REQ_2_Profile_level_to access_RCAMS	<HMI> <Human Performance>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway Status	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report

REQ-02.25.1-SPRINTEROP-AIOP.0011	Predicted runway surface condition dissemination	The Airport Operator should disseminate the Predicted Runway Condition with prediction horizon of at least 1 hour for each third of each runway if any change of Runway Condition is expected in that time frame.	<in progress>	The Airport Operator shall be responsible for the Current RWYCC and Predicted RWYCC assessment and dissemination. Current RWYCC and Predicted RWYCC have been automatically or manually assessed by the Airport Operator.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Issue RCR	[NODE] Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition dissemination
REQ-02.25.1-SPRINTEROP-AIOP.0012	Airport Operator Surface Condition Sensors monitoring	The Airport Operator shall be informed about the status of all RCAMS inputs.	<validated>	Cover technical status reporting. Inputs covered by this requirement should include: • Any MET inputs • Any ground sensor inputs • • OBACS and other data links.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Collect Information	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report
REQ-02.25.1-SPRINTEROP-AIOP.0013	Computed Current RWYCC and Computed Predicted RWYCC will be displayed with a measure of certainty	The Airport Operator shall be provided the Computed Current RWYCC and the Computed Predicted RWYCC values with the accompanying certainty level.	<validated>	This significantly increases the situational awareness of the Airport Operator. Some situations may be e. g. borderline between RWYCC 3 and 4. In those cases the system should display the lower value. The certainty level is important in assessment of potential system performance and identifying potential degraded situations.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway Status	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report
REQ-02.25.1-SPRINTEROP-ACFT.0014	Flight Crew to get predicted Runway Surface tendency	If ROAAS is equipped, the Flight Crew shall take into account the Predicted runway surface tendency and the most up-to-date values of Current RWYCC in its decision of Runway State Parameter to be entered to ROAAS HMI.	<in progress>	Pre-flight and in-flight phases covered. Runway surface condition covers Current RWYCC and Predicted RWYCC for each third of the runway concerned. Means proposed for the Flight Crew to get the Runway Surface Condition are ATIS, request to ATCO via R/T, request to AOC, SNOWTAM, SWIM services, etc.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Prepare and Brief Expected Approach	[NODE] Arriving Aircraft	Terminal Airspace	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition dissemination

REQ-02.25.1-SPRINTEROP-ACFT.0015	OBACS activation/ deactivation	If aircraft is equipped with OBACS, OBACS monitoring shall be active for the ground part of the landing.	<validated>	In order to measure aircraft-observed runway friction.	<Operational >	PJ.02-W2-25.1	S25-HLOR-01			Automatic assessment	[NODE] Flight Deck Landed	Airport	[NOV-5]Elaborate Runway Condition
REQ-02.25.1-SPRINTEROP-ACFT.0016	OBACS Braking Action Flight Crew Dissemination	If the aircraft is equipped with OBACS, the Flight Crew should be able to retrieve the Computed Braking Action provided that the value is relevant for PiREP assistance.	<validated>	This is for Flight Crew benefit and allows OBACS result to be shared with airports that do not have live OBACS connection.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Automatic assessment of	[NODE] Flight Deck Landed Aircraft	Airport	[NOV-5]Elaborate Runway Condition Report
REQ-02.25.1-SPRINTEROP-ACFT.0017	OBACS Braking Action computation	If aircraft is equipped with OBACS, when OBACS is activated and it is in the OBACS intended operational domain, OBACS shall automatically calculate the Computed Braking Action relevant for the portion of the runway the aircraft rolled on at landing.	<validated >	In order to measure aircraft-observed runway friction.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Automatic assessment of Braking Action	[NODE] Flight Deck Landed Aircraft	Airport	[NOV-5]Elaborate Runway Condition Report
REQ-02.25.1-SPRINTEROP-ACFT.0018	OBACS Braking Action automatic report	If aircraft is equipped with OBACS, when Computed Braking Action is available, OBACS should automatically transmit it in a Braking Action Aircraft Report to RCAMS.	<in progress>	Provided airport subscribed to OBACS service. A report is transmitted by the aircraft to a ground server which automatically transmit the information to be input in the Airport Operator system.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Automatic assessment of	[NODE] Flight Deck Landed	Airport	[NOV-5]Elaborate Runway Condition Report

REQ-02.25.1-SPRINTEROP-ATSS.0019	ATS Current Runway Surface Condition awareness	All relevant ATS services shall have means to know the most up to date Current Runway Surface Condition of any runway the RCAMS system is operational.	<validated>	So any tower controller to be able to transmit on request Runway Surface Condition to the Flight Crew without delay. For any other controllers, runway surface condition of any airport should also be made available. PJ.03b-06 SAF-REQ-03 PJ.03b-06 SAF-REQ-37 ATCO shall be presented runway condition using standard RCR format.	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Issue RCR	[NODE] Control Tower [NODE] En-Route/Approach ATS	Terminal Airspace Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition dissemination
REQ-02.25.1-SPRINTEROP-ATSS.0020	ATS Predicted Runway Surface Condition awareness	All relevant ATS services should have means to know the most up to date Predicted Runway Surface Condition estimation of any runway the RCAMS system is operational.	<validated>	So any controller to be able to transmit on request Runway Surface Condition to the Flight Crew without delay. For any controllers, runway surface condition of any airport should also made available. PJ.03b-06 SAF-REQ-03 PJ.03b-06 SAF-REQ-37 ATCO shall be presented runway condition using standard RCR format	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Issue RCR	[NODE] Control Tower [NODE] En-Route/Approach	Terminal Airspace Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition dissemination
REQ-02.25.1-SPRINTEROP-ATSS.0021	Tower controller RWY condition change awareness	The Tower Runway Controller shall be aware about any significant change of the runway surface condition for any runway of the airport due to relevant CWP functionality.	<validated>	New from PJ.03b-06 HP req. REQ_4_Tower_Controller_awareness The tower controller needs to forward this update to all departing and arriving flights which may have received outdated runway surface condition	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Forward runway information to flight	[NODE] Control Tower	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition dissemination
REQ-02.25.1-SPRINTEROP-ATSS.0022	Runway Surface Condition available on ATIS	On each update of the Runway Surface Condition, the new values shall be updated in the ATIS elaboration process.	<in progress>	So as to be known in due time by arriving and departing Flight Crews	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Update ATIS	[NODE] Control Tower	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway

REQ-02.25.1-SPRINTEROP-ATSS.0023	ATCO disseminates runway condition	Approach/Tower Runway ATCO shall disseminate the Current Runway Condition to the Flight Crew upon each change in a timely manner or on request.	<validated>	PJ.03b-06 SAF-REQ-04_ ATC shall disseminate the RWY condition to the FLC upon each change in a timely manner or on request.	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Forward runway information to	[NODE] Control Tower	Terminal Airspace Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition
REQ-02.25.1-SPRINTEROP-AIOP.0024	RWYCC should not be overestimated	The algorithm should calculate taking into consideration worst of the possible Computed Current RWYCC values if more than one is likely as a result of the assessment.	< validated>	Rationale: as an automatic function it is safer to inform the operator of the worse scenario to maintain safety.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway Status	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report
REQ-02.25.1-SPRINTEROP-AIOP.0025	Current RWYCC deterioration	Airport Operator shall be informed when Current RWYCC deteriorates.	<validated>	Rationale: awareness of the system operator must be maintained to achieve satisfactory safety levels.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway	[NODE] Airport	Airport	[NOV-5]Elaborate Runway Condition
REQ-02.25.1-SPRINTEROP-AIOP.0026	Predicted RWYCC deterioration	Airport Operator shall be informed when Predicted RWYCC is lower than Current RWYCC.	<validated>	Rationale: awareness of the system operator must be maintained to achieve satisfactory safety levels.	<Operational >	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway	[NODE] Airport	Airport	[NOV-5]Elaborate Runway Condition
REQ-02.25.1-SPRINTEROP-AIOP.0027	RCAMS output quality maintained even when inputs are missing	The AO shall be provided with RCAMS output of the same quality when some of the input data are unavailable for a limited period of time.	<validated>	PJ.03b-06 SAF-REQ-34_ RCAMS shall be able to maintain the quality of its output with partially missing inputs for limited duration. This is a placeholder requirement until a set of relevant safety requirements is fully developed.	<Performance>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway Status	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report
REQ-02.25.1-SPRINTEROP-AIOP.0028	RCAMS Airport Operator training	Airport Operator shall be trained about principles and usage of RCAMS, including the relative criticality of RCAMS input data feeds.	<validated>	PJ.03b-06 SAF-REQ-08_ Airport Operator shall be aware of relative criticality of RCAMS data feeds.	<Human Performance>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway	[NODE] Airport	Airport	[NOV-5]Elaborate Runway Condition

REQ-02.25.1-SPRINTEROP-AIOP.0029	Only validated RCAMS output dissemination	Only the validated Current Runway Condition (in form of RCR) shall be disseminated.	<validated>	PJ.03b-06 SAF-REQ-10_ Only the validated Current Runway Condition (in form of RCR) and Predicted Runway Condition shall be disseminated.	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Issue RCR	[NODE] Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition
REQ-02.25.1-SPRINTEROP-AIOP.0030	Airport Operator awareness of observed braking action	Airport Operator shall be aware of all Braking Action Aircraft Report and Braking Action PIREP report if it is lower than the Current RWYCC.	<validated>	PJ.03b-06 SAF-REQ-16_ Airport Operator shall be aware of the latest automated braking action estimate received if it is lower than the current computed RWYCC. PJ.03b-06 SAF-REQ-17_Airport Operator shall be aware of the latest PIREP received if it is lower than the current computed RWYCC.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway Status	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report
REQ-02.25.1-SPRINTEROP-AIOP.0031	RCAMS warning on inputs inconsistency or missing	Airport Operator shall be warned when inputs exceed RCAMS operational domain or inputs are detected as not consistent or missing.	<validated>	PJ.03b-06 SAF-REQ-20 RCAMS shall warn Airport Operator when inputs tolerance has been exceeded.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway Status	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report
REQ-02.25.1-SPRINTEROP-AIOP.0032	RCAMS output deterioration warning	Airport Operator shall be warned when missing inputs cause significant deterioration of RCAMS output quality.	<validated>	PJ.03b-06 SAF-REQ-21 RCAMS shall warn Airport Operator when missing inputs cause significant deterioration of output quality.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway	[NODE] Airport	Airport	[NOV-5]Elaborate Runway Condition
REQ-02.25.1-SPRINTEROP-AIOP.0033	Conservative RWYCC in case of planned runway maintenance	In case runway maintenance is decided Airport Operator should update and publish conservative current runway condition (lower RWYCC value), waiting for runway inspection result to confirm or update this status if flights are scheduled to land before the maintenance action.	<validated>	PJ.03b-06 SAF-REQ-39 In case runway maintenance is decided Airport Operator should update and publish conservative current runway condition, waiting for runway inspection result to confirm or update this status if flights are scheduled to land before the maintenance action..	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Coordinate Runway Closure	[NODE] Airport Operations	Airport	[NOV-5]Use Case PJ.02-W2-25-2-5: Decontamination execution

REQ-02.25.1-SPRINTEROP-AIOP.0034	Conservative RWYCC in case of planned runway inspection	In case inspection to verify Runway Surface Condition is decided Airport Operator should update and publish conservative current runway surface condition (lower RWYCC value), waiting for runway inspection result to confirm or update this status if flights are scheduled to land before inspection.	<validated>	PJ.03b-06 SAF-REQ-38 In case inspection to verify RWYCC is decided Airport Operator should update and publish conservative current runway condition, waiting for runway inspection result to confirm or update this status if flights are scheduled to land before inspection.	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Coordinate Runway Closure	[NODE] Airport Operations	Airport	[NOV-5]Use Case PJ.02-W2-25-2-5: Decontamination execution
REQ-02.25.1-SPRINTEROP-ATSS.0035	RCR to SNOWTAM conversion	Only select RCR shall be converted by AO to SNOWTAM and subsequently sent to AIS, there are criteria outlined in the cited source	<validated>	source: ICAO Doc 9981 -PANS Aerodromes, 2nd ed. 2016, Part II, point 1.1.1.8, page 125	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Issue RCR	[NODE] Airport	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway
REQ-02.25.1-SPRINTEROP-ATSS.0036	SNOWTAM publication	Whenever a new RCR is received by AIS from AO, AIS shall publish corresponding SNOWTAM	<validated>	source: ICAO guidance on the Issuance of SNOWTAM (Feb. 2020), point 3.3, page 7	<Operational >	PJ.02-W2-25.1	S25-HLOR-01			Prepare and disseminate	AIS	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway
REQ-02.25.1-SPRINTEROP-AIOP.0037	RCR conversion responsibility	AO should decide which RCR needs conversion to SNOWTAM and subsequent publication	<validated>	It is most efficient if the local authority took decision on RCR to SNOWTAM conversion. However, this may not be legal for all local implementations of GRF. Conversion criteria are not straightforward at the moment.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Issue RCR	[NODE] Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition
REQ-02.25.1-SPRINTEROP-AIOP.0038	RCR conversion responsibility - execution	AO shall convert to SNOWTAM all RCR that require AIS publication and subsequently send it to AIS office for further publishing	<validated>	Due to GRF regulatory setup, i.e. well defined SNOWTAM and not very precise definition of RCR, as well as other practical AIS offices prefer local SNOWTAM generation on the airport.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01	RCR to AIS		Non-local RCR dissemination	[NODE] Airport	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway
REQ-02.25.1-SPRINTEROP-AIOP.0039	RCR direct publication to AIS	AO shall have ability to disseminate RCR to AIS office (instead of SNOWTAM)	<validated>	This is the default ICAO GRF setup.	<Operational >	PJ.02-W2-25.1	S25-HLOR-01	RCR to AIS		Non-local RCR	[NODE] Airport	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway

REQ-02.25.1-SPRINTEROP-AIOP.0040	RWYCC evolution after OBACS use	The OBACS data should only be used as a secondary information, meaning to downgrade RWYCC	<validated>	Operational requirement to improve safety	<Operational >	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway	[NODE] Airport	Airport	[NOV-5]Elaborate Runway Friction
REQ-02.25.1-SPRINTEROP-ACFT.0041	A/C equipped with ROAAS	A/C may be equipped with ROAAS fulfilling ED-250 requirements and allowing for use with all RWYCC values.	<validated>	For maximum benefit on board automation is advised. ROAAS will allow flight crew to use the values provided in RCR with maximum safety benefit.	<Interoperability>	PJ.02-W2-25.1	S25-HLOR-01					Airport	
REQ-02.25.1-SPRINTEROP-ACFT.0043	Runway Condition rapid access for airspace users	The Flight Crew and Airline Operational Centre may have means of rapid direct access to RCR disseminated by Duty Officer.	<in progress>	Disseminating RCR via a SWIM service will be much quicker way of assuring the end-user awareness of runway condition than traditional means of AIS or ATIS dissemination.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01	SWIM RCR info		Release SWIM RCR equivalent	[NODE] Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-2-0: Runway Condition
REQ-02.25.1-SPRINTEROP-ACFT.0044	OBACS Braking Action Computation conditions	OBACS shall inform users of the braking friction limitation conditions in which the Braking Action was automatically computed	<in progress>	Pending braking and runway condition, OBACS may compute Braking Action in friction limited conditions (maximum achievable runway-tire braking efficiency) or non-friction limited conditions.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Automatic assessment of	[NODE} Flight Deck Arriving	Airport	[NOV-5]Elaborate Runway Friction Status
REQ-02.25.1-SPRINTEROP-AIOP.0045	RCAMS Failure AO HMI	Airport Operations shall be informed of any continuous awareness and monitoring provision related failure in a clear manner via appropriate HMI.	<validated>	Airport Operations is the most critical user of RCAMS inference and primary maintainer of aerodrome infrastructure.	<HMI> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Coordination between RCAMS	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-3: Failure of Runway

REQ-02.25.1-SPRINTEROP-AIOP.0046	RCAMS Failure AO internal coordination	In case of any continuous awareness and monitoring provision failure or solution RCR dissemination failure Airport Operator shall ensure sufficient coordination between RCAMS maintainers and operational staff to develop safe and timely response while keeping common situational awareness ensured.	<validated>	Airport Operations is the party responsible for RCAMS safe operations.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Coordination between RCAMS Admin and RCAMS operator	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-3: Failure of Runway Condition inference function without loss of Tower communication/ Persistent
REQ-02.25.1-SPRINTEROP-AIOP.0047	RCAMS Failure AO maintenance action	In case of any continuous awareness and monitoring provision failure or solution RCR dissemination failure Airport Operator shall commence adequate maintenance actions following internal coordination.	<validated>	Airport Operations is the party responsible for RCAMS maintenance.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			RCAMS Maintenance	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-3: Failure of Runway Condition inference function
REQ-02.25.1-SPRINTEROP-AIOP.0048	Initiate fallback to GRF operations	If at the same time continuous awareness and monitoring provision and solution RCR dissemination are lost Airport Operations shall fall back to regular GRF operations.	<validated>	Airport Operator is responsible for determination and dissemination of runway condition in all circumstances.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Coordination between RCAMS	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-3: Failure of Runway Condition inference
REQ-02.25.1-SPRINTEROP-AIOP.0049	Airport Operator to be informed if missing data is deteriorating RCAMS inference	Airport Operator shall be informed if missing data is significantly deteriorating continuous awareness and monitoring provision.	<validated>	Not all missing data will cause significant RCAMS inference degradation.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Coordination between RCAMS Admin and RCAMS	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-3: Failure of Runway Condition inference function

REQ-02.25.1-SPRINTEROP-AIOP.0050	Airport Operator RCAMS dissemination when inference failed	Airport Operator shall be able to keep the RCR dissemination mode unchanged in case of continuous awareness and monitoring provision failure.	<validated>	Changes in the RCR dissemination mode involve coordination between stakeholders and potentially can lead to decreased situational awareness and decreased safety.	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Coordination between RCAMS	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-3: Failure of Runway Condition inference
REQ-02.25.1-SPRINTEROP-AIOP.0051	RCAMS operations initiated by Airport Operations	Continuous awareness and monitoring provision and solution RCR dissemination initiation shall be conducted by Airport Operations.	<validated>	Airport Operations is responsible for RCAMS operation.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Inform Tower of RCAMS	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-5: Transition
REQ-02.25.1-SPRINTEROP-ATSS.0052	Aerodrome ATS informed of RCAMS initiation	Continuous awareness and monitoring provision and solution RCR dissemination initiation shall be communicated to Aerodrome ATS by Airport Operations immediately upon system initiation.	<validated>	Aerodrome ATS use RCAMS for rapid RCR dissemination.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Inform Tower of RCAMS initiation	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-5: Transition from GRF to Solution working
REQ-02.25.1-SPRINTEROP-ATSS.0053	Aerodrome ATS tower RCAMS operational confirmation	Aerodrome ATS shall confirm to Airport operations that tower RCR reception HMI is operational.	<validated>	Airport Operations is responsible for RCR dissemination and need to know tower status.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Confirm RCAMS Tower Operational	Aerodrome ATS	Airport	[NOV-5] Use Case PJ.02-W2-25-5: Transition from GRF to Solution working
REQ-02.25.1-SPRINTEROP-ATSS.0054	Aerodrome ATS means to identify tower RCAMS state	Aerodrome ATS shall be able to determine if tower RCR reception HMI is connected to Airport Operations.	<validated>	As the system is used for RCR dissemination it is important to be able to verify if it is connected .	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Confirm RCAMS Tower Operational	Aerodrome ATS	Airport	[NOV-5] Use Case PJ.02-W2-25-5: Transition from GRF to Solution working

REQ-02.25.1-SPRINTEROP-AIOP.0055	Airport Operations RCAMS connectivity confirmation	Airport Operations shall be able to determine the status of solution RCR dissemination mode independently from Aerodrome ATS confirmation.	<validated>	This is to be able to double check and override any erroneous communication.	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Confirm RCAMS fully operational	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-5: Transition from GRF to Solution working
REQ-02.25.1-SPRINTEROP-AIOP.0056	Airport Operations able to detect RCAMS dissemination to Aerodrome ATS	Airport Operations shall be able to detect solution RCR dissemination to Aerodrome ATS failure.	<validated>	This event is important and will force change of mode of communication.	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Initiate fallback R/T communication	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-6 Failure of local RCR dissemination via RCAMS
REQ-02.25.1-SPRINTEROP-ATSS.0057	Aerodrome ATS able to detect RCR dissemination failure from Airport Operations	Aerodrome ATS shall be able to detect solution RCR dissemination failure independent of Airport Operation actions.	<validated>	This guarantees common situation awareness without the need of additional prior communication. Expected result is a quicker enactment of failure contingency,	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Inform about loss of RCR dissemination	Aerodrome ATS	Airport	[NOV-5] Use Case PJ.02-W2-25-6 Failure of local RCR dissemination via RCAMS
REQ-02.25.1-SPRINTEROP-ATSS.0058	Aerodrome ATS request RCR communication feedback.	In case of solution RCR dissemination mode failure Aerodrome ATS shall request new mode of RCR dissemination from Airport Operations.	<validated>	This guarantees that controller (main information source for airspace users on approach) does not end up in passive waiting mode during failure.	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Inform about loss of RCR dissemination	Aerodrome ATS	Airport	[NOV-5] Use Case PJ.02-W2-25-6 Failure of local RCR dissemination via

REQ-02.25.1-SPRINTEROP-AIOP.0059	Airport Operations to provide alternative RCR dissemination.	Upon failure of solution RCR dissemination mode and request from Aerodrome ATS Airport Operations shall provide an alternative RCR dissemination mode and commence transition.	<validated>	Ultimately Airport Operations is the entity responsible for runway condition information dissemination.	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Initiate fallback R/T communication	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-6 Failure of local RCR dissemination via
REQ-02.25.1-SPRINTEROP-ATSS.0060	Aerodrome ATS to acknowledge alternative RCR dissemination	Upon establishment of alternative RCR dissemination mode Aerodrome ATS shall immediately acknowledge readiness to operate with the new RCR dissemination mode.	<validated>	Acknowledgment to make sure both stakeholders are on the same foot regarding alternative RCR dissemination mode.	<Operational> <Safety>	PJ.02-W2-25.1	S25-HLOR-01			Acknowledge R/T fallback usage	Aerodrome ATS	Airport	[NOV-5] Use Case PJ.02-W2-25-6 Failure of local RCR dissemination via
REQ-02.25.1-SPRINTEROP-AIOP.0061	Airport Operations to provide alternative RCR dissemination mode until solution means can be established again	Airport Operations shall continue providing alternative RCR dissemination mode until solution associated dissemination method is again available.	<validated>	RCR information dissemination should be available to stakeholders with minimal interruptions.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Continue using fallback communication until service finished	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-6 Failure of local RCR dissemination via RCAMS
REQ-02.25.1-SPRINTEROP-AIOP.0062	Airport Operations responsible for reinstating solution associated RCR dissemination mode	Airport Operations shall be responsible for reinstating solution associated RCR dissemination mode.	<validated>	Airport Operations is responsible for hosting most of solution associated hardware elements.	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Coordinate internally to initiate service	Airport Operations	Airport	[NOV-5] Use Case PJ.02-W2-25-6 Failure of local RCR dissemination via RCAMS

REQ-02.25.1-SPRINTEROP-ATSS.0063	Aerodrome ATS failure information exchange with Airport Operations	Aerodrome ATS shall be able to communicate the loss of RCR dissemination mode to the Airport Operations using independent communication mode immediately upon failure occurrence.	<validated>	Aerodrome ATS initiates the communication chain leading to alternative RCR dissemination usage.	<IER>	PJ.02-W2-25.1	S25-HLOR-01	RCAMS Failure	Aerodrome ATS o--> Airport Operations			Airport	
REQ-02.25.1-SPRINTEROP-AIOP.0064	Airport Operations solution RCR dissemination mode initiation communication	Airport Operations shall be able to send and receive communication status messages using the same communication interface as solution RCR dissemination mode to/from Aerodrome ATS whenever solution RCR dissemination mode changes its status.	<validated>	Aerodrome ATS and Airport Operations need common awareness of RCR dissemination status.	<IER>	PJ.02-W2-25.1	S25-HLOR-01	RCAMS initiation	Airport Operations o--> Aerodrome ATS			Airport	
REQ-02.25.1-SPRINTEROP-ACFT.0065	Transponder equipage	Aircraft shall be equipped with surveillance transponder of Mode S Level 2 with Extended Squitter as per Annex II, point B of IR (EU) No 1207/2011.	<in progress>	In order to support precise enough localisation on runway to build braking profile.	<Interoperability >	PJ.02-W2-25.1	S25-HLOR-01					Airport	
REQ-02.25.1-SPRINTEROP-AIOP.0066	RCAMS Availability	The RCAMS shall be able to operate under all weather conditions	<validated>	The RCAMS should ensure seamless functionality during all the weather conditions.	<Performance>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway	[NODE] Airport	Airport	[NOV-5]Elaborate Runway Condition
REQ-02.25.1-SPRINTEROP-AIOP.0067	RCAMS output information recording	The RCAMS output information shall be recorded	<validated>	All ATM System used for providing of ATS shall be recorded	<Operational>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway	[NODE] Airport	Airport	[NOV-5]Elaborate Runway Condition

EUROPEAN PARTNERSHIP

Co-funded by the European Union

REQ-02.25.1-SPRINTEROP-AIOP.0068	Recognition of RCAMS output information change	The RCAMS should provide to Airport Operator a Computed Current Runway Condition (including but not limited to Computed Current RWYCC) and Computed Predicted RWYCC in graphical interpretation highlighting the changes of values compared to reported runway conditions	<validated>	Operational requirement to quickly identify changes in runway conditions and evaluating trends to improve safety	<HMI>	PJ.02-W2-25.1	S25-HLOR-01			Monitor Runway Status	[NODE] Airport Operations	Airport	[NOV-5]Elaborate Runway Condition Report
REQ-02.25.1-SPRINTEROP-AIOP.0069	Quality of exchange data	All data exchange shall comply with required reliability, performance latency, and security criteria	<validated>	For all exchange data and interfaces shall be defined minimum performance and quality criteria.	<Interoperability>	PJ.02-W2-25.1	S25-HLOR-01					Airport	
REQ-02.25.1-SPRINTEROP-AIOP.0072	RCAMS Runway sensors capabilities	The RCAMS system should be deployed at the airport equipped with a Runway built-in sensors able to determine at least the contaminant type and depth.	<validated>	RCAMS is using built-in sensors in the runway as important input for runway condition calculation.	<Interoperability>	PJ.02-W2-25.1	S25-HLOR-01					Airport	
REQ-02.25.1-SPRINTEROP-AIOP.0073	RCAMS Runway sensors - spatial coverage	The RCAMS Runway built-in sensors shall cover reasonably the entire runway and provide data for each third of the runway.	<validated>	RCAMS is using built-in sensors in the runway as important input for runway condition calculation for each third of runway.	<Interoperability>	PJ.02-W2-25.1	S25-HLOR-01					Airport	
REQ-02.25.1-SPRINTEROP-AIOP.0074	AWOS Installation	The Airport should be equipped at least with AWOS III P installation.	<validated>	In order to determine Runway conditions RCAMS is supported by local AWOS System at the Airport	<Interoperability>	PJ.02-W2-25.1	S25-HLOR-01					Airport	

REQ-02.25.1-SPRINTEROP-AIOP.0075	AWOS data access	The RCAMS server shall have access to weather data originating from AWOS (at least type III P) or equivalent measurement system in real time or near-real time with no more than 3 min. delay	<validated>	In order to determine Runway conditions RCAMS is supported by local AWOS System at the Airport	<Interoperability>	PJ.02-W2-25.1	S25-HLOR-01					Airport	
REQ-02.25.1-SPRINTEROP-AIOP.0076	Local Weather Forecast	The RCAMS should have an access to local weather forecast at least for the next 3 hours	<validated>	To predict Runway conditions and determine their further trends the RCAMS system should be supported by local weather forecast	<Interoperability>	PJ.02-W2-25.1	S25-HLOR-01					Airport	
REQ-02.25.1-SPRINTEROP-ACFT.0078	OBACS RWYCC measurement	The RCAMS should have an access to OBACS RWYCC measurements	<validated>	OBACS (if available) may compute Braking Action in friction limited conditions (maximum achievable runway-tire braking efficiency) or non-friction limited conditions	<Interoperability>	PJ.02-W2-25.1	S25-HLOR-01					Airport	
REQ-02.25.1-SPRINTEROP-ACFT.0079	Aircraft equipment - transponder	Aircraft shall be equipped by transponder at least of Mode S Level 2 with Extended Squitter (ES) ADS-B protocol	<in progress>	RCAMS is using ADS-B function as minimum means to detect position of Aircraft at Runway	<Interoperability>	PJ.02-W2-25.1	S25-HLOR-01					Airport	
REQ-02.25.1-TS-OBACS.0001	OBACS activation	When OBACS is installed and available, OBACS shall be active during ground part of the landing	< validated >	In order to monitor ground part of the landing, when the A/C is on the runway.	<Functional>	PJ.02-W2-25.1	S25-HLOR-01						
REQ-02.25.1-TS-OBACS.0002	OBACS friction limited braking conditions detection	When OBACS is active, OBACS shall automatically detect if braking is anti-skid limited or not.	< validated >	OBACS Braking Action usage depends on friction limited braking conditions.	<Functional>	PJ.02-W2-25.1	S25-HLOR-01						

REQ-02.25.1-TS-OBACS.0003	Automatic OBACS Braking Action computation	When OBACS is active and in its intended operational domain, OBACS shall automatically calculate the Computed Braking Action relevant for the portion of the runway the aircraft rolled on at landing.	< validated >	OBACS is autonomous to detect the conditions and execute Braking Action computation.	<Functional>	PJ.02-W2-25.1	S25-HLOR-01						
REQ-02.25.1-TS-OBACS.0004	Transparent OBACS Braking Action computation	The OBACS computation shall be silent and run in background without need of or any interference with Flight Crew actions.	< validated >	Silent and background computation to prevent any additional workload to the crew during the landing phase.	<Functional>	PJ.02-W2-25.1	S25-HLOR-01						
REQ-02.25.1-TS-OBACS.0005	OBACS result display available to Flight crew after landing	When OBACS Computed Braking Action is available and useful for PiREP, Flight Crew shall be able to retrieve the OBACS result on a display after landing to assist them to do a PiREP	<validated>	In order to enhance crew awareness of the braking conditions encountered during the last landing. To help flight crew in addition of his/her experience to decide Braking Action to report to ATC.	<Functional>, <HMI>, <Interface>	PJ.02-W2-25.1	S25-HLOR-01						
REQ-02.25.1-TS-OBACS-0006	OBACS Friction Limited Braking Conditions reporting	OBACS shall inform Computed Braking Action result users whether the computation was done in friction limited braking or not friction limited conditions	<in progress>	OBACS Braking Action usage depends on friction limited braking conditions.	<Functional> , <Interface>	PJ.02-W2-25.1	S25-HLOR-01						
REQ-02.25.1-TS-FLCW.151	Pilot Braking Action assessment	Pilot shall perform braking action assessment after landing.	<validated>	Flight Crew assesses braking action using their experience and automatic braking action report from OBACS when available to verify whether reported runway conditions correspond to assessed braking action.	<Human Performance>	PJ.02-W2-25.1	S25-HLOR-01						

REQ-02.25.1-TS-OBACS-0007	Automatic OBACS reporting to RCAMS	When OBACS Computed Braking Action is available, OBACS should automatically transmit the result to RCAMS via OBACS ground server, pending Airport Operator has subscribed to OBACS service.	<in progress>	OBACS result availability for Airport Operator. A report is transmitted by the aircraft to a ground server which automatically transmit the information to be input in the Airport Operator system.	<Interoperability>, <Interface>	PJ.02-W2-25.1	S25-HLOR-01						
SRS 001		The Airport Operator shall be provided with the Computed Current RWYCC and the Computed Predicted RWYCC values with the required certainty level.	<validated>	The system shall provide to Airport Operator both Current and predicted RWYCC value with sufficient reliability. It shall not overestimate RWYCC values.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01						
SRS 002		Airport Operator within its Airport Duty Officer role shall perform the validation of Computed Current Runway Condition in a timely manner upon any significant change	<validated>	The Airport Operator is responsible for runway condition reporting. RCAMS warns Airport Operator when any significant changes occurs, but computed runway condition shall not be disseminated automatically, but only after validation by Airport Operator and issuance of new RCR/SNOWTAM.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01						
SRS 003		The Airport Operator shall disseminate RCR in timely manner via ATIS or R/T means of communications.	<validated>	It is safety critical to inform pilot about current Runway Surface Condition via standard means like ATIS or R/T.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01						
SRS 004		All relevant ATS services shall have means to know the most up to date Current Runway Surface Condition of any runway the RCAMS system is operational and to inform about any observed discrepancies (PIREP).	<validated>	In order to identify a change of runway conditions, the new Runway Surface Condition report should be disseminated to strengthen Air Traffic Controllers awareness;	<Safety>	PJ.02-W2-25.1	S25-HLOR-01						

EUROPEAN PARTNERSHIP

Co-funded by the European Union

SRS 005		Approach/Tower Runway ATCO shall disseminate the Current Runway Condition to the Flight Crew upon each change in a timely manner and/or on request.	<validated>	It is safety critical to inform pilot about current Runway Surface Condition.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01						
SRS 006		Whenever RCAMS system or its part is down, a degraded mode is provided	<validated>	The system shall be built in the way that fail of any of its part should not lead to missing or outdated information about runway surface condition. It is provided using degraded mode of operation.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01						
SRS 007		Whenever RCAMS output is not received by ATIS, an alternative manual input is provided	<validated>	It shall be possible to Airport Operator manually put data to ATIS.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01						
SRS 008		Provision of monitoring and alerting of the RCAMS functioning, reverting to manual AO procedures for RCR creation and dissemination	<validated>	It is necessary to provide adequate mitigations to reduce the likelihood that specific failures would propagate up to the service hazard.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01						
SRD 001		RCAMS system shall validate the RCR in accordance with the available information and assure the correct information is available	<validated>	RCAMS shall continuously validate latest reported runway conditions (RCR/SNOWTAM) with the runway condition machine learning model outputs and warns Airport Operator in case of any significant change is detected.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01						
SRD 002		The RCAMS system shall assure the correct computation, visualization and distribution to all the involved Stakeholders of the Current and Predicted RWYCC	<validated>	The RCAMS shall have internal built-in test on its functionalities to ensure all its functionalities work correctly.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01						

SRD-003		The RCAMS system shall have the possibility to seamlessly provide degraded mode, until RCAMS system parts recover from the failure.	<validated>	The RCAMS system shall be designed in robust and redundancy way to eliminate single point failures and allow soft degradation (degraded mode of operation).	<Safety>	PJ.02-W2-25.1	S25-HLOR-01						
SRD-004		Implementation of monitoring and alerting of the RCAMS functioning, enabling reverting to manual AO procedures for RCR creation and dissemination during RCAMS system failures	<validated>	The RCAM shall inform users about all the system failures and allow to Airport Operator come back to manual procedures.	<Safety>	PJ.02-W2-25.1	S25-HLOR-01						
HP_Req_1		RCAMS Admin role and procedures should be operational.	<validated>	RCAMS Admin should be responsible for monitoring of system functionalities, detect and remove potential failures of any part of the system and enable seamless transition to degrade mode of operation and its recovery back to normal operation.	<Human Performance>	PJ.02-W2-25.1	S25-HLOR-01						
HP_Req_2		Workload measures for the next maturity phase should be included in the experimental protocol.	<validated>	Workload shall be measured to prove the usability of the new system/operating method.	<Human Performance>	PJ.02-W2-25.1	S25-HLOR-01						
HP_Req_3		ATCO performance should be re-evaluated with RCAMS info integrated within ATIS.	<in progress>	During validation ATCOs rejected using separate ATCO RCMAS screen, rather integrate outputs into ATIS.	<Human Performance>	PJ.02-W2-25.1	S25-HLOR-01						

5 References and Applicable Documents

5.1 Applicable Documents

Content Integration

- PJ.19: EATMA Guidance Material and Report (2019), Ed. 01.00.01, October 2019

Content Development

- SESAR Concept of Operations (CONOPS 2019), Ed. 01.00.00, May 2019

System and Service Development

- B.04.05 Common Service Foundation Method

Performance Management

- PJ19.04: Performance Framework (2019), Ed. 01.00.01, November 2019
- Performance Assessment and Gap Analysis Report (2019), Ed. 00.01.02, December 2019

Validation

- European Operational Concept Validation Methodology (E-OCVM), Ed. 3.0, February 2010

System Engineering

- SESAR 2020 Requirements and Validation Guidelines, Ed. 02.01, May 2020

Safety

- SESAR, Safety Reference Material, Edition 4.01, December 2018
- SESAR, Guidance to Apply the Safety Reference Material, Edition 3.01, December 2018
- SESAR, Resilience Engineering Guidance, May 2016

Human Performance

- 16.06.05 D27 HP Reference Material D27

Environment Assessment

- SESAR Environment Assessment Process, Ed. 04.00.00, September 2019

5.2 Reference Documents

- European Action Plan for the Prevention of Runway Excursions (EAPPRE) - Edition 1.0 - EUROCONTROL - January 2013.
- Take Off and Landing Performance Assessment (TALPA) Initiative by the FAA.
- Review of aeroplane performance requirements for commercial air transport operations, Notice of Proposed Amendment 2016-11 - EASA – 30.09.2016.
- EUROCONTROL Specification for Advanced-Surface Movement Guidance and Control System (A-SMGCS) Services. Edition 1.0 – EUROCONTROL – March 2018.
- Procedures for Air Navigation Services — Aerodromes (PANS-Aerodromes) – 2nd edition – ICAO Doc 9981 – 2016.
- Procedures for Air Navigation Services — Aircraft Operations — Volume I: Flight Procedures – ICAO Doc 8168 –5th edition – 2006.
- Meteorological Service for International Air Navigation – ICAO Annex 3 – 16th Edition –2007.
- Runway Excursions Analysis Report 2004-2009 – IATA – RERR 2nd edition – 2011.
- A Study of Runway Excursions from a European Perspective – EUROCONTROL – March 2010.
- Assessment, Measurement and Reporting of Runway Surface Condition – ICAO Cir 355 – 2019.
- Annex 6 to the Convention on International Civil Aviation (Operation of Aircraft), Part I – International Commercial Air Transport – Aeroplanes, 11th edition – ICAO – July 2018.
- Annex 8 to the Convention on International Civil Aviation (Airworthiness of Aircraft), 12th edition – ICAO - 2018.
- Annex 14 to the Convention on International Civil Aviation (Aerodromes), Volume I – Aerodrome Design and Operations, 8th edition – ICAO – July 2018.
- European Action Plan for the Prevention of Runway Excursions, Edition 1.0, January 2013
- Annex 15 to the Convention on International Civil Aviation (Aeronautical Information Services), 16th edition – ICAO – 2018.
- Mitigating the Risks of a Runway Overrun Upon Landing - FAA AC 91-79A – September 2014.
- Landing Performance Data for Time-of-Arrival Landing Performance Assessments – FAA AC 25-32 –December 2015.
- Safety Report 2019 – IATA – April 2020.
- SESAR WPB4.2 Actors - Roles and Responsibilities – edition 00.01.05 – May 2011.
- IATA Safety Report, 2014
- Draft ED-250 Minimum Operational Performance Specification (MOPS) for a Runway Overrun Awareness and Alerting System.

- Runway Excursion AIM v0.3 (Dec 2015) (being part of P16.01.01, Accident Incident Models)
- PJ.03b-06 V2 VALR, Ed. 01.02 – March 2019
- ATSB Transport Safety Report (AR-2008-018(1)), Runway Excursions, Part I: A worldwide review of commercial jet aircraft runway excursions – 2009
- EASA Notice of Proposed Amendment (NPA) 2018-14 – December 2018
- PJ19: EATMA Guidance Material and Report (2019), Ed. 01.00.01 – October 2019
- D4.0.1 PJ19-W2: Validation Targets – Wave 2 & Wave 3 – May 2021
- SESAR Solution PJ.03b-06 - V2 SPR-INTEROP/OSED - Part I, Ed. 01.00.00 – October 2019
- SESAR PJ03B Solution 06 SPR/INTEROP-OSED V2 - Part V - Performance Assessment Report, Ed. 01.00.00 – October 2019
- ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.

Appendix A Cost and Benefit Mechanisms

A.1 Stakeholders identification and Expectations

Stakeholder	Involvement	Why it matters to stakeholder
Airport Operator	Internal (involved in validation execution)	Airport Operators expect to minimise the number of runway excursions especially under contaminated runway conditions, as well as associated cost and consequences. Having near real-time awareness of runway condition allows the Airport Operators to better manage real time operations (enhancing awareness about operations safety, optimization of the runway capacity in relation with ANSP, providing reasonable treatment of the runways taking economic and environmental issues into account).
ANSP (ATCO)	Internal (ANSP is involved in solution, ATCOs involved in validation execution and indirectly in BIM development)	ANSP expect enhancing the ATCOs' level of awareness about runway safety by providing direct, accurate, and up to date information about runway condition. ANSP as responsible for AIS is also looking for benefits resulting from easier and faster SNOWTAM publication.
Airspace User (Airline)	External (not directly involved in any project activity)	Airlines expect to minimise the number of runway excursions especially under contaminated runway conditions, as well as associated cost and consequences. Airlines also expect to optimise operations through good landing and approach preparation .
Airspace User (Flight Crew)	External (only involved in form of consultants in various solution activities)	Flight Crews expect enhancing the level of awareness about runway safety by sharing direct, accurate, and up to date information about runway condition. This is especially valuable in adverse weather conditions and contaminated runway conditions. The introduction of Runway Condition Tendency information is also important for the flight crew alerting them of the possible future deterioration of expected landing conditions.

Table 17: Stakeholder's expectations

Co-funded by the European Union

A.2 Benefits mechanisms

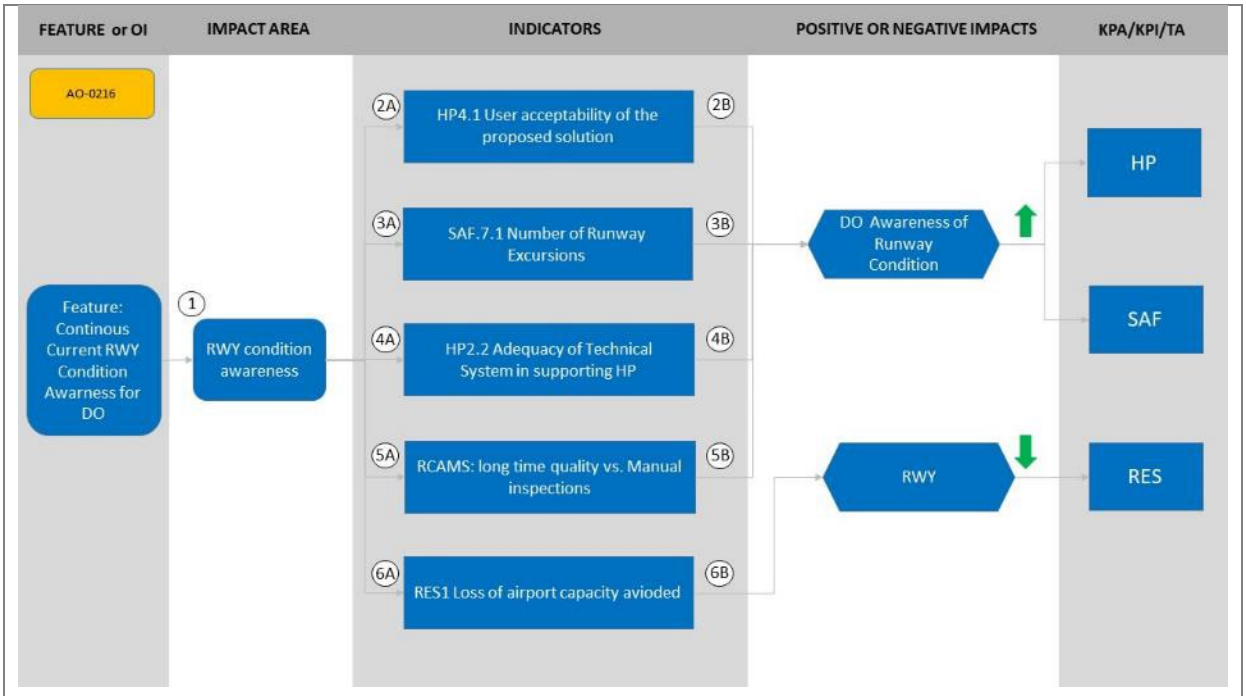
Validation Targets document [39] expresses solution PJ.02-W2-25.1 ambition to influence positively Safety and Human Performance. Solution also identified possible impact on resilience, especially on resilience to rapidly changing weather conditions. However, because of lack of reference data and measurements (the year of validation was the first year of new GRF intorduction); it wasn't proved.

The following subsections contain detailed BIMs for the following stakeholders:

- A.2.1 Airport Operator
    - **Table 19** RCAMS inference – continuous monitoring of Current Runway Condition
    - **Table 20** RCAMS RCR generation interface.
    - **Table 21** RCAMS inference – introduction of Predicted Runway Condition
- A.2.2 ANSP
    - **Table 22** RCAMS inference & faster information sharing – Predicted Runway Condition Tendency availability
- A.2.3 Airspace User
    - **Table 23** RCAMS inference & information sharing – indirect Predicted Runway Condition Tendency availability
    - **Table 24** RCAMS quicker information sharing

Co-funded by the European Union

A.2.1 Stakeholder : Airport Operator



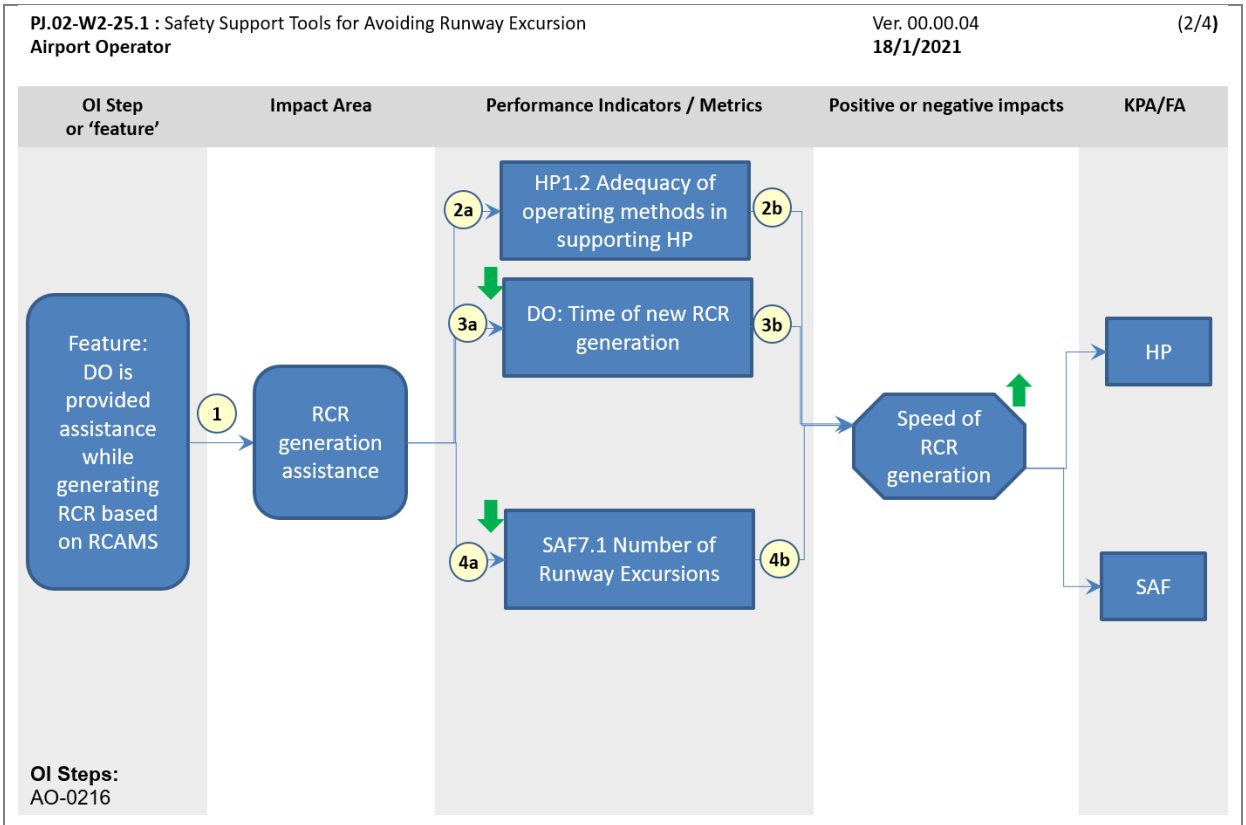
AO-0216 introduces RCAMS (Runway Condition Awareness and Monitoring System) which informs Duty Officer (DO) of any changes of Runway condition based on ground sensors and machine learning algorithm which ingests data from various sources available on airport (MET,). DO is informed of any deviation form published Runway Condition Report (RCR) in Current Runway Condition in real time using appropriate HMI and dedicated alerts.

(1)	*Introduction of RCAMS allows for the ability to constantly monitor runway condition changes by Duty Officer as a result of dynamic continuous inference and alerting.*
(2a)	*Ability to continuously monitor the runway condition is a featured expected by Duty Officers. Robust fulfilling of this function and tailored HMI presentation will allow for satisfactory RCAMS acceptance.*
(2b)	*The acceptance of RCAMS will allow for successful using it as an awareness increasing tool. This in turn impacts HP and SAF (as a result of an assumption that correct awareness of runway condition for this role is critical for runway safety).*
(3a)	*Introduction of RCAMS will increase DO awareness of changes of the runway condition. All other stakeholders are dependent on DO for correct runway condition awareness. As a result, this is impacting the probability of Runway Excursion (RE) occurrence.*
(3b)	*Increased DO awareness of runway condition is essential in fulfilling one of key DO functions: informing other stakeholders of the runway condition. As a result, it is positively impacting HP and Safety.*
(4a)	*RCAMS will be generating alerts of quality sufficient for safe operations. At the same time, the system will maintain DO awareness of currently published RCR allowing for easier decision making with all information in one place.*
(4b)	*Support of DO in efficient performance of their duties is important for HP and Safety.*

Co-funded by the European Union

(5a)	*Introduction of RCAMS will increase the quality of runway condition information available to DO.*
(5b)	*Satisfactory RCAMS alert quality will make It a safe and trustworthy tool. This is important for HP but also for safety benefit to materialise.*
(6a)	*Continuous awareness of runway condition will allow for better planning of runway inspections,* runway cleaning (snow removal) or runway de-icing*, especially in degraded weather conditions.*
(6b)	*Better situational awareness is expected to influence RWY inspection summary time however during validation it wasn't measured. No reference data available*

Table 18: Benefit and Impact Mechanisms – Stakeholder: Airport Operator – part 1 of 3



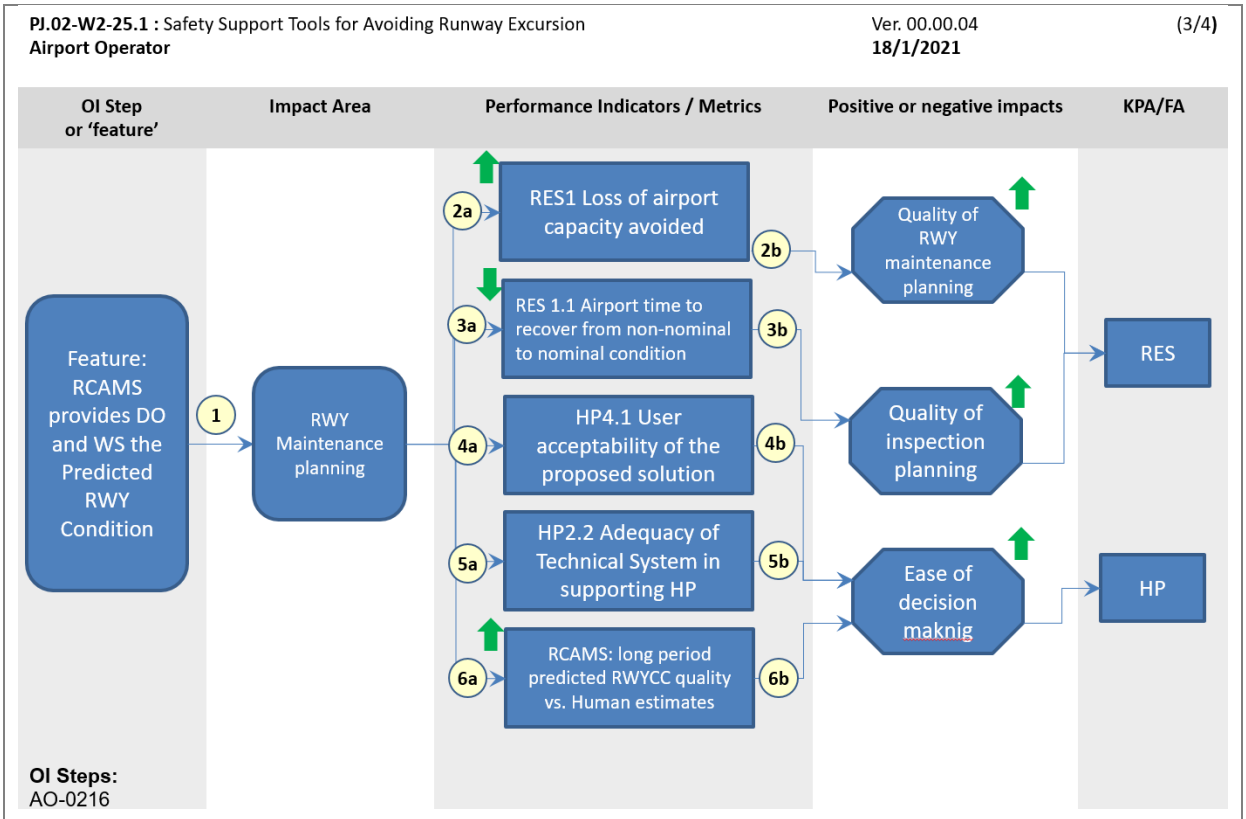
AO-0216 introduces RCAMS system which assists DO during the process of creating the RCR, tracks presently published RCR and provides the present Runway Condition alerts allowing for quick RCR update.

(1)	*Introduction of RCAMS HMI assists DO in making decision when to initiate new RCR/SNOWTAM publication process and why.*
(2a)	*RCAMS HMI gathers all data necessary to publish RCR in one place introducing functions like pre-population of RCR based on current RCAMS inference, tracking of published RCR, etc.). Effective usage of these functions will decrease DO workload impacting HP.*
(2b)	*Reduction of work necessary to prepare RCR/SNOWTAM for publication will increase the average speed of publication.*
(3a)	*Introduction of RCAMS RCR formulation assistance will reduce the time needed for RCR/SNOWTAM formulation.*

Co-funded by the European Union

(3b)	*Reduction of time needed for formulation of RCR will increase the speed of the publishing process positively impacting SAF and HP.*
(4a)	*RCAMS assistance during RCR generation will positively impact Safety by reducing amount of flights that could potentially receive outdated runway condition information.*
(4b)	*The safety benefit will be achieved due to acceleration of RCR/SNOWTAM generation and dissemination process allowing more up to date information to reach stakeholders other than DO.*

Table 19: Benefit and Impact Mechanisms – Stakeholder: Airport Operator – part 2 of 3



AO-0216 introduces RCAMS system with ability to provide Predicted Runway Condition – a short term forecast of runway surface condition - to Duty Officer (DO).

(1)	*Introduction of Predicted Runway Condition – a short term forecast of runway surface condition is intended to support airport actors in more robust maintenance planning.*
(2a)	*Awareness of Predicted Runway Condition will allow for more focused and efficient maintenance lowering the number of unnecessary "preventive maintenance" actions.*
(2b)	*Less numerous and more focused maintenance actions are corresponding to higher quality of the maintenance planning. High quality planning of maintenance is essential in reduction of runway capacity loss due to weather which supports Resilience.*
(3a)	*Awareness of Predicted Runway Condition will allow for reduction of inspections number and their total duration as a result of more optimised planning and ability to better judge the situation.*

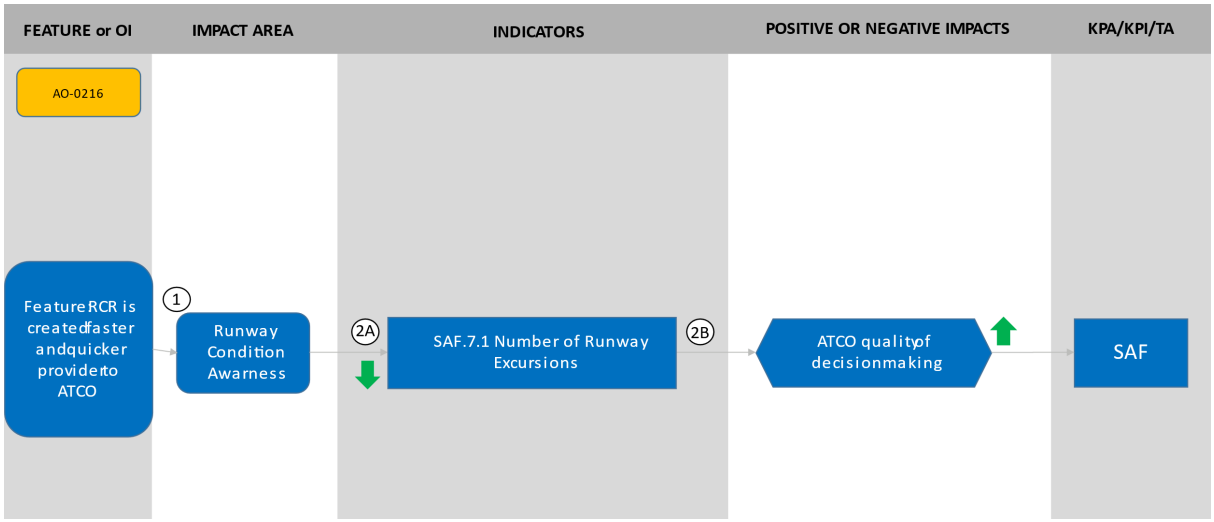
EUROPEAN PARTNERSHIP
Co-funded by the European Union

(3b)	*Total time and amount of Runway Inspections reduction, especially in degraded conditions, is the result of better quality planning which is supporting Resilience by allowing for quicker traffic resumption after necessary maintenance.*
(4a)	*Provision of reliable RWY Predicted Condition will increase trust in the system.*
(4b)	*Trust in RCAMS alerts and forecasts is a necessary prerequisite allowing to use it in decision making to reduce the complexity of the cognitive process. This Impacts HP.*
(5a)	*Provision of summarised present and predicted Runway Conditions in one place is allowing for increased situational awareness of DO and Winter Services.*
(5b)	*Increased level of situational awareness (a HP aspect) is important in informed decision making.*
(6a)	*RCAMS provides Predicted Runway condition of satisfactory quality to be operationally useful.*
(6b)	*Good quality of RCAMS predictions is important in supporting human actor decisions which is important for HP.*

Table 20: Benefit and Impact Mechanisms – Stakeholder: Airport Operator – part 3 of 3

Co-funded by the European Union

A.2.2 Stakeholder : ANSP



AO-0216 introduction of RCAMS in mobile version allow Duty Officer to faster create and disseminate RCR

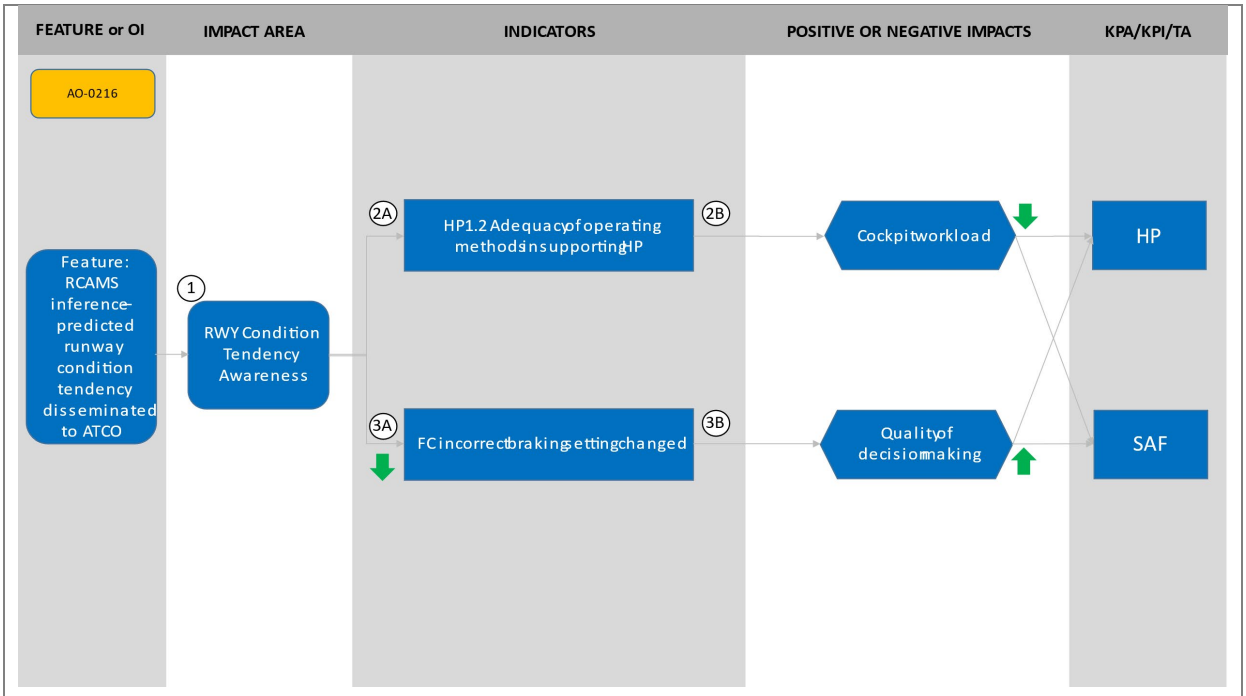
(1)	*ATCO is informed about changes of RCR faster and can be also informed about runway condition tendency, which improves his runway condition awareness.*
(2a)	*Knowledge of near-term runway condition tendency will allow Tower ATS to maintain better information about runway condition for other stakeholders which reduces the probability of runway excursion.*
(2b)	*Reduced probability of runway excursion risk resulting from ATCO runway condition awareness and better decision making is an aspect of Safety KPA*

Table 21: Benefit and Impact Mechanisms – Stakeholder: ANSP

Co-funded by the European Union

A.2.3 Stakeholder : Flight Crew

Note: It is expected that more accurate information transmitted by ATCO will impact Flight Crew work and performance positively, which is reflected in the BIM proposition below.

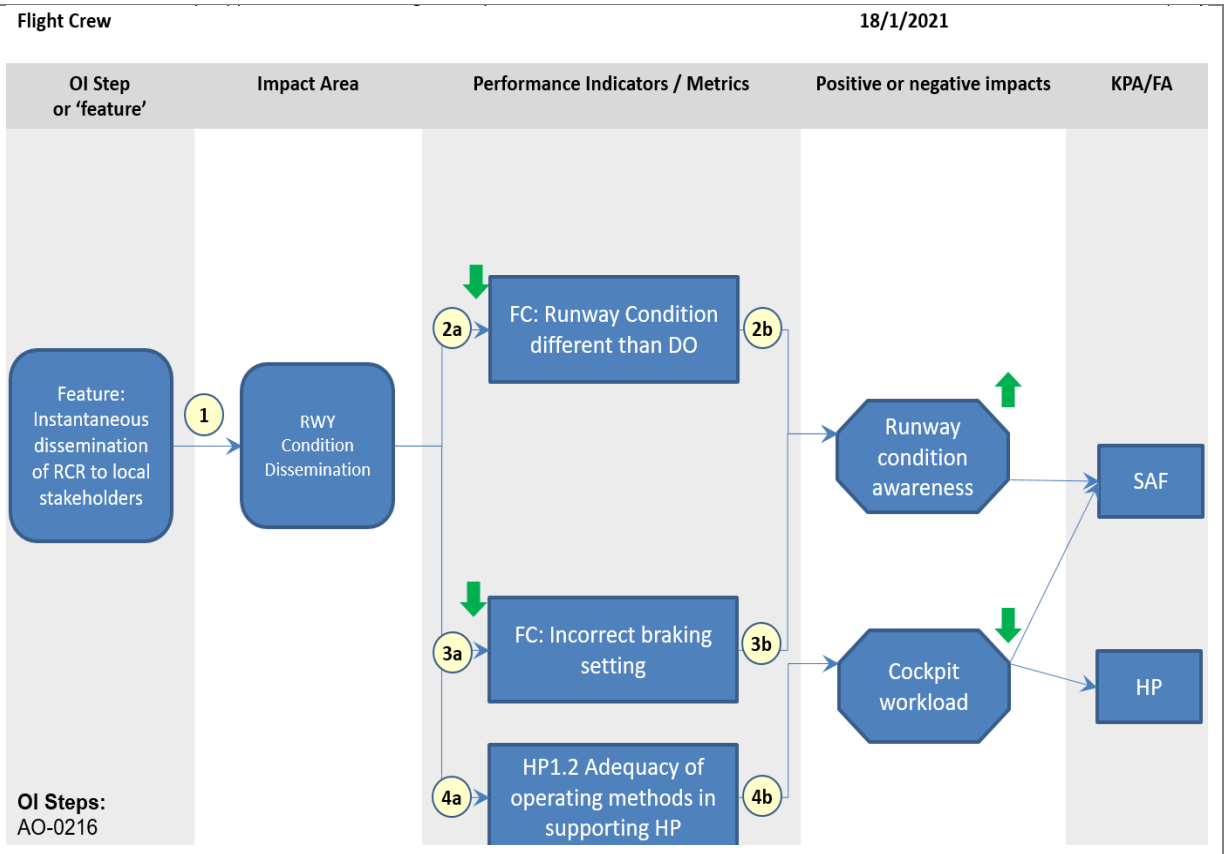


AO-0216 introduces RCAMS system with function of short term runway condition forecast. Each locally disseminated RCR is also including the short term variability information.

(1)	Introduction of RCAM shortens the lead time for current and predicted RWYCC
(2a)	*Awareness of upcoming RWY condition tendency will lead to less R/T communication on final approach.*
(2b)	*Reduction of R/T communication will reduce cockpit workload intensity on final approach. This is an aspect of HP but also impacts SAF allowing for more careful landing preparation especially in degraded RWY conditions.*
(3a)	*Awareness of upcoming RWY condition tendency will allow for more informed choice of a braking setting for a given approach.*
(3b)	*Better information availability in cockpit will improve the quality of braking setting choice and reducing risk of runway excursion (HP, SAF).*

Table 22: Benefit and Impact Mechanisms – Stakeholder: Flight Crew – part 1 of 2

Co-funded by the European Union



AO-0216 introduces RCAMS system with function of instantaneous direct dissemination of RCR to local stakeholders.

(1)	*Accelerated dissemination of RCR will allow the DO to frequently update RCR increasing other stakeholders awareness of RWY condition.*
(2a)	*More efficient RCR dissemination will reduce the probability of occurrence of the differences in RWY condition awareness between Flight Crew and DO.*
(2b)	*As a result of more harmonised and up to date RWY condition view among stakeholders awareness of RWY condition increases directly mitigating one of runway excursion event precursors (Safety).*
(3a)	*More efficient RCR dissemination will reduce the risk of incorrect braking setting during final approach.*
(3b)	*Runway condition awareness corresponds to increased chance of correct braking setting by Flight Crew which decreases runway excursion risk (Safety).*
(4a)	*More reliable and up to date dissemination of runway condition will decrease the R/T occupancy dedicated to this activity.*
(4b)	*Decreased R/T occupancy corresponds to decreased workload during final approach (HP) allowing for more careful landing preparation and resulting in decrease in landing incidents probability (especially runway excursion – Safety).*

Table 23: Benefit and Impact Mechanisms – Stakeholder: Flight Crew – part 2 of 2

Co-funded by the European Union

A.3 Costs mechanisms

OBACS equipped Aircraft Manufacturer:

- **Not recurring cost:**
    - OBACS software development and production,
    - Software installation (linefit or media and service bulleting for retrofit),
- **Recurring cost:**
    - OBACS ground service infrastructure cost and support,
    - Support for OBACS software.

Take-off Monitoring system equipped Aircraft Manufacturer:

- **Not recurring cost:**
    - Take-off Monitoring system development, certification and production,
    - Take-off Monitoring system installation in linefit and upgrade in retrofit
- **Recurring cost:**
    - Take-off Monitoring system Support.

Airspace Users (Airlines, Business Aviation):

- **Not recurring cost:**
    - OBACS software installation,
    - TOMS software installation,
    - Flight crew training on OBACS,
    - Flight crew training on ROAAS,
- **Recurring cost:**
    - Communication cost (OBACS),
    - Runway database update and maintenance (for TOMS).

Airport:

- **Not recurring cost:**
    - Safety support tool software installation, local server,
    - Airport Operators training,
- **Recurring cost:**
    - Maintenance and regular updating of software,
    - Support and communication cost,
    - Runway condition sensors (e.g., built-in sensors) maintenance.
    - Subscription to OBACS.
- **Necessary prerequisite:**
    - Infrastructure cost: runway condition sensors (e.g., built-in sensors), weather sensors.

Co-funded by the European Union

MET Service:

- **Necessary prerequisite:**
    - Infrastructure cost: weather sensors.

Co-funded by the European Union

Appendix B Deleted Requirements

B.1 Deleted requirements

[REQ]

Identifier	REQ-03b.06-SPRINTEROP-FLCR.0003
Title	Advanced ROAAS alert depending on RWYCC
Requirement	If Advanced ROAAS is equipped and Airplane is in the Advanced ROAAS intended operational domain, the Flight Crew should get timely aural and visual alert in case of detected runway excursion risks taking into account all RWYCC.
Status	<in progress>
Rationale	**TBD: do we leave ROAAS related requirements?** [ACFT-ENV 1][ACFT-ENV 2] SAF-REQ-13 ROAAS shall provide FLC an alert according to EUROCAE ED-250 and also taking into account any RWYCC value.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.03b-06
<ALLOCATED_TO>	<Activity>	Monitor trajectory until DH Monitor and Control Landing Trajectory on Runway
<ALLOCATED_TO>	<Role>	[NODE] Arriving Aircraft
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

[REQ]

Identifier	REQ-03b.06-SPRINTEROP-FLCR.0004
Title	ROAAS automatic activation/deactivation

Co-funded by the European Union

Requirement	ROAAS shall activate and deactivate automatically.
Status	<in progress>
Rationale	**TBD: do we leave ROAAS related requirements?** [ACFT-ENV 1][ACFT-ENV 2] ROAAS activation triggers aircraft trajectory survey to raise alert to Flight Crew in case of Runway Excursion overrun risk
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.03b-06
<ALLOCATED_TO>	<Activity>	Monitor trajectory until DH Monitor and Control Landing Trajectory on Runway
<ALLOCATED_TO>	<Role>	[NODE] Arriving Aircraft
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

[REQ]

Identifier	REQ-03b.06-SPRINTEROP-FLCR.0005
Title	ROAAS manual inhibition
Requirement	If ROAAS equipped, the Flight Crew shall have the ability to inhibit ROAAS alerts.
Status	<in progress>
Rationale	**TBD: do we leave ROAAS related requirements?** [ACFT-ENV 1][ACFT-ENV 2]
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier

<ALLOCATED_TO>	<SESAR Solution>	PJ.03b-06
<ALLOCATED_TO>	<Activity>	Decide for landing or missed approach
<ALLOCATED_TO>	<Role>	[NODE] Arriving Aircraft
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

[REQ]

Identifier	REQ-03b.06-SPRINTEROP-ATSS.0004
Title	Tower ATS CWP RCR display
Requirement	All operational ATS CWP (Tower, Approach, En-route) shall display up to date RCR for any runway of the airport.
Status	<in progress>
Rationale	SAF-REQ-12 ATCO shall provide up to date runway current RWYCC and predicted RWYCC trend to flight crew upon request and with the landing clearance (as required by other regulations). The tower controller needs this to provide this information in its departure, take-off and landing clearances and upon any Flight Crew's request (as per GRF).
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.03b-06
<ALLOCATED_TO>	<Activity>	Provide Runway Condition for any rwy in the area Provide start-up and push-back instructions Provide Line-up Clearance Provide landing clearance (PJ.03b-06)
<ALLOCATED_TO>	<Role>	[NODE] Control Tower [NODE] En-Route/Approach ATS

		[NODE] Aeronautical Information Service Provision
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

[REQ]

Identifier	REQ-03b.06-SPRINTEROP-ATSS.0005
Title	ATS CWP Predicted Runway Surface Condition
Requirement	All operational ATS CWP (Tower, Approach, En-route) should display up to date Predicted Runway Condition estimation for any runway of the airport.
Status	<in progress>
Rationale	So any controller to be able to transmit on request Runway Surface Condition to the Flight Crew without delay.For any controllers, runway surface condition of any airport should also made available. SAF-REQ-03 SAF-REQ-37 ATCO shall be presented runway condition using standard RCR format
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.03b-06
<ALLOCATED_TO>	<Activity>	Provide Runway Condition for any rwy in the area Provide start-up and push-back instructions Provide landing clearance (PJ.03b-06) Provide Line-up Clearance
<ALLOCATED_TO>	<Role>	[NODE] Control Tower

		[NODE] En-Route/Approach ATS [NODE] Aeronautical Information Service Provision
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

[REQ]

Identifier	REQ-03b.06-SPRINTEROP-ATSS.0008
Title	PIREP transmission to Airport Operator
Requirement	Upon reception of a PIREP on Braking Action from a landed aircraft, all Tower Controllers should have means to inform RCAMS of the Observed Braking Action.
Status	<in progress>
Rationale	SAF-REQ-18 ATCO shall have means to inform RCAMS of the latest PIREP.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.03b-06
<ALLOCATED_TO>	<Activity>	Report Braking Action PIREP to Airport Operator
<ALLOCATED_TO>	<Role>	[NODE] Control Tower
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

[REQ]

Identifier	REQ-03b.06-SPRINTEROP-ATSS.0009
Title	RCAMS input data SWIM compliance
Requirement	Input data provided to RCAMS for the runway surface condition computation may be supported by SWIM.
Status	<in progress>

Rationale	Usually the local airport data will not use SWIM protocol. However, in cases when the data is for some reason not local or RCAMS is not local to the airport it is expected they will be provided via dedicated SWIM service.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.03b-06
<ALLOCATED_TO>	<Information Exchange>	[NOV] ATC Braking Action report [NOV] MET Info Provision [NOV] Surveillance Data Provision [NOV] Automatic Braking Action Display
<ALLOCATED_TO>	<Information Flow>	Report Braking Action PIREP to Airport Operator o--> Collect Information Throwing o--> Collect Information Meteorological Service Provision o--> Collect Information Airport Surveillance o--> Collect Information
<ALLOCATED_TO>	<Functional Block>	Runway Surface Condition Computing (PJ03b-06)

[REQ]

Identifier	REQ-03b.06-SPRINTEROP-FLCR.0012
Title	ROAAS informed of braking device failure
Requirement	In case of detected single or multiple braking device failure ROAAS shall be informed of this condition.
Status	<in progress>
Rationale	**TBD: do we leave ROAAS related requirements?** SAF-REQ-40 To perform its function correctly ROAAS needs to account for braking devices state.

Co-funded by the European Union

Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.03b-06
<ALLOCATED_TO>	<Activity>	Monitor trajectory until DH Monitor and Control Landing Trajectory on Runway
<ALLOCATED_TO>	<Role>	[NODE] Arriving Aircraft
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

[REQ]

Identifier	REQ-03b.06-SPRINTEROP-FLCR.0013
Title	ROAAS operation in case of a braking device failure
Requirement	**TBD: do we leave ROAAS related requirements?** In case of detected single or multiple braking device failure ROAAS shall either: a) Become inoperative, in which case, an alert shall be provided to the crew, stating that the protection is lost. b) Remain active and ROAAS shall generate no undue alerts.
Status	<in progress>
Rationale	SAF-REQ-41 In case of single or multiple braking device failure the braking characteristics of an aircraft is changed. ROAAS might either be able to account for that or not. If the former is true the system shall work as designed and not generate undue alerts. Otherwise, if the braking characteristics change is not taken into account properly, ROAAS will disengage but the crew shall be aware of this.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.03b-06
<ALLOCATED_TO>	<Activity>	Monitor trajectory until DH Monitor and Control Landing Trajectory on Runway
<ALLOCATED_TO>	<Role>	[NODE] Arriving Aircraft
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

[REQ]

Identifier	REQ-02.25.1-SPRINTEROP-ATSS.0042
Title	Approach Controller RWY condition change awareness
Requirement	The Approach Controller should be aware about any significant change of the runway surface condition for any runway of the airport due to relevant CWP functionality.
Status	<in progress>
Rationale	Approach controller is obliged to monitor runway condition and inform any flights approaching of any significant change. RCAMS HMI will be in most cases more reliable source of information than ATIS display since the time of update is expected to be much shorter.
Category	<Safety> <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-W2-25.1
<ALLOCATED_TO>	<Activity>	Forward runway condition
<ALLOCATED_TO>	<Role>	Approach ATS
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

[REQ]

Identifier	REQ-02.25.1-SPRINTEROP-ATSS.0070

Title	Surveillance means at the Airport (A-SMGCS)
Requirement	Surveillance system used at Airport equipped with RCAMS should be compliant with the Minimum Operational Performance Specification (MOPS) for A-SMGCS.
Status	<in progress>
Rationale	RCAMS is using local surveillance system which should be compliant with performance specification for A-SMGCS
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-W2-25.1
<ALLOCATED_TO>	<Activity>	
<ALLOCATED_TO>	<Role>	
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

[REQ]

Identifier	REQ-02.25.1-SPRINTEROP-ATSS.0071
Title	Surveillance means at the Airport (ADS-B)
Requirement	The RCAMS shall be deployed at the airport equipped with Surveillance System at minimum specification for ADS-B for Airport Surface Surveillance (ADS-B APT)
Status	<in progress>
Rationale	RCAMS is using local surveillance system which shall be compliant with minimum performance specification
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-W2-25.1

<ALLOCATED_TO>	<Activity>	
<ALLOCATED_TO>	<Role>	
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

B.2 Requirements to be moved to TS

[REQ]

Identifier	REQ-03b.06-SPRINTEROP-ATSS.0010
Title	RCAMS output SWIM compliance
Requirement	All RCAMS output Dissemination may be supported by SWIM.
Status	<in progress>
Rationale	SWIM compliant data candidates: Predicted RWYCC, RCR, Predicted Runway Surface Condition, Runway surface condition trend assessment
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.03b-06
<ALLOCATED_TO>	<Information Exchange>	[NOV] Runway Status transmission
<ALLOCATED_TO>	<Information Flow>	Disseminate Runway Status o--> Prepare and Brief Expected Approach (PJ.03b-06) Disseminate Runway Status o--> Prepare Flight Data Disseminate Runway Status o--> Prepare Take-Off Disseminate Runway Status o--> Aeronautical Information Service Provision
<ALLOCATED_TO>	<Functional Block>	Runway Surface Condition Computing (PJ03b-06)

[REQ]

Identifier	REQ-03b.06-SPRINTEROP-ATSS.0003
Title	Current Runway Surface Condition in RCR format
Requirement	The Current Runway Surface Condition of any runway the RCAMS system is operational shall be disseminated to all relevant ATS services in standard RCR format.
Status	<in progress>
Rationale	So any controller to be able to transmit on request Runway Surface Condition to the Flight Crew without delay. For any controllers, runway surface condition of any airport should also made available. SAF-REQ-03 SAF-REQ-37 ATCO shall be presented runway condition using standard RCR format
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.03b-06
<ALLOCATED_TO>	<Activity>	Provide Runway Condition for any rwy in the area
<ALLOCATED_TO>	<Role>	[NODE] Control Tower [NODE] En-Route/Approach ATS [NODE] Aeronautical Information Service Provision
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

Identifier	REQ-02.25.1-SPRINTEROP-AIOP.0077

Co-funded by the European Union

Title	Local Weather Radar
Requirement	The RCAMS should have an access to local Radar Weather data
Status	<in progress>
Rationale	To predict Runway conditions and determine its further trend the RCAM system should be supported by Radar Weather data
Category	< Interoperability >

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-W2-25.1
<ALLOCATED_TO>	<Activity>	
<ALLOCATED_TO>	<Role>	
<ALLOCATED_TO>	<Sub-Operating Environment>	Airport

Co-funded by the European Union

-END OF DOCUMENT-

EUROPEAN PARTNERSHIP

Co-funded by the European Union

Solution PJ02-W2-25.1 Beneficiaries

Co-funded by
the European Union