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PJ.02-W2 AART

AIRPORT, AIRSIDE AND RUNWAY THROUGHPUT

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Abstract

This document collects and describes the Technical System Requirements (functional and non-functional) which shall guide the development and implementation of addressing the wake turbulence separation optimization concept for departures. These System Requirements are derived from the Operational Requirements collected by the specification of previous R&D projects and studies, and from SESAR project PJ.02-01-06 WTS (for Departures) based on Static Aircraft Characteristics.

This document details Technical and Interface specifications related to the three concepts under WTS (for Departures) based on Static Aircraft Characteristics:

- AO-0323 – Static Pairwise Separations (S-PWS) for Departures;
- AO-0304 – Weather -Dependent Reductions of Wake Turbulence Separations for Departures;
- AO-0329 – Optimised Separation Delivery for Departure.

technical system requirements have been made in SESAR 2020 Wave 2.

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1 Executive summary

This document lists and details the Technical System Requirements (functional and non-functional) that shall guide the development and implementation of prototypes involved in PJ.02-01-06 Validation exercises. This document addresses Interface Requirements as well.

In line with the SPR/INTEROP-OSED [40], functional and non-functional are addressing three concepts.

The departures concepts solutions consist of Wake Turbulence Separations for Departure based on Static Aircraft Characteristics (PWS-D), Optimised Separation Delivery for Departure (OSD) and Weather-Dependent Reductions of Wake Turbulence Separation for Departure (WDS-D).

OSD is the ATC support tool to enable consistent and efficient delivery of the required separation or spacing between departure pairs on the initial departure path.

PWS-D is the efficient aircraft type pairwise wake separation rules for departure operations. In SESAR 2020 Wave 2 the methodology for determining time-based pairwise wake separation minima was refined and the time-based pairwise wake separation minima for departures was expanded from a 96x96 matrix to a matrix of 103x103 aircraft types. Therefore, pairwise wake separation for departure operations consists of the time-based seven wake category (7-CAT) based wake separation minima, the time-based and distance-based 103 x 103 aircraft type based pairwise wake separation minima in conjunction with the twenty wake category (20-CAT) based wake separation minima for departure pairs involving other aircraft types. Details of the refined methodology for defining time based pairwise wake separation minima together with the updated 103x103 S-PWS-D matrix can be found in [40].

In SESAR 2020 Wave 1 draft aircraft type pairwise time-based wake separation minima and refined wake category time-based wake separation minima were established and employed in the validation exercises in order to support assessment of the Human Performance, Safety and Performance validation objectives. In Wave 2, a flight simulation was conducted to validate the refined methodology for time based pairwise wake separations for departures and gain additional evidence to support the safety case for time based pairwise separations.

WDS-D is the conditional reduction or suspension of the wake separation minima for departure operations, applicable under pre-defined wind conditions so as to enable a runway throughput increase compared to the applicable standard weather independent wake separation minima. This is on the basis that under the pre-defined wind conditions the wake turbulence generated by the lead aircraft is either crosswind transported out of the path of the follower aircraft on the initial departure path, or has decayed sufficiently to be acceptable to be encountered by the follower aircraft on the initial departure path.

The wake separation minima on the initial departure path are defined as both distance-based minima and time-based minima, and so may be applied as either distance-based minima or time-based minima.

OSD, PWS-D and WDS-D will increase departure runway capacity, and improve the efficiency, predictability and resilience of departure operations, while maintaining safety.

technical system requirements have been made in SESAR 2020 Wave 2.

2 Introduction

2.1 Purpose of the document

This TS/IRS document ¹provides the requirements specification of the PJ.02-01-06 Solution addressing Wake vortices separation reduction, covering functional, non-functional and interface requirements related to SESAR Solution PJ.02-01-06. This document focuses on specifying the functional description and the logical interfaces with other functional blocks

2.2 Scope

This TS/IRS covers functional, non-functional and interface requirements related to SESAR Solution PJ.02-01-06.

The listed requirements shall comply with the operational requirements listed in the SPR-INTEROP/OSED [40].

2.3 Intended readership

The intended readership is the SESAR Solution PJ.02-01-06 project members, the other solutions in SESAR Project PJ.02 Increased Runway and Airport Throughput, the related solutions in SESAR Project PJ.01 Enhanced Arrivals and Departures, the related solutions in SESAR Project PJ.04 Total Airport Management, the related solutions in SESAR Project PJ.09 Advanced Demand & Capacity Balancing, the related transversal SESAR Projects PJ.19 and PJ.22, and all impacted and interested stakeholders.

2.4 Background

For this solution, the baseline from which this document has been written partly consists of SESAR 1 Technical Specification documents

- SESAR 1, 12.02.02-D56

2.5 Structure of the document

The document is organised as described hereafter

- ***Section 1 gives a brief summary of this Technical Specification document***
- ***Section 2 gives an introduction to how the document is organised***
- ***Section 3 describes the links between Functional blocks, Enablers and Roles coming from the EATMA models***

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

- Section 4 describes the Functional Architecture and lists the Technical Requirements
- **Section 5 lists the options**
- Section 6 explains the assumptions for the technical feasibility of the solution
- Section 7 lists the Applicable documents and the references
- Appendix C describes how Optimised separation delivery in mixed mode operations are specified

2.6 Glossary of terms

Term	Definition	Source of the definition
DBS	Refers to applying wake separations on final approach which are based on distances. This is how wake separations are applied in the majority of current operations.	OFA 01.03.01 Enhanced Runway Throughput Consolidated Final Step 1 OSED [39]
In-trail aircraft pair	Refers to consecutive aircraft pairs that are landing on the same runway.	OFA 01.03.01 Enhanced Runway Throughput Consolidated Final Step 1 OSED [39]
Not-in-trail aircraft pair	Refers to consecutive aircraft pairs that are landing on different parallel runways.	OFA 01.03.01 Enhanced Runway Throughput Consolidated Final Step 1 OSED [39]
ORD	Refers to the Optimised Runway Delivery concept which intends to provide additional tool support to show the Controller the required spacing on the approach to take into account the effect of compression primarily caused by aircraft decelerating to land.	OFA 01.03.01 Enhanced Runway Throughput Consolidated Final Step 1 OSED [39]
S-PWS	A wake separation concept where wake separations are optimised by defining them between aircraft type pairs rather than between wake categories.	OFA 01.03.01 Enhanced Runway Throughput Consolidated Final Step 1 OSED [39]
TBS	Refers to the generic TBS concept that was developed in SESAR 1 Project P06.08.01 which included tool support to show the Controller the required separation.	OFA 01.03.01 Enhanced Runway Throughput Consolidated Final Step 1 OSED [39]

<p>WDS (arrivals)</p>	<p>There are two versions: WDS (total wind) and WDS (crosswind).</p> <p>WDS (total wind) aims to allow reduced Wake Turbulence (WT) separations based on the argument that WT is more rapidly decayed as the wind magnitude increases.</p> <p>WDS (crosswind) aims to allow the reduction of WT separations based on the argument that WT is transported out of the path of follower aircraft.</p>	<p>OFA 01.03.01 Enhanced Runway Throughput Consolidated Final Step 1 OSED [39]</p>
<p>WDS (departures)</p>	<p>A concept that allows the reduction of wake separations between departures when the wind is above a certain threshold based on the argument that WT is more rapidly decayed as the wind magnitude increases.</p> <p>Note that within SESAR 2020 there are two main versions: WDS (total wind) and WDS (crosswind).</p> <p>WDS (total wind) aims to allow reduced Wake Turbulence (WT) separations based on the argument that WT is more rapidly decayed as the wind magnitude increases.</p> <p>WDS (crosswind) aims to allow the reduction of WT separations based on the argument that WT is transported out of the path of follower aircraft.</p> <p>Also note that a third version of differentiated rotation positions and climb profiles is under consideration in SESAR 2020.</p>	<p>OFA 01.03.01 Enhanced Runway Throughput Consolidated Final Step 1 OSED [39]</p>

Table 1: Glossary of terms

2.7 Acronyms and Terminology

Term	Definition
------	------------

3-CAT	Three Wake Category
6-CAT	Six Wake Category
7-CAT	Seven Wake Category
14-CAT	Fourteen Wake Category
20-CAT	Twenty Wake Category (Fourteen Wake Category with Six Wake Category)
A-CDM	Airport Collaborative Decision Making
A-SMGCS	Advanced Surface Movement Guidance and Control System
ACC	Area Control Centre
ADI	Average Departure Interval
ADS-B	Automatic Dependent Surveillance Broadcast
AFTN	Aeronautical Fixed Telecommunication Network
AIP	Aeronautical Information Publication
AO	Aircraft Operations
AOCC	Aircraft Operations Control Centre
AoR	Area of Responsibility
AMAN	Arrival Manager (System)
APOC	Airport Operations Centre
AROT or aROT	Arrival Runway Occupancy Time
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATFCM	Air Traffic Flow and Capacity Management
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATS	Air Traffic Service
ATSA	Air Traffic Services Assistant
CAP	Capacity
CAT	Category (for aircraft classification for wake)
CAT <n>	Category of ILS System (CAT I, CAT II, CAT III)
CBA	Cost Benefit Assessment

CDM	Collaborative Decision Making
CNS	Communication Navigation and Surveillance
CONOPS	Concept of Operations
CR	Change Request
CREDOS	Crosswind-Reduced Separation for Departure Operations
CTOT	Calculated Take Off Time
CWP	Controller Working Position
D-ATIS	Digital Automatic Terminal Information Service
DBS	Distance Based Separation
DC	Data Collection
DER	Departure End of the Runway
DF	Deceleration Fix (for landing stabilisation)
DLR	Deutsches Zentrum für Luft- und Raumfahrt
DMAN	Departure Manager (System)
DME	Distance Measuring Equipment
EASA	European Aviation Safety Agency
EATMA	European ATM Architecture
E-ATMS	European Air Traffic Management System
EC 6FP	European Commission 6 th Framework Programme
EFPS	Electronic Flight Progress Strip
EU	European Union
EXE	Exercise
FAF	Final Approach Fix
FAP	Final Approach Point
FOC	Flight Operations Centre
FPL	Flight Plan
ft	Feet
FTD	Final Target Distance
FTS	Fast Time Simulation
GH	Ground Handlers
GMC	Ground Movement Controller
GMP	Ground Movement Planner
GNSS	Global Navigation Satellite System

GPS	Global Positioning System
GWCS	Glideslope Wind Conditions Service
HEAVY	ICAO Heavy Wake Category
HMI	Human Machine Interface
HPAR	Human Performance Assessment Report
Hz	Hertz
IAF	Initial Approach Fix
ICAO	International Civil Aviation Organisation
IAS	Indicated Air Speed
ILS	Instrument Landing System
INTEROP	Interoperability Requirements
ITD	Initial Target Distance
kg	kilograms
KPA	Key Performance Area
kt or kts	Knots
LiDAR	Light Detection and Ranging
LIGHT	ICAO Light Wake Category
LT	Live Trial
m	Metres
m/s	metres per second
MDI	Minimum Departure Interval
MEDIUM	IACO Medium Wake Category
MET	Meteorological
MHz	Megahertz (1,000,000 Hz)
MLS	Microwave Landing System
MRS	Minimum Radar Separation
MTOM	Maximum Take Off Mass
MTOW	Maximum Take Off Weight
N/A	Not applicable
NDB	Non Directional Beacon
NM	Nautical Mile (1852m)
NMF	Network Management Function
NPR	Noise Preferential Route

OFA	Operational Focus Area
OI	Operational Improvement
OM	Outer Marker (final approach)
OPAR	Operational Performance Assessment Report
ORD	Optimised Runway Delivery (arrivals)
OSD	Optimised Separation Delivery (departures)
OSED	Operational Service and Environment Definition
PANS	Procedures for Air Navigation Services
PAR	Performance Assessment Report
PCP	Pilot Common Project
PFS	Paper Flight Strip
PIRM	Programme Information Reference Model
PJ	Project
PSR	Primary Surveillance Radar
PWS	Pair Wise Separation
PWS-A	Pair Wise Separation for Arrivals
PWS-D	Pair Wise Separation for Departures
QoS	Quality of Service
R&D	Research & Development
R/C	Radio Communications
RBT	Reference Business Trajectory
RECAT	Re-categorisation (wake scheme)
RECAT-EU	RECAT Europe
RECAT-EU-PWS	RECAT Europe Pair Wise Separation
REQ	Requirement
RMT	Reference Mission Trajectory
ROT	Runway Occupancy Time
RSVA	Reduced Separation in the Vicinity of the Aerodrome
RT (or R/T)	Radio Telephone or Radiotelephony
RTS	Real-Time Simulation
s	seconds
S-PWS	Static Pair Wise Separation
S-PWS-A	Static Pair Wise Separation for Arrivals

SAC	Safety Criteria
SAR	Safety Assessment Report
SBT	Shared Business Trajectory
SecAR	Security Assessment Report
SESAR	Single European Sky ATM Research Programme
SESAR 1	SESAR from 2010 to 2016
SESAR 2020	SESAR from 2016 (to 2020)
SID	Standard Instrument Departure
SJU	SESAR Joint Undertaking
SMT	Shared Mission Trajectory
SPR	Safety and Performance Requirements
SSR	Secondary Surveillance Radar
STAR	Standard Terminal Arrival Route
SWIM	System Wide Information Model
TAS	True Air Speed
TB	Time Based
TBA	To be added
TBD	To be determined
TBS	Time Based Separation
TBS-A	Time Based Separation for Arrivals
TDI	Target Distance Indicator
TIS-B	Traffic Information Services - Broadcast
TOBT	Target Off Blocks Time
TMA	Terminal Manoeuvring Area
TS	Technical Specification
TSAT	Target Start-up Approval Time
TT	Target Time
TTOT	Target Take-Off Time
UTC	Universal Coordinated Time
V APP	Approach Speed
VCR	Visual Control Room
VOR	VHF Omnidirectional Range
V_R	Rotation Speed (for Take Off)

WDS	Weather Dependent Separation
WDS-A	Weather Dependent Separation for Arrivals
WDS-D	Weather Dependent Separation for Departures
WT	Wake Turbulence
WTE	Wake Turbulence Encounter
WVE	Wake Vortex Encounter

Table 2: Acronyms and terminology

3 SESAR Solution Impacts on Architecture

3.1 Target Solution Architecture

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

- AO-0329: Optimised Separation Delivery for Departure.
- AO-0323: Wake Turbulence Separations (for Departures) based on Static Aircraft Characteristics;
- AO-0304: Weather-Dependent Reductions of Wake Turbulence Separations for Departures;

3.1.1 SESAR Solution(s) Overview

PJ.02-01-06: WTS (for Departures) based on Static Aircraft Characteristics

PJ.02-01-06 Solution aims to optimise wake turbulence separation minima for departures to enhance airport runway throughput. It focuses on development of:

- Wake turbulence separations based on static aircraft characteristics and weather dependent reductions;
- Separation delivery support tools for ATCOs.

OI Step	OI description	Open CR
AO-0304	Weather-Dependent Reductions of Wake Turbulence Separations for Departures	CR 03427 Update AO-0304 (PJ.02-01)
EN code	EN description	Open CR
A/C-47	On-board management of meteorological data from on-board sensors for sharing and integration by ATM and ATM-MET systems	
A/C-48a	Air broadcast of aircraft position/vector (ADS-B OUT) compliant with DO260B	
METEO-03	Provision and monitoring of real-time airport weather information (PCP)	
METEO-04b	Generate and provide MET information services relevant for Airport and final approach related operations (PCP)	
METEO-05b	Generate and provide MET information relevant for TMA and En-route related operations (PCP)	

	SWIM-APS-07a	Stakeholder systems consumption of G/G Meteorological Information services	
	AERODROME-ATC-60	Airport ATC system to monitor wake turbulence risk using ground-based LIDAR/Radar	CR 02027 Unset AERODROME-ATC-60 V3 date (PJ.02-01)
	AERODROME-ATC-19	Runway Usage Management sub-system capable of processing initial departure path wind conditions information	CR 03241 Update AERODROME-ATC-19 links to EATMA (AO-0304 - PJ.02-01)
	APP ATC 99	ATC System to use Real-Time Meteo Information Received From Met Systems	CR 03424 Update APP ATC 99 (PJ.02-01)
	PJ.02-01	Wake Turbulence Separation Optimization	CR 03504 Amend PJ.02-01 Solution description
	AO-0323	Wake Turbulence Separations (for Departures) based on Static Aircraft Characteristics	CR 03477 Update AO-0323 (PJ.02-01)
	EN code	EN description	Open CR
	AERODROME-ATC-60	Airport ATC system to monitor wake turbulence risk using ground-based LIDAR/Radar	CR 02027 Unset AERODROME-ATC-60 V3 date (PJ.02-01)
	PJ.02-W2-14	Evolution of separation minima for increased runway throughput	CR 02992 Set OI list for PJ02-W2-14
	PJ.02-01	Wake Turbulence Separation Optimization	CR 03504 Amend PJ.02-01 Solution description
	AERODROME-ATC-42b	Airport ATC tool to support static pair-wise wake separation (S-PWS) for departure operations	CR 03519 Create AERODROME-ATC-42b (PJ.02-01)
	REG-0523	Regulatory provisions (AMC) for static pair-wise wake separation minima (S-PWS)	CR 03520 Update REG-0523 (PJ.02-01)
	AO-0329	Optimised Separation Delivery for Departure	CR 03433 Update AO-0329 (PJ.02-01)
	EN code	EN description	Open CR
	A/C-37a	Downlink of trajectory data according to contract terms (ADS-C) compliant to ATN baseline 2 (FANS 3/C)	
	A/C-47	On-board management of meteorological data from on-board sensors for sharing and integration by ATM and ATM-MET systems	

METEO-03	Provision and monitoring of real-time airport weather information (PCP)	
METEO-04b	Generate and provide MET information services relevant for Airport and final approach related operations (PCP)	
METEO-05b	Generate and provide MET information relevant for TMA and En-route related operations (PCP)	
SWIM-APS-07a	Stakeholder systems consumption of G/G Meteorological Information services	
AERODROME-ATC-69	ATC system to support optimised departure separation	CR 03243 Update AERODROME-ATC-69 (AO-0329 - PJ.02-01)
AERODROME-ATC-55	Aerodrome ATC System to support Optimised Runway Delivery on Final Approach based on Aircraft ROT categorisation	CR 03413 Update AERODROME-ATC-55 (PJ.02-01- PJ02-08)
AERODROME-ATC-93	Aerodrome ATC system to support optimised runway separation delivery in mixed mode operations	CR 03436 Update AERODROME-ATC-93 (AO-0329 - PJ.02-01)
PJ.02-01	Wake Turbulence Separation Optimization	CR 03504 Amend PJ.02-01 Solution description

Table 3 : SESAR Solution Overview

The main FBs impacted by this SESAR Solution are the Departure Separation Management, Operational Supervision Aerodrome ATC and Controller Human Machine Interaction Management Aerodrome ATC.

SESAR Solution ID and Title	Functional Blocks/Role impacted by the SESAR Solution (from EATMA)	Enabler ID (from EATMA)	Enabler Title (from EATMA)	Enabler coverage
PJ.02-01-06: WTS (for Departures) based on Static Aircraft Characteristics	Departure Separation Management	AERODROME-ATC-19	Runway Usage Management sub-system capable of processing initial departure path wind conditions information	Fully
	Controller Human Machine Interaction Management Aerodrome ATC			
	Operational Supervision Aerodrome ATC			

Departure Separation Management	AERODROME-ATC-42a	Airport ATC Runway Usage Management sub-system enhanced for processing static wake-turbulence information	Fully
Departure Separation Management	AERODROME-ATC-69	ATC system to support optimised departure separation	Fully
Controller Human Machine Interaction Management Aerodrome ATC			

Table 4: SESAR Solution PJ.02-01-06 Scope and related Functional Blocks/roles & Enablers for Departures

Mainly, the roles impacted on this solution are the Tower controllers (Tower Runway Controller and Airport Tower Supervisor) and the Flight Crew:

- Airport Tower Supervisor:** Responsible for ensuring the duty runways-in-use information, and the separation policy information, and planned changes to these, is available, set up, and maintained consistently in the Separation Delivery ATC tool support for Tower ATC (e.g. A-CDM System & DMAN System).

Responsible for ensuring runway conditions, and planned and forecast changes to the runway conditions, are reflected in the separation policy information.

Is aware of the wind conditions, and for determining and deciding on the application (if required) of the departures separations solutions concepts (PWS-D, WDS-D) in consultation with the TMA Supervisor or TMA Planner Controller, and the TMA Departure Radar Controller.

Responsible for ensuring that flight crew are informed of the application of WDS (departures), for example, through D-ATIS.

- Tower Runway Controller:** Responsible for employing the efficient departure wake separations for enabling the safe and efficient flow of departure traffic.

Uses the Separation Delivery ATC tool support to determine and provide for the safe and efficient flow of departure traffic.

Informs departure aircraft when the WDS (departure) concept is being employed.

Monitors safe separations and the efficient spacing and sequence for departures when using the reduction of WT separations.

Receives, from different sources, and disseminates to the flight deck, critical WT and weather information, when needed.

- Flight Crew:** Is aware of the applicable concept (PWS-D, WDS-D) in operation and the impact on the time separation and/or distance separation minima set up on climb out on the initial departure path.

Is informed of when the applicable concept (PWS-D, WDS-D) is being employed on climb-out on the initial departure path, for example, through D-ATIS.

Reports critical weather and WT information to ATC.

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

Enabler	Opt/Req	Deviation
A/C-47_On-board management of meteorological data from on-board sensors for sharing and integration by ATM and ATM-MET systems	Optional	
A/C-48a_Air broadcast of aircraft position/vector (ADS-B OUT) compliant with DO260B	Optional	
METEO-03_Provision and monitoring of real-time airport weather information (PCP)	Required	
METEO-04b_Generate and provide MET information services relevant for Airport and final approach related operations (PCP)	Required	
METEO-05b_Generate and provide MET information relevant for TMA and En-route related operations (PCP)	Optional	
SWIM-APS-07a_Stakeholder systems consumption of G/G Meteorological Information services	Optional	
AERODROME-ATC-60_Airport ATC system to monitor wake turbulence risk using ground-based LIDAR/Radar	Optional	
AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information	Required	
APP ATC 99_ATC System to use Real-Time Meteo Information Received From Met Systems	Required	
PJ.02-01_Wake Turbulence Separation Optimization	Required	
APP ATC 118_ATC System to support static pair-wise wake separation (S-PWS) on approach	Required	
AERODROME-ATC-60_Airport ATC system to monitor wake turbulence risk using ground-based LIDAR/Radar	Optional	
PJ.02-W2-14_Evolution of separation minima for increased runway throughput	Required	
AERODROME-ATC-42a_Airport ATC tool to support static pair-wise wake separation (S-PWS) in final approach	Required	
PJ.02-01_Wake Turbulence Separation Optimization	Required	
REG-0523_Regulatory provisions (AMC) for static pair-wise wake separation minima (S-PWS)	Required	
A/C-47_On-board management of meteorological data from on-board sensors for sharing and integration by ATM and ATM-MET systems	Optional	

APP ATC 74_ATC System Support for Reduced, Weather-Dependent Separation Standards in Final Approach	Required	
METEO-03_Provision and monitoring of real-time airport weather information (PCP)	Required	
METEO-04b_Generate and provide MET information services relevant for Airport and final approach related operations (PCP)	Required	
METEO-05b_Generate and provide MET information relevant for TMA and En-route related operations (PCP)	Required	
SWIM-APS-07a_Stakeholder systems consumption of G/G Meteorological Information services	Optional	
AERODROME-ATC-60_Airport ATC system to monitor wake turbulence risk using ground-based LIDAR/Radar	Optional	
APP ATC 99_ATC System to use Real-Time Meteo Information Received From Met Systems	Required	
PJ.02-01_Wake Turbulence Separation Optimization	Required	
AERODROME-ATC-60_Airport ATC system to monitor wake turbulence risk using ground-based LIDAR/Radar	Optional	
PJ.02-W2-14_Evolution of separation minima for increased runway throughput	Required	
PJ.02-01_Wake Turbulence Separation Optimization	Required	
AERODROME-ATC-42b_Airport ATC tool to support static pair-wise wake separation (S-PWS) for departure operations	Required	
REG-0523_Regulatory provisions (AMC) for static pair-wise wake separation minima (S-PWS)	Required	
PJ.02-01_Wake Turbulence Separation Optimization	Required	
A/C-48a_Air broadcast of aircraft position/vector (ADS-B OUT) compliant with DO260B	Required	
AERODROME-ATC-60_Airport ATC system to monitor wake turbulence risk using ground-based LIDAR/Radar	Optional	
PJ.02-01_Wake Turbulence Separation Optimization	Required	
A/C-48b_Air broadcast of aircraft data (ADS-B OUT) compliant with new DO260C standard	Required	
A/C-47_On-board management of meteorological data from on-board sensors for sharing and integration by ATM and ATM-MET systems	Optional	
AERODROME-ATC-17_Airport ATC tool to Support Time-Based Separation in Final Approach	Optional	
APP ATC 156_ATC System to Support Time-Based Separation in Final Approach	Optional	

METEO-03_Provision and monitoring of real-time airport weather information (PCP)	Required	
METEO-04b_Generate and provide MET information services relevant for Airport and final approach related operations (PCP)	Required	
SWIM-APS-07a_Stakeholder systems consumption of G/G Meteorological Information services	Optional	
AERODROME-ATC-55_Aerodrome ATC System to support Optimised Runway Delivery on Final Approach based on Aircraft ROT categorisation	Required	
APP ATC 99_ATC System to use Real-Time Meteo Information Received From Met Systems	Required	
PJ.02-01_Wake Turbulence Separation Optimization	Required	
APP ATC 169_Approach ATC System to support Optimised Runway Delivery on Approach based on Aircraft ROT categorisation	Optional	
STD-093_EUROCONTROL Guidelines for Optimised Runway Delivery	Required	
A/C-37a_Downlink of trajectory data according to contract terms (ADS-C) compliant to ATN baseline 2 (FANS 3/C)	Optional	
A/C-47_On-board management of meteorological data from on-board sensors for sharing and integration by ATM and ATM-MET systems	Optional	
METEO-03_Provision and monitoring of real-time airport weather information (PCP)	Required	
METEO-04b_Generate and provide MET information services relevant for Airport and final approach related operations (PCP)	Required	
METEO-05b_Generate and provide MET information relevant for TMA and En-route related operations (PCP)	Optional	
SWIM-APS-07a_Stakeholder systems consumption of G/G Meteorological Information services	Optional	
AERODROME-ATC-69_ATC system to support optimised departure separation	Required	
AERODROME-ATC-55_Aerodrome ATC System to support Optimised Runway Delivery on Final Approach based on Aircraft ROT categorisation	Required	
AERODROME-ATC-93_Aerodrome ATC system to support optimised runway separation delivery in mixed mode operations	Optional	
PJ.02-01_Wake Turbulence Separation Optimization	Required	

Table 5 : Deviations from SESAR Solution

3.1.1.2 Relevant Use Cases

This section lists and describes the relevant operational Use cases covered in this solution

Operational Case	Use Case	Description
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[NOV-5][MIX-01]
Airport Operational Scenario Planning Phase for PWS, WDS and ORD for Arrivals - Mixed Mode (ORD, PWS-A, WDS-A)

This Use Case takes place in the planning or tactical execution phase. It describes the coordination workflow and exchanges between ATC Supervisors (Tower and Approach) and Controllers when a scenario change is detected.

The following scenarios change are identified:

- Mix Mode of operations, applying tactical or planned specific scenario spacing (GAP management)
- Degraded mode of operations, where the ATCO Separation Delivery Tool or supporting services like GWCS are no longer suitable for operations.

Other specific non-nominal/alternative flows in addition to the cases mentioned above (e.g. planned or unplanned change of runway in-use) are detailed in the SESAR1 OFA01.03.01 Enhanced Runway Throughput OSED.

The use case starts when the Tower or Approach Supervisor identifies the need for a change in the scenario. The nominal flow ends when the new scenario is implemented.

General Conditions (Scope and Summary)

Approach and Tower Controllers make use of ORD and related SESAR1 and SESAR2020 concepts (e.g. TBS-A, PWS-A) as described in [NOV-5] [ARR-02].

Approach and Tower Supervisors put in place a coordination process that can lead to the following scenarios change:

- Mix Mode of operations, applying tactical or planned specific scenario spacing (GAP management)
- Degraded mode of operations, where the ATCO Separation Delivery Tool or supporting services like GWCS are no longer suitable for operations.

Pre Conditions

The Separation Delivery tool and all applicable alerting / monitoring tools are operational.

The GWCS is operational.

The Approach Arrival Sequence Service is operational.

Post Conditions

Post conditions are depending on the change scenario implemented:

- Mix Mode
The Approach and Tower Supervisors have coordinated the application of specific scenario spacing.
- Degraded Mode

	<p>The Approach and Tower Supervisors have coordinated the reversion to DBS with or without TDI.</p> <p>The Separation Delivery tool and/or all applicable alerting / monitoring tools and/or GWCS and/or Approach Arrival Sequence Service are no longer operational.</p> <p>For all the scenarios changes an updated flow of arrival aircraft for the aerodrome into the TMA is established. The new flow matches the runway capacity in the prevailing operating conditions.</p>
<p>[NOV-5][MIX-02] Airport Operational Scenario Execution Phase for PWS, WDS and ORD for Arrivals - Mixed Mode (ORD, PWS-A, WDS-A)</p>	<p>This use case takes place in the execution phase. It describes the operational flow involved in sequencing and delivering arrival aircraft on the approach phase with an Optimised Runway Delivery (ORD) Separation tool and the applicable SESAR1 and SESAR2020 concepts (e.g. TBS, PWS-A, and /or WDS-A) including additional specific spacing requests previously coordinated by Approach and Tower Supervisors in the [NOV-5][MIX-01] Use Case.</p> <p>Spacing requests are called GAP in the Use Case.</p> <p>The use case starts when the flight enters the TDI Area (taking into account that the Flight Deck has prepared and briefed the approach at the end of cruise). The nominal flow ends when the aircraft has landed.</p> <p>General Conditions (Scope and Summary)</p> <p>As per [NOV-5][ARR-02].</p> <p>Pre Conditions</p> <p>As per [NOV-5][ARR-02]</p> <p>In addition the Approach and Tower Supervisors have coordinated the provision of scenario specific spacing (GAP) between two or more aircraft and they agreed on the position in the sequence (see [NOV-5][MIX-01]).</p> <p>Post Conditions</p> <p>The arrival aircraft after the spacing has landed and vacated the runway.</p> <p>The aircraft(s) planned for departure within the arrival sequence has been cleared for take-off</p>
<p>[NOV-5][DEP-01] Airport Operational Scenario Execution Phase for Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PWS-</p>	<p>General Conditions (Scope and Summary)</p> <p>This Use Case describes in detail the steps involved for the Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PWS-D) and Weather Dependent Separation for Departures (WDS-D)</p> <p>Pre Conditions</p>

<p>D) and Weather Dependent Separation for Departures (WDS-D)</p>	<p>The OSD or Enhanced OSD system support is deployed and available for supporting PWS-D and WDS-D respectively.</p> <p>The OSD or Enhanced OSD system support is configured to support applying PWS-D and WDS-D respectively and optionally SID route separations and possibly MDI and ADI dependent on local requirements.</p> <p>The OSD or Enhanced OSD system support is being provided with the high integrity departure sequence take-off order on the runway.</p> <p>The OSD or Enhanced OSD system support is being provided with the ““airborne time”” or the ““start of take-off roll time”” for each departure aircraft dependent on local procedures.</p> <p>The OSD or Enhanced OSD system support is being provided with high integrity aircraft type and wake category information for each departure aircraft.</p> <p>The OSD or Enhanced OSD system support is being provided with high integrity SID route information for each departure aircraft.</p> <p>The OSD or Enhanced OSD system support is being informed of departure aircraft taking off from an intermediate position.</p> <p>The OSD or Enhanced OSD system support, dependent on local procedures, is being informed of departure aircraft requesting that the RECAT-EU or the ICAO wake separation be applied.</p> <p>In the local case of supporting distance-based separation for departures, the required wind conditions service over each of the SID routes from the initial airborne positions to the maximum ““Required Minimum Distance Spacing”” is deployed and available for supporting the calculation of the position of the ““Required Minimum Distance Spacing Arc”” by the OSD or Enhanced OSD system support.</p> <p>The A-CDM System and DMAN System have been configured to take into account the PWS-D and WDS-D wake separation rules that are being applied so that an appropriate pressure of departure aircraft with an appropriately optimised departure sequence order is delivered to the departure holding points for the departure runway-in-use.</p> <p>The Flight Crew have been informed that the PWS-D and WDS-D wake separation rules are being applied and have been fully briefed and aware of the PWS-D and WDS-D wake separation rules.</p> <p>Post Conditions</p> <p>The departure aircraft has been delivered with optimised separation to the TMA Departure Radar Controller.</p> <p>Actors</p>
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	<p>Tower Runway Controller, Flight Crew, TMA Departure Radar Controller.</p> <p>Trigger</p> <p>Departure aircraft at or approaching the runway holding points, and have contacted the Tower Runway Controller.</p>
<p>[NOV-5][DEP-02] Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)</p>	<p>General Conditions (Scope and Summary)</p> <p>This Use Case describes in detail the steps involved for transitioning to and from Weather Dependent Separation for Departures (WDS-D).</p> <p>Pre Conditions</p> <p>The WDS-D system support is deployed and available for supporting WDS-D.</p> <p>The required wind conditions service over the straight-out initial departure path from becoming airborne to the first SID turn is deployed and available for supporting WDS-D for each departure runway.</p> <p>The Tower Supervisor and Approach Supervisor have coordinated tactically about departure rates when WDS-D reduced wake separations can be applied.</p> <p>The Tower Supervisor and Tower Runway Controller have coordinated when WDS-D reduced wake separations are to be applied taking into account the wind information.</p> <p>The Flight Crew are aware of the operation of the WDS-D reduction of wake turbulence separations, and have been fully briefed and aware of the WDS-D wake separation rules.</p> <p>Post Conditions</p> <p>The WDS-D system support has correctly indicated whether the WDS reduced wake separations can be applied.</p> <p>Actors</p> <p>Tower Supervisor, Tower Runway Controller, Flight Crew, TMA Departure Radar Controller, Approach Supervisor.</p> <p>Trigger</p> <p>The wind condition information over the initial departure path for the departures runway is available for determining whether or not the WDS-D reduced wake separations can be applied.</p>

Table 6: Relevant Use Cases – NOVs

System Process	Description
[NSV-4][ARR/MIX-01] Airport Operational Scenario Planning Phase for PWS, WDS and ORD for Arrivals or Mix-mode (ORD, PWS-A, WDS-A)	
[NSV-4][DEP-01] Airport Operational Scenario Execution Phase for Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PWS-D) and Weather Dependent Separation for Departures (WDS-D)	This NSV-4 reflects the Use Case [DEP-01] Airport Operational Scenario Execution Phase for Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PWS-D) and Weather Dependent Separation for Departures (WDS-D).
[NSV-4][DEP-02] Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)	This diagram reflects the technical layer of the Use Case [DEP-02] Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)
[NSV-4][MIX-02] Airport Operational Scenario Execution Phase for PWS, WDS and ORD for Arrivals - Mixed Mode (ORD, PWS-A, WDS-A)	

Table 7: Relevant Use Cases - NSVs

A technical architecture has been developed in order to cover the following use cases mentioned in the SPR-INTEROP/OSED[40].

[NOV-5] [DEP-01] / Airport Operational Scenario Execution Phase for Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PWS-D) and Weather Dependent Separation for Departures (WDS-D)
[NOV-5] [DEP-02] / Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)

With the two following Technical Use Cases, all the relevant operational Use Cases are covered:

[NSV-4][DEP-01] Airport Operational Scenario Execution Phase for Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PWS-D) and Weather Dependent Separation for Departures (WDS-D)

The system process for the Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PWS-D) and Weather Dependent Separation for Departures (WDS-D) is described.

The preconditions are the following:

- The OSD or Enhanced OSD system support is deployed and available for supporting PWS-D and WDS-D respectively.
- The OSD or Enhanced OSD system support is configured to support applying PWS-D and WDS-D respectively and optionally SID route separations and possibly MDI and ADI dependent on local requirements.

- The OSD or Enhanced OSD system support is being provided with the high integrity departure sequence take-off order on the runway.
- The OSD or Enhanced OSD system support is being provided with the “airborne time” or the “start of take-off roll time” for each departure aircraft dependent on local procedures.
- The OSD or Enhanced OSD system support is being provided with high integrity aircraft type and wake category information for each departure aircraft.
- The OSD or Enhanced OSD system support is being provided with high integrity SID route information for each departure aircraft.
- The OSD or Enhanced OSD system support is being informed of departure aircraft taking off from an intermediate position.
- The OSD or Enhanced OSD system support, dependent on local procedures, is being informed of departure aircraft requesting that the RECAT-EU or the ICAO wake separation be applied.
- In the local case of supporting distance-based separation for departures, the required wind conditions service over each of the SID routes from the initial airborne positions to the maximum “Required Minimum Distance Spacing” is deployed and available for supporting the calculation of the position of the “Required Minimum Distance Spacing Arc” by the OSD or Enhanced OSD system support.
- The A-CDM System and DMAN System have been configured to take into account the PWS-D and WDS-D wake separation rules that are being applied so that an appropriate pressure of departure aircraft with an appropriately optimised departure sequence order is delivered to the departure holding points for the departure runway-in-use.
- The Flight Crew have been informed of the PWS-D and WDS-D wake separation rules are being applied and have been fully briefed and aware of the PWS-D and WDS-D wake separation rules.

The triggering event for the process is the giving of the line-up clearance to the next aircraft. Depending on the local procedures, either the clearance is given to the next aircraft in the sequence, or when the departure clearance is issued with the line-up clearance, it is added to the departure take-off sequence.

Once the departure aircraft is issued with the line-up clearance, the OSD tool calculates the separation with respect to the lead aircraft that is required to be delivered, either in terms of time or distance, depending on the mode that is being applied.

The local procedures determine both the local wake separation procedures and the associated local controller workstation positions support and local surveillance based automatic monitoring support.

The local wake separation procedures determine what event information is required by the OSD tool:

- ‘Airborne Time’ wake separation procedures require notification of ‘Airborne Time’ of the preceding departure aircraft to enable OSD calculation of the NBAT for the follower departure aircraft. Notification of the ‘Start of Take-Off Roll’ of the preceding departure aircraft may also be required to inform the OSD tool of when to start calculating the wake separation time to the follower departure aircraft.

- ‘Take-Off Roll Time’ wake separation procedures require notification of the ‘Start of Take-Off Roll Time’ of the preceding departure aircraft to enable OSD calculation of the NBTOT for the follower departure aircraft
- All wake separation procedures (Time and Distance) require notification of when a departure aircraft is populated into the departure take-off sequence in order for the OSD tool to start the consideration of when to start calculating the wake separation and associated support to be provided to the departure runway controller.

The associated local controller workstation support determines whether the event information is provided from the electronic environment actions of the departure runway controller; for example when the departure aircraft electronic flight progress strip is moved to the runway bay when issued clearance to line-up and moved to the airborne bay when visually confirmed as airborne.

The associated local surveillance based automatic monitoring support determines whether there is automatic monitoring for when each departure aircraft begins to line-up and the associated line-up position, when each departure aircraft commences their start of take-off roll, and when each departure aircraft becomes airborne.

For the calculation of the separation, the OSD tool takes into account both aircraft types (leader and follower), the corresponding wake separation, SID separation, Minimum Radar Separation and any other separation that could be constraining.

The OSD tool considers the most restrictive separation amongst the ones aforementioned and calculates either the preceding aircraft earliest position to issue the take-off clearance (which is shown as a DDI-D) or the earliest take-off clearance time (which could be shown as the NBAT or the NBTOT).

The Tower Runway Controller is provided with this information and waits until:

- The preceding aircraft passes the earliest distance position DDI-D (in distance mode), or;
- The earliest take-off time passes (in time mode)
 - o NBTOT is achieved
 - o (NBAT – Anticipated Take-Off Roll Time) is achieved

Once the take-off clearance has been issued, the Tower Runway Controller monitors and record the roll time, the aircraft becoming airborne and transfers the flight to the TMA Departure Controller.

[NSV-4][DEP-02] Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)

The steps involved for transitioning to and from Weather Dependent Separation for Departures (WDS-D) are described.

The preconditions are the following:

- The WDS-D system support is deployed and available for supporting WDS-D.
- The required wind conditions service over the straight-out initial departure path from becoming airborne to the first SID turns is deployed and available for supporting WDS-D for each departure runway.
- The Tower Supervisor and Approach Supervisor have coordinated tactically about departure rates when WDS-D reduced wake separations can be applied.

- The Tower Supervisor and Tower Runway Controller have coordinated when WDS-D reduced wake separations are to be applied taking into account the wind information.
- The Flight Crew are aware of the operation of the WDS-D reduction of wake turbulence separations, and have been fully briefed and aware of the WDS-D wake separation rules.

The wind data are provided by Aerodrome ATM-MET to the system through service MET for WTS created by PJ.18-04b. The data consists presumably of wind speed and direction. The OSD tool assesses whether the wind is above or below predefined thresholds, in other words, if conditions are sufficient to apply the WDS-D Xw concept reduced wake separation.

- The OSD tool proposes the activation of WDS-D Xw mode in case the wind conditions are sufficient and the mode is not active. The Tower Supervisor assesses the proposal and decides whether to switch the mode status to active or not. If rated so, the Supervisor authorises the WDS-D mode and the OSD tool takes into account WDS-D rules.
- The OSD tool de-activates the WDS-D Xw mode in case it detects that the wind conditions have fallen under thresholds and the reduced separations are no longer applicable. Controllers are hence de-authorised to use the WDS-D mode.
- The OSD tool does not change the WDS-D mode status if conditions remain the same as they were in terms of WDS-D Xw concept reduced wake separations applicability.

Controllers are always informed about the WDS-D status in order to maintain situation awareness.

3.1.1.3 Trace Relevant UC and Technical Models

Table hereunder show the trace of the Technical Use cases developed in the validation against the Operational Use Cases from PJ.02-01-06 SPR/INTEROP-OSED[40].

Operational Use Case	Related Technical Model
[NOV-5] [DEP-01] Airport Operational Scenario Execution Phase for Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PWS-D) and Weather Dependent Separation for Departures (WDS-D)	[NSV-4] [DEP-01] Airport Operational Scenario Execution Phase for Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PWS-D) and Weather Dependent Separation for Departures (WDS-D)
[NOV-5] [DEP-02] Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)	[NSV-4] [DEP-02] Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)

Table 8 : Trace Relevant Operational UC and Technical Models for Departures

3.1.2 Capability Configurations required for the SESAR Solution

SESAR Solution ID and Title	Capability Configurations (CCs)	Sub-Operating Environment(s) where the CCs operate	Capabilities (from EATMA)	Nodes (from EATMA)	Stakeholders (from EATMA)
PJ.02-01-06: WTS (for Departures) based on Static Aircraft Characteristics	TWR	TMA High Complexity TMA Medium Complexity	Separation Provision Spacing	Aerodrome ATS	ANSPs
	Civil Aircraft	Airport High Utilisation Complex Layout Airport High Utilisation Simple Layout	Meteorological Information Provision	Flight Deck	Airspace Users

Table 9: List of Capability Configurations required for the SESAR Solution PJ.02-01-06 Departures

Aerodrome ATM-MET (PJ.18-04b) CC is not directly impacted by the SESAR Solution, but is responsible for providing the MET for WTS service to TWR CC.

3.2 Changes imposed by the SESAR Solution on the baseline Architecture

In the table below, list the Capability Configurations (CCs) required by the SESAR Solution, the relevant (sub)-Operating Environments where the CCs operate, and the links between CCs and Capabilities, Nodes and Stakeholders.

Enabler	Element type	Element name	Impact	Change
APP ATC 118 (CR)	ATC System to support static pair-wise wake separation (S-PWS) on approach			
	Function	Compute TDI	Update	
	Function	Display Approach applicable separation	Update	
	Function	Display TDI	Update	
	Function	Manage Inputs	Update	
	Function	Record Inputs	Update	
	Function	Support Traffic Separation	Update	
AERODRO	Runway Usage Management sub-system capable of processing initial departure path wind conditions information			

ME-ATC-19 (CR)				
	Function	Assess WDS-D Status	Introduce	
	Function	Assess Wind	Update	
	Function	Authorise WDS-D	Introduce	
	Function	De-authorise WDS-D	Introduce	
	Function	Deactivate WDS-D	Introduce	
	Function	Display WDS-D Activation Proposal	Introduce	
	Function	Display WDS-D Status	Introduce	
	Function	Display Wind Conditions	Update	
	Function	Propose WDS-D Application	Introduce	
	Function	Receive WDS-D Authorisation/De-authorisation	Introduce	
AERODRO ME-ATC-42a (CR)	Airport ATC tool to support static pair-wise wake separation (S-PWS) in final approach			
	Function	Display applicable separation	Update	
	Function	Support Final Approach Traffic Spacing	Update	
AERODRO ME-ATC-69 (CR)	ATC system to support optimised departure separation			
	Function	Apply WDS-D mode	Introduce	
	Function	Calculate DDI-D for the SID Separation and MRS (if these are supported)	Introduce	
	Function	Calculate NBAT (for the WST)	Introduce	
	Function	Calculate NBAT for the SID Separation and MRS (if these are supported)	Introduce	
	Function	Calculate NBTOT (for the WST)	Introduce	
	Function	Calculate NBTOT for the SID Separation and MRS (if these are supported)	Introduce	
	Function	Determine the Largest DDI-D	Introduce	
	Function	Determine the Largest NBAT	Introduce	
	Function	Determine the Largest NBTOT	Introduce	

	Function	Display WSD and DDI-D Information	Introduce	
	Function	Display WST and NBAT/NBTOT Information	Introduce	
	Function	Not Apply WDS-D Mode	Introduce	
APP ATC 99 (CR)	ATC System to use Real-Time Meteo Information Received From Met Systems			
	Function	Compute TDI	Update	
	Function	Display Wind Conditions	Introduce	
	Function	Manage Inputs	Update	
	Function	Record Inputs	Update	
	Function	Support Traffic Separation	Update	
AERODROME-ATC-42b (CR)	Airport ATC tool to support static pair-wise wake separation (S-PWS) for departure operations			
	FB	Departure Separation Management (PJ.02-01)	Introduce	This FB computes the applicable separation between departures according to a Static Pair-Wise separation scheme.
	Function	Display WSD and DDI-D Information	Introduce	
	Function	Display WST and NBAT/NBTOT Information	Introduce	

Table 10 : Changes on the baseline PJ.02-01-06 Architecture

The table hereunder describes the changes imposed on Departure concepts

Enabler ID (from EATMA)	Enabler Title (from EATMA)	Changes
AERODROME-ATC-19 – Runway Usage Management sub-system capable of processing initial departure path wind conditions information	Departure Separation Management	Departure Separation Management is updated to perform the following Functions: <ul style="list-style-type: none"> - Assess Wind - Assess WDS-D Status - Propose WDS-D Application - Deactivate WDS-D - Receive WDS-D Authorisation/De-authorisation

	Operational Supervision Aerodrome ATC	Operational Supervision Aerodrome ATC is updated to perform the following Functions: <ul style="list-style-type: none"> - Display Wind Conditions - Display WDS-D Activation Proposal - De-authorise WDS-D - Authorise WDS-D - Display WDS-D Status - Receive WDS-D Status Update
	Controller Human Machine Interaction Management Aerodrome ATC	Controller Human Machine Interaction Management Aerodrome ATC is updated to perform the following Functions: <ul style="list-style-type: none"> - Display WDS-D Status
AERODROME-ATC-42a – Airport ATC Runway Usage Management sub-system enhanced for processing static wake-turbulence information		Proposal: change the use of WT separations to the execution phase (AMAN and DMAN), it doesn't make sense to use it in a 'Runway DCB' as the capacity of the Runway(s) is always a fix value. The sub-system doesn't calculate directly the capacity.
	Departure Separation Management	Departure Separation Management is updated to perform the following Functions: <ul style="list-style-type: none"> - Calculate NBTOT (for the WTS) - Calculate NBAT (for the WTS) - Calculate DDI-D Position (for the WSD)
AERODROME-ATC-69 – ATC system to support optimised departure separation	Departure Separation Management	Departure Separation Management is updated to perform the following Functions: <ul style="list-style-type: none"> - Calculate NBTOT (for the WTS) - Calculate NBAT (for the WTS) - Calculate DDI-D Position (for the WSD) - Calculate NBTOT for the SID Separation and MRS (if these are supported) - Calculate DDI-D for the SID Separation and MRS (if these are supported) - Calculate NBAT for the SID Separation and MRS (if these are supported) - Determine the Largest NBTOT - Determine the Largest DDI-D - Determine the Largest NBAT - Apply WDS-D Mode - Not Apply WDS-D Mode

	<p>Controller Human Machine Interaction Management Aerodrome ATC</p>	<p>Controller Human Machine Interaction Management Aerodrome ATC is updated to perform the following Functions:</p> <ul style="list-style-type: none"> - Display WST and NBAT/NBTOT Information - Display WSD and DDI-D Information
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Table 11 : List of changes due imposed related to Departure Concepts

4 Technical Specifications

4.1 Functional architecture overview

This section describes the new system method to achieve the WTS (for Departures) based on Static Aircraft Characteristics.

A functional architecture overview is provided for the different concepts of the WTS (for Departures) based on Static Aircraft Characteristics.

Role	Functional Block	Function
[NSV-4][ARR/MIX-01] Airport Operational Scenario Planning Phase for PWS, WDS and ORD for Arrivals or Mix-mode (ORD, PWS-A, WDS-A)		
ACC/Approach/TMA Supervisor (PJ.02-01-06)		Assess Operational Situation and Conditions at the Approach; Coordinate with Tower Supervisor; Switch to New Mode Operations in APP Control;
Airport Tower Supervisor (PJ.02-01-06)		Assess Operational Situation and Conditions at the Airport; Coordinate with Approach Supervisor; Switch to New Mode Operations in TWR Control;
	Operational Supervision Aerodrome ATC (PJ.02-01-06)	Display Wind Conditions;
	Operational Supervision ER/APP ATC (PJ.02-01-06)	Display Wind Conditions;
[NSV-4][MIX-02] Airport Operational Scenario Execution Phase for PWS, WDS and ORD for Arrivals - Mixed Mode (ORD, PWS-A, WDS-A)		
	Aerodrome Safety Nets	Aerodrome Safety Nets;
	Approach Traffic Separation (PJ.02-01-06)	Manage Inputs; Support Traffic Separation;
	Arrival Traffic Separation (PJ.02-01-06)	Support Final Approach Traffic Spacing;

ATC Executive Controller (PJ.02-01-06)		Identify Aircraft; Insert GAP Spacing; Monitor and separate traffic; Provide Approach Clearance; Transfer Flight;
	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)	Display applicable separation;
	Controller Human Machine Interaction Management ER/APP (PJ.02-01-06)	Display Approach applicable separation; Display TDI; Record Inputs; Release Flight;
	Coordination and Transfer	Coordination and Transfer;
	Legacy G/G Datalink Communications	Legacy G/G Datalink Communications;
	Safety Nets	Safety Nets;
Sequence Manager (Sequencer) (PJ.02-01-06)		Update Sequence;
Tower Runway Controller (PJ.02-01-06)		Assess Departures versus GAP Spacing; Hold Departing Aircraft; Line-up Departing Aircraft; Monitor Spacing during Final Approach; Provide Landing Clearance; Request Cancel GAP; Request New GAP Spacing and/or Position;
[NSV-4][DEP-01] Airport Operational Scenario Execution Phase for Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PWS-D) and Weather Dependent Separation for Departures (WDS-D)		
	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)	Display WSD and DDI-D Information; Display WST and NBAT/NBTOT Information;
	Departure Separation Management (PJ.02-01-06)	Calculate DDI-D for the SID Separation and MRS (if these are supported); Calculate DDI-D Position (for the WSD); Calculate NBAT (for the WST); Calculate NBAT for the SID Separation and MRS (if these are supported); Calculate NBTOT (for the WST);

		<p>Calculate NBTOT for the SID Separation and MRS (if these are supported); Clear Stale Displayed Information; Determine the Largest DDI-D; Determine the Largest NBAT; Determine the Largest NBTOT;</p>
Tower Runway Controller (PJ.02-01-06)		<p>Check DDI-D Position; Instruct Next Aircraft in the Sequence to Line-up; Issue Take-Off Clearance; Issue Transfer to TMA Departure Controller Clearance; Monitor and Record Roll Time; Monitor for Aircraft Becoming Airborne and Record Airborne Time; Receive NBAT/NBTOT Information;</p>
[NSV-4][DEP-02] Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)		
Airport Tower Supervisor (PJ.02-01-06)		<p>Assess WDS-D Activation; Authorise WDS-D Application;</p>
	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)	<p>Display WDS-D Status;</p>
	Departure Separation Management (PJ.02-01-06)	<p>Compute Separations with WDS-D De-activated; Apply WDS-D mode; Assess WDS-D Status; Assess WDS-D Status; Assess Wind; Deactivate WDS-D; Propose WDS-D Application; Receive WDS-D Authorisation/De-authorisation;</p>
	Operational Supervision Aerodrome ATC (PJ.02-01-06)	<p>Authorise WDS-D; De-authorise WDS-D; Display WDS-D Activation Proposal; Display WDS-D Status; Display Wind Conditions;</p>

		Receive WDS-D Status Update;
Tower Runway Controller (PJ.02-01-06)		Receive WDS-D Status;

Table 12: Summary of functional blocks

This functional breakdown is consistent with the latest applicable version of EATMA.

It describes the Functions needed to realise the Solution and provides a functional view of how the technical systems, functional block(s), system ports and roles that participate in realising the operational needs.

Some Functional Blocks within the domains impacted by the *WTS (for Departures) based on Static Aircraft Characteristics for Departures* concept are substantially impacted and will be addressed in detail in this document.

Controller Human Machine Interaction Management provides the controllers with a graphical user interface and with the means to interact with the aerodrome ATC system. CHMIM will provide the ATCO with the separation to be applied to each departure aircraft pair (either as a distance or as time), and will inform about the current mode in use, e.g. WDS-D Xw concept reduced separations mode active or not.

Departure Separation Management is in charge of managing the time or distance separations to be applied between two aircrafts for departure operations with the goal of increasing runway efficiency and throughput while maintaining safety levels. For the separations computation; aircraft types, meteorological information, new wake separations, minimum radar separation and SID constraints are taken into account.

Operational Supervision Aerodrome ATC allows the Supervisor to manage the most appropriate operational configuration, according to traffic demand and aerodrome needs, and to react in case of system fault, re-assigning and distributing available resources in order to maintain adequate safety levels and quality of service. It presents the current mode of separations that is being applied, as well as mode switch proposals depending on the conditions, e.g. WDS-D activation proposal when wind conditions are sufficient for the safe application. Operational Supervision allows the Tower Supervisor to authorise/de-authorise the application of WDS-D.

Some of the functional blocks will be impacted in a minor way only and will only be briefly addressed in this document.

A/G Voice Communication provides the A-G functions performed by a VCS, and the functions performed to handle ground ATS communication through various communication interfaces.

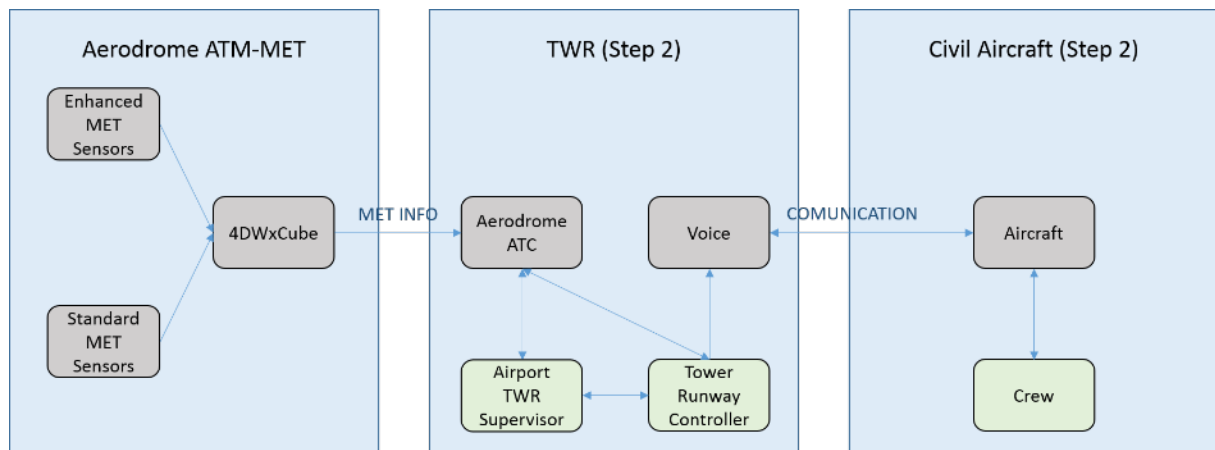


Figure 1: Overall architecture for PJ.02-01-06 - Departures

Capability Configuration	Technical System	Functional Block	Function
TWR	Aerodrome ATC	Departure Separation Management	Calculate NBTOT (for the WST); Calculate DDI-D Position (for the WST); Calculate NBAT (for the WST); Calculate NBTOT for the SID Separation and MRS (if these are supported); Calculate DDI-D for the SID Separation and MRS (if these are supported); Calculate NBAT for the SID Separation and MRS (if these are supported); Determine the Largest NBTOT; Determine the Largest DDI-D; Determine the Largest NBAT; Clear Stale Displayed Information and Reformulate Sequence; Assess Wind; Assess WDS-D Status; Propose WDS-D Application; Deactivate WDS-D; Receive WDS-D Authorisation/De-authorisation;

Capability Configuration	Technical System	Functional Block	Function
			Apply WDS-D Mode; Not Apply WDS-D Mode;
		Controller Human Machine Interaction Management Aerodrome ATC	Display WST and NBAT/NBTOT Information; Display WSD-D and DDI_D Information; Display WDS-D Status;
		Operational Supervision Aerodrome	Display Wind Conditions; Display WDS-D Activation Proposal; De-authorise WDS-D; Authorise WDS-D; Receive WDS-D Authorisation/De-authorisation; Display WDS-D Status;
	Voice	A/G Voice Communication	-
Civil Aircraft	-	-	-

Table 13 : Functional architecture overview for PJ.02-01-06 Departures concept

Capability Configuration	Role	Function	Related to FB
TWR	Tower Runway Controller	Instruct Next Aircraft to Line-up; Receive NBAT/NBTOT Information; Check DDI-D Position; Issue Take-Off Clearance; Monitor and Record Roll Time; Monitor for Aircraft Becoming Airborne and Record Airborne Time;	Departure Separation Management CHMIM Aerodrome ATC

Capability Configuration	Role	Function	Related to FB
		Issue Transfer to TMA Departure Controller Clearance; Receive WDS-D Status;	
	Airport Tower Supervisor	Assess WDS-D Activation; Authorise WDS-D Application;	Operational Supervision Aerodrome ATC
Civil Aircraft	Flight Crew	-	Voice

Table 14 : Roles involved in the PJ.02-01-06 Departures concept

4.1.1 Resource Connectivity view

The following diagrams represent the high-level interactions between the CCs involved. The Resource Connectivity for Solution PJ.02-01-06 : Arrivals and Departure concepts are described.

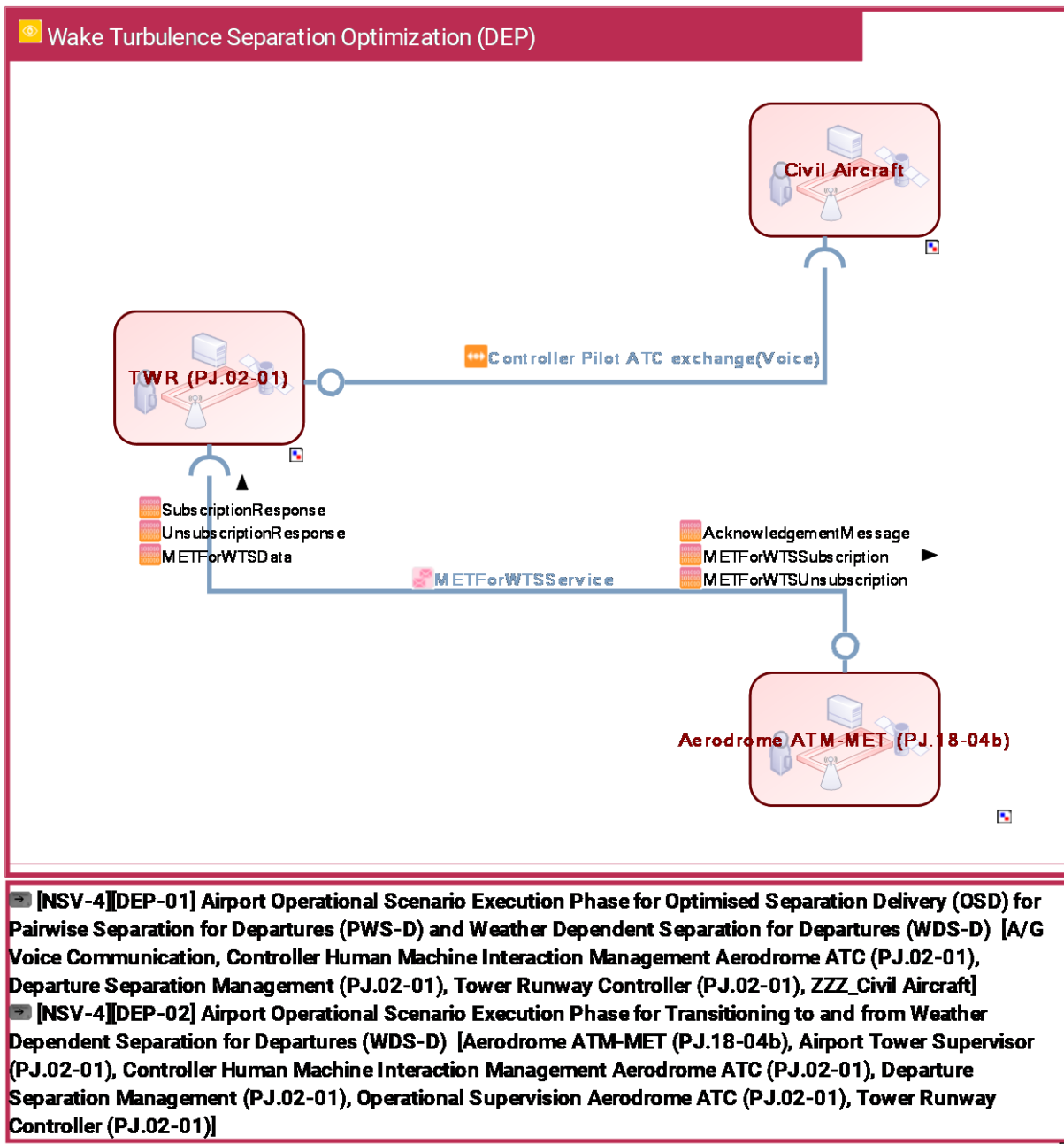


Figure 2: Resource connectivity for Departures

The high-level interactions between Capability Configurations are simple in this case, since the process and main interactions happen within the TWR CC.

METforWTS Service was created by PJ.18-04b. This Service intends to provide relevant MET data to the calculations computed by departures separation related FB within TWR CC. No other Services were created within PJ.02-01-06 framework.

4.1.2 Resource Infrastructure Connectivity view

This supporting infrastructure is the set of:

- Capability Configurations:
 - TWR
 - Civil Aircraft
 - Aerodrome ATM-MET (PJ.18-04b)
- Main Technical Systems
 - Aerodrome ATC
 - Voice
 - Aircraft
- System Ports:
 - ATC Voice Air
 - Voice Radio Air
 - ATC Voice Ground
 - Transport Secured AMQP
 - IP Ground

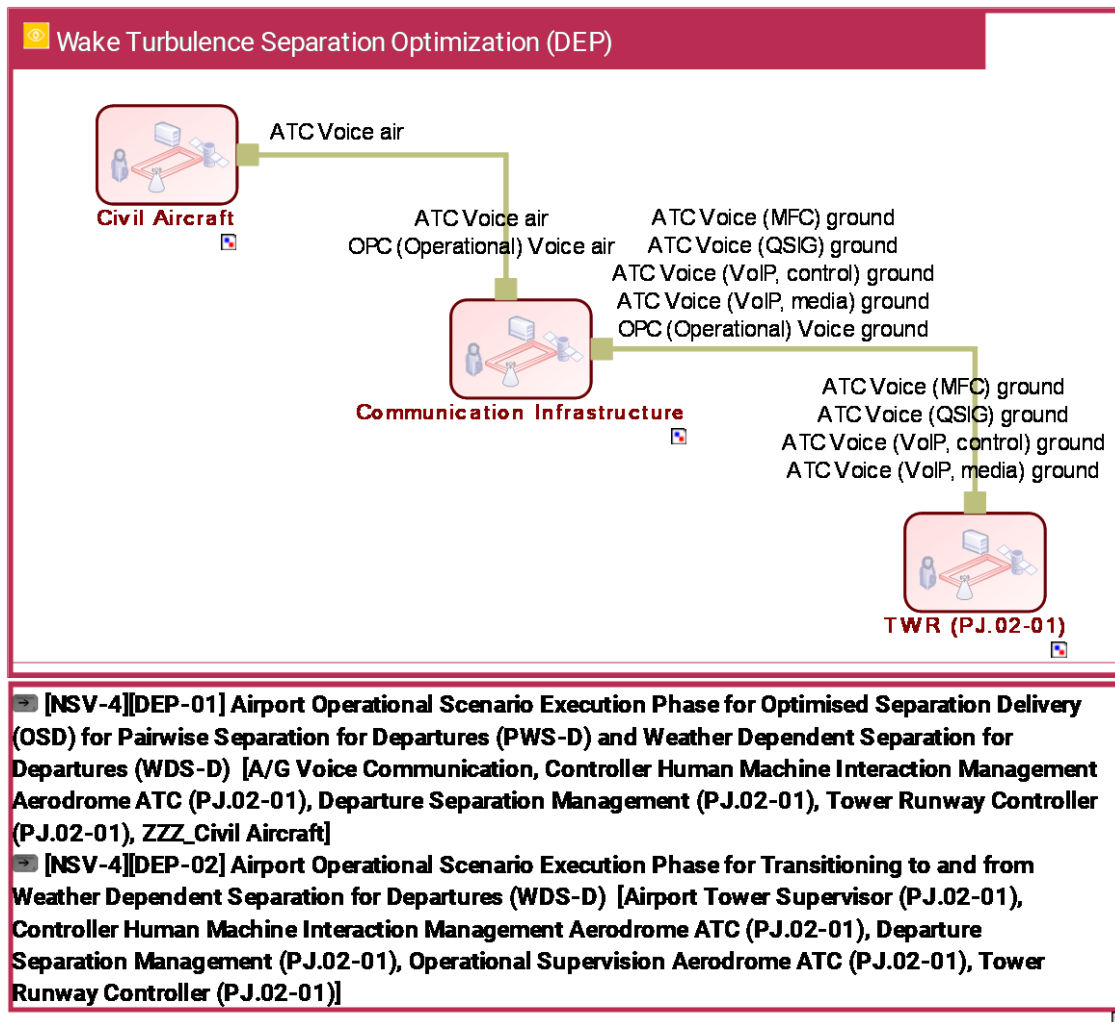


Figure 3: NSV-2 Infrastructure Connectivity Model for PJ.02-01-06 WTS (for Departures) based on Static Aircraft Characteristics (Departures)

4.1.3 Resource Orchestration view

The diagrams within this section represent the interactions of the main FBs involved. The logical architecture is modelled in MEGA, and therefore compliant with EATMA, and lists all functional components of the PJ.02-01-06 solution and their dependencies and relations.

The models are available in MEGA. For a better resolution, refer to:

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

Please, refer to Section 3.1.1 to read the description for each model.

4.1.3.1 [NSV-4][ARR/MIX-01] Airport Operational Scenario Planning Phase for PWS, WDS and ORD for Arrivals or Mix-mode (ORD, PWS-A, WDS-A)

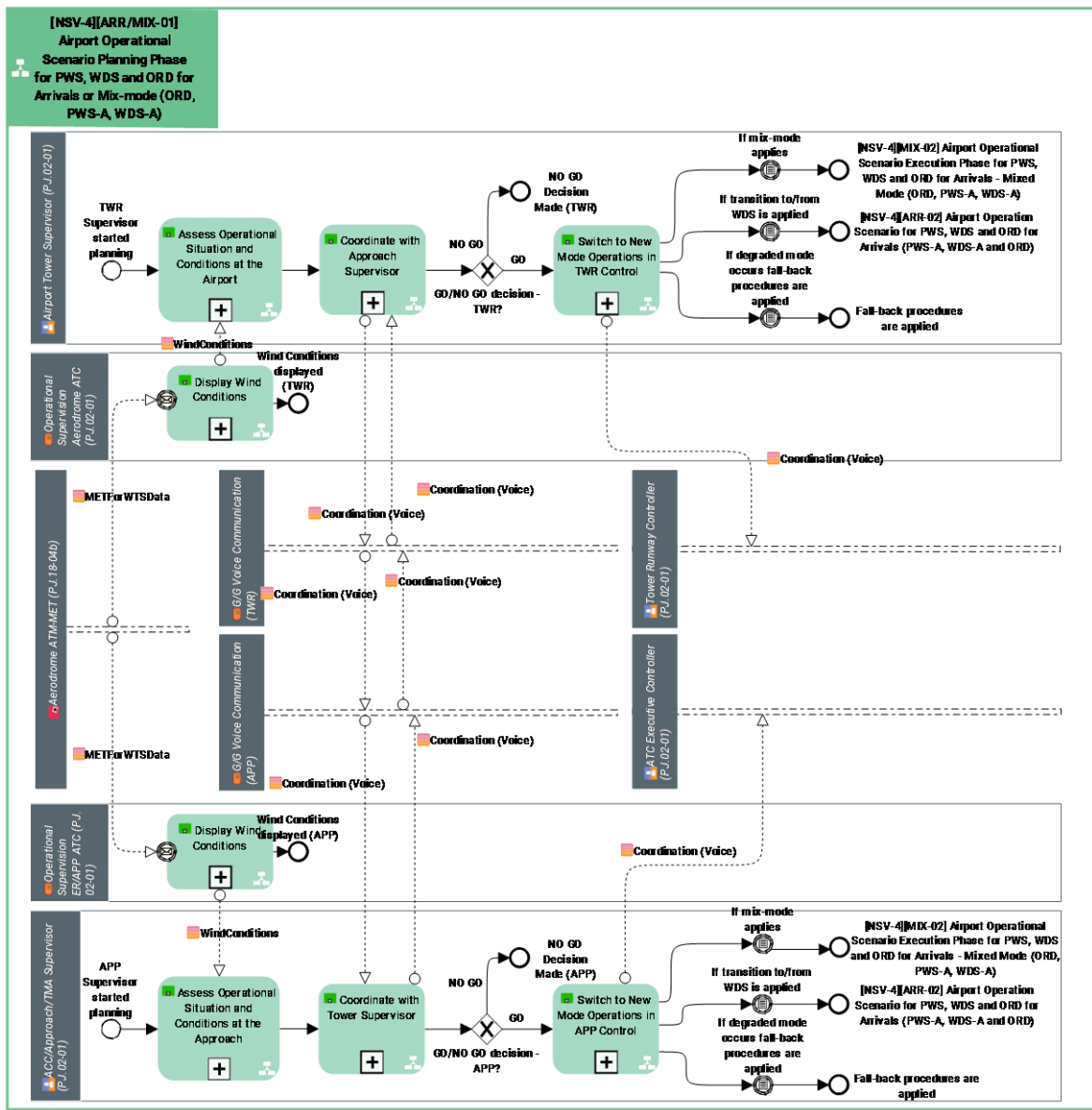


Figure 4: [NSV-4][ARR/MIX-01]

4.1.3.2 [NSV-4][MIX-02] Airport Operational Scenario Execution Phase for PWS, WDS and ORD for Arrivals - Mixed Mode (ORD, PWS-A, WDS-A)

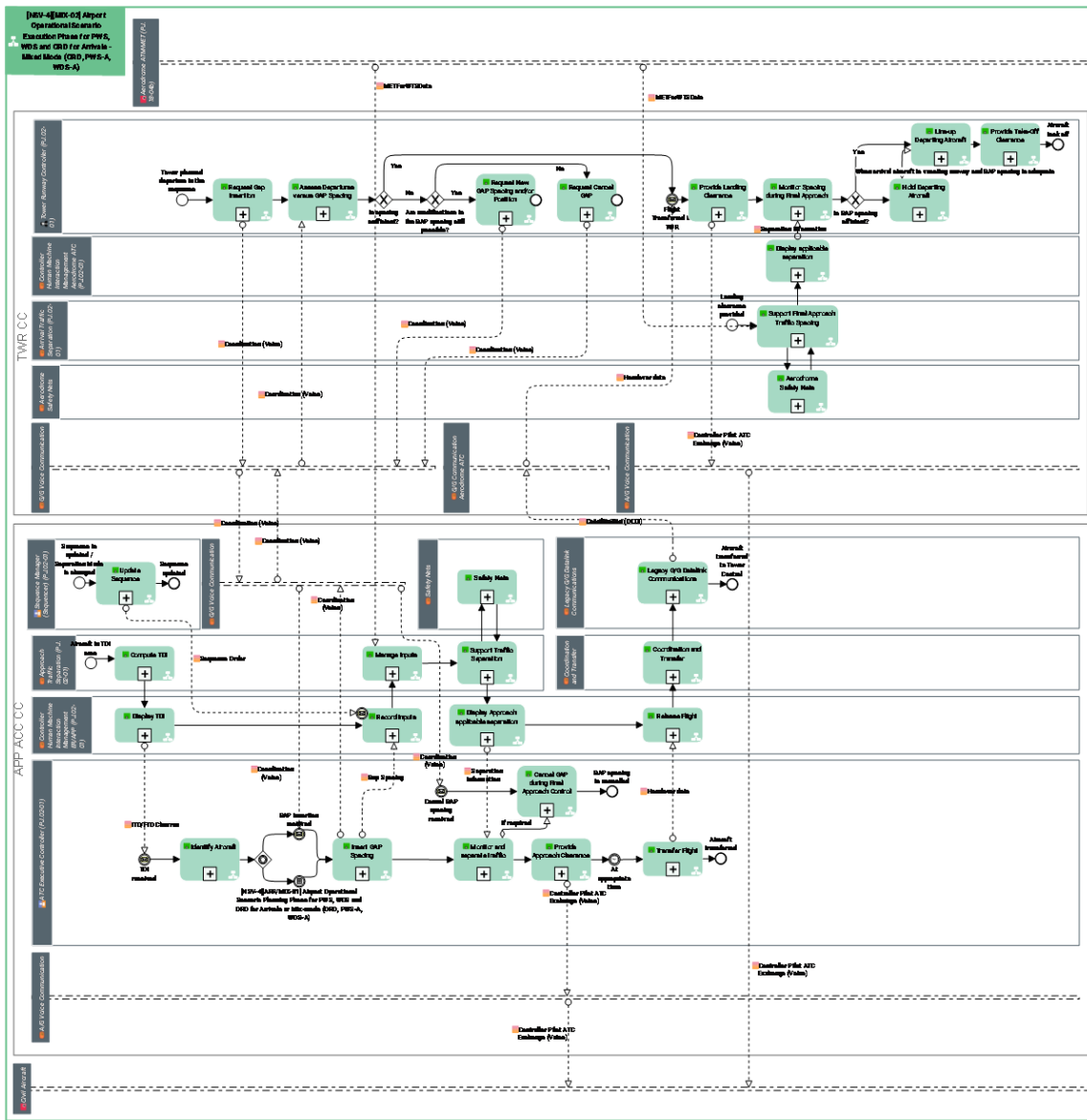


Figure 5: [NSV-4][MIX-02]

4.1.3.3 [NSV-4][DEP-01] Airport Operational Scenario Execution Phase for Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PWS-D) and Weather Dependent Separation for Departures (WDS-D)

This NSV-4 reflects the Use Case [DEP-01] Airport Operational Scenario Execution Phase for Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PWS-D) and Weather Dependent Separation for Departures (WSD-D).

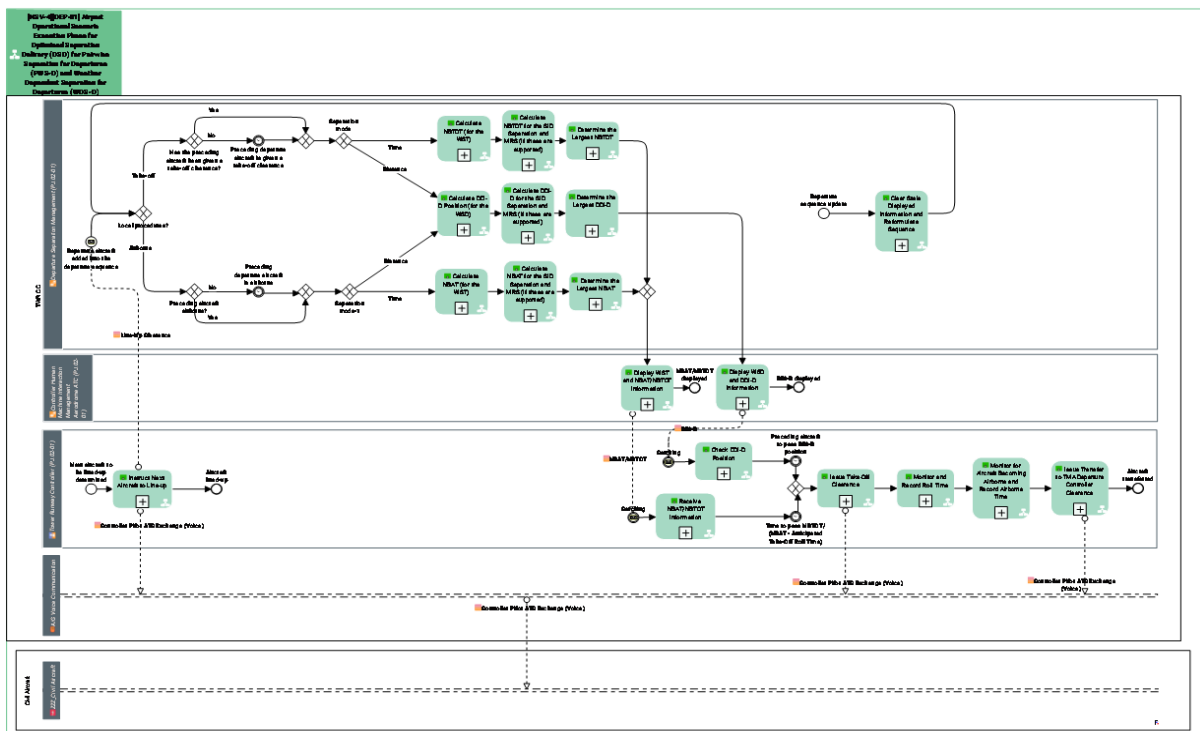


Figure 6 : NSV-4 model. DEP-01 Airport Operational Scenario Execution Phase for Optimised Separation Delivery (OSD) for Pairwise Separation for Departures (PSW-D) and Weather Dependent Separation for Departures (WDS-D)

4.1.3.4 [NSV-4][DEP-02] Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)

This diagram reflects the technical layer of the Use Case [DEP-02] Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)

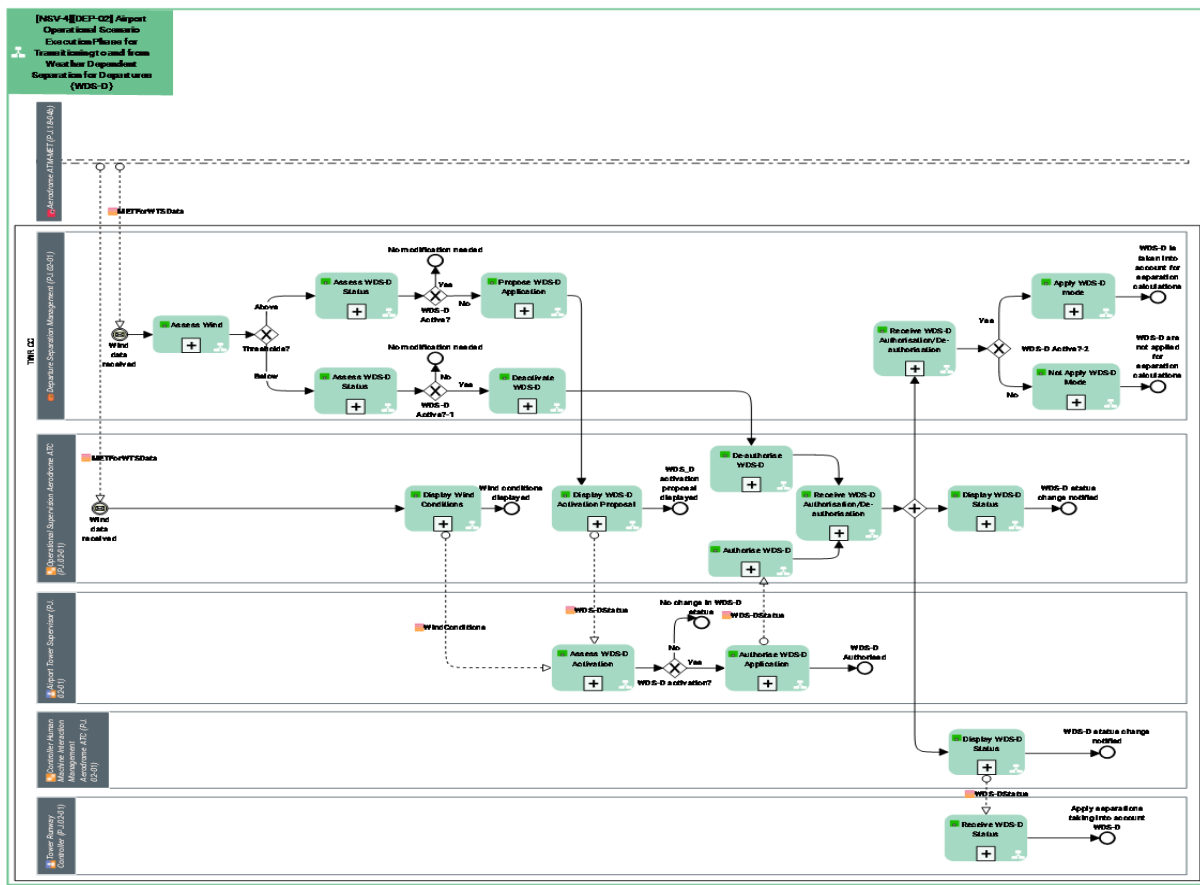


Figure 7: NSV-4 model. DEP-02 Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)

4.1.4 Resource Composition

The functional block composition of the technical system has not been modified. The changes are localised only on one functional block and there is no impact on other interfaces and functional blocks. Therefore, no changes have been identified.

4.1.5 Service view

No Services were created under PJ.02-01-06 Departures framework.

METforWTS Service was created by PJ.18-04b Meteorological (MET) information in relation with PJ.02-01-06 WTS (for Departures) based on Static Aircraft Characteristics (Departures).

METforWTS Service addresses the dependency with PJ.02-01-06 where needs for detailed wind information has been identified. Wind information comprises head- and crosswind components along the glide path which will be used for optimising the runway throughput by addressing new arrival and departure concepts. Therefore, a glide path wind profile will be provided as service including current, nowcast and forecast wind information.

Departure concepts make use of this Service. Refer to following diagrams (covering related FB, Functions and Activities):

- [NSV-4] [DEP-02] Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)
- [NOV-5][DEP-02] Airport Operational Scenario Execution Phase for Transitioning to and from Weather Dependent Separation for Departures (WDS-D)

4.2 Functional and non-Functional Requirements

[REQ]

Identifier	REQ-02-01-TS-DEP0.0001
Title	Optimised departure sequence plan for pushback and taxi-out computation
Requirement	The Departure Sequence Management shall compute an optimised departure sequence plan for pushback and taxi-out
Status	<validated>
Rationale	A-CDM/DMAN support will be provided to formulate and optimise the departure sequence order and departure rate for coordinating the TOBTs and TSATs and managing the taxi-out flow of departure aircraft to the runway holding points
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0001
<ALLOCATED_TO>	<Functional block>	Departure Sequence Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Clear Stale Displayed Information and Reformulate Sequence
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.9001
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Title	Optimised departure sequence plan for pushback and taxi-out display
Requirement	The CHMIM shall display the optimised departure sequence plan for pushback and taxi-out
Status	<validated>
Rationale	The Tower ATC Roles shall be able to check the initial optimised departure sequence plan for pushback and taxi-out in the HMI
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.0001
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.1001
Title	Optimised departure sequence plan for line-up and take-off computation
Requirement	The Departure Sequence Management should compute an optimised departure sequence plan for line-up and take-off
Status	<validated>
Rationale	This requirement is considered as optional as to whether this support is provided to the Tower Runway Controller and whether the system permits late changes in the sequence due to unexpected events such as aircraft not being ready to line-up and take-off or a change of CTOT.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.1001
<ALLOCATED_TO>	<Functional block>	Departure Sequence Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Clear Stale Displayed Information and Reformulate Sequence
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.1901
Title	Optimised departure sequence plan for line-up and take-off display
Requirement	The CHMIM should display the optimised departure sequence plan for line-up and take-off
Status	<validated>
Rationale	The Tower ATC Roles should be able to check the initial optimised departure sequence plan for line-up and take-off in the HMI
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.1001
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.0002
Title	Aircraft separation monitoring for distance-based separation
Requirement	The CHMIM shall display the situation view in a way that allows to check the delivery conformance to the required distance-based wake separation
Status	<validated>
Rationale	The HMI shall present in the situation view display the means to check if the right distance-based wake separation is delivered between aircraft to avoid separation minima infringement and to confirm the appropriate application of the OSD tool support
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0002
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WSD and DDI-D Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.1002
Title	Aircraft separation monitoring for time-based separation
Requirement	The CHMIM should display the situation view in a way that allows to check the delivery conformance to the required time-based wake separation
Status	<validated>

Rationale	The HMI should present means to check if the right time-based wake separation is delivered between aircraft to avoid separation minima infringement and to confirm the appropriate application of the OSD tool support.
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.1002
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.0003
Title	Editable Departure Sequence
Requirement	The Departure Sequence Management departure sequence plan shall be editable
Status	<validated>
Rationale	The possibility of manually editing the departure sequence plan allows the Tower Runway Controller to amend sequence plan/order on a tactical basis in case it is needed, either because of an unexpected event or according to controllers' judgement.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06

<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0003
<ALLOCATED_TO>	<Functional block>	Departure Sequence Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Clear Stale Displayed Information and Reformulate Sequence
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.9003
Title	Departure separation recalculation
Requirement	The OSD tool shall take into account any modification made in the departure sequence plan/order to recalculate the separation between leader and follower (even if they are late/tactical changes)
Status	<validated>
Rationale	When the departure sequence order is modified, the former leader-follower pairs are no longer valid, so new separations between pairs need to be computed
Category	<IER> , <Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0003
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0030
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Clear Stale Displayed Information and Reformulate Sequence
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.0004
Title	Wake separation time display
Requirement	The CHMIM shall present the remaining time to next departure that satisfies the wake separation based on the separation mode that is being applied.
Status	<validated>
Rationale	The system shall present the time left until the next departure, either the "airborne time" separation or "start of take-off roll time" separation depending on local procedures
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0004
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.0005
Title	SID separation minima support
Requirement	The CHMIM should display the SID separation minima to be applied between departures
Status	<validated>
Rationale	SID separation is taken into consideration when determining the most restrictive separation between aircraft pairs
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0005
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.0006
Title	Wake separation time calculation
Requirement	The OSD tool shall calculate the time until next departure correctly representing the WDS (departure) or standard wake separation (according to the wake separation in use) for all departure pairs in all normal ranges of weather and operating conditions.
Status	<validated>
Rationale	The system shall take into account the aircraft types and calculate the wake separation time based on the wake separation rules in use for each departing aircraft pair.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0006
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate NBTOT (for the WST) Calculate NBAT (for the WST)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.9006
Title	Time to next departure calculation
Requirement	The OSD tool shall calculate the time to next departure taking into account the wake separation rules in use
Status	<validated>
Rationale	The wake separation rules are based on the defined matrices depending on which separation method is being applied.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0006
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate NBAT (for the WST) Calculate NBTOT (for the WST)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.8006
Title	Take-off from intermediate position
Requirement	The OSD tool shall add 60s to the time to next departure if the flight takes off from an intermediate position relative to the preceding departure aircraft take-off position for time-based separation
Status	<validated>

Rationale	When an aircraft is departing from an intermediate position relative to the preceding aircraft take-off position, it is necessary to add time to the standard wake separation time for that pair as a safety measure. Departing from an intermediate position could increase the likelihood of a wake encounter if this measure is not applied.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0006
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate NBAT (for the WST) Calculate NBTOT (for the WST)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.9007
Title	Radar separation minima support
Requirement	The CHMIM should display the Minimum Radar Separation to apply
Status	<validated>
Rationale	The Minimum Radar Separation is taken into account when determining the most restrictive separation between aircraft pairs
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06

<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0007
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information Display WSD and DDI-D Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.0007
Title	Radar separation minima computation
Requirement	The OSD tool should compute the Minimum Radar Separation to apply
Status	<validated>
Rationale	The Minimum Radar Separation is taken into account when determining the most restrictive separation between aircraft pairs
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0007
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate NBTOT for the SID Separation and MRS (if these are supported) Calculate NBAT for the SID Separation and MRS (if these are supported) Calculate DDI-D for the SID Separation and MRS (if these are supported)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.0008
Title	Wake separation provision
Requirement	The OSD tool shall provide accurate and robust information on the required wake turbulence separation interval between each successive departing aircraft
Status	<validated>
Rationale	The tool shall ensure the delivery of consistent and accurate wake turbulence separation information
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0008
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate DDI-D Position (for the WSD) Calculate NBAT (for the WST) Calculate NBTOT (for the WST)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.0009
Title	Determining when aircraft becomes airborne
Requirement	The system should automatically determine when aircraft become airborne
Status	<validated>

Rationale	Accuracy in determining when take-off clearances must be issued is a key element in order to take full advantage of the reduced separations while maintaining safety levels. This will be achieved by the automatic provision of aircraft becoming airborne time by ground systems, which will replace the current detection method based on controller’s judgement.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.0009
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.1009
Title	Aircraft take-off roll start determination
Requirement	Aerodrome Surveillance should detect when aircraft start their take-off roll
Status	<validated>
Rationale	<p>When separations are reduced it is important that decisions as to when to issue take-off clearances are based on accurate information.</p> <p>Whilst a manual approach to determining the "start of take-off roll" may be suitable for current operations, it is possible that the level of accuracy will be unacceptable from both a safety (too early could be unsafe) and service delivery (too late is inefficient) perspective for the future.</p> <p>The "start of take-off roll" may be able to be reliably determined using conventional surveillance (radar surveillance, multilateration).</p>

Category	<Functional>
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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.1009
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.1909
Title	Aircraft take-off roll start presentation
Requirement	The CHMIM should notify when aircraft start their take-off roll
Status	<validated>
Rationale	<p>When separations are reduced it is important that decisions as to when to issue take-off clearances are based on accurate information.</p> <p>Whilst a manual approach to determining the "start of take-off roll" may be suitable for current operations, it is possible that the level of accuracy will be unacceptable from both a safety (too early could be unsafe) and service delivery (too late is inefficient) perspective for the future.</p> <p>The "start of take-off roll" may be able to be reliably determined using conventional surveillance (radar surveillance, multilateration).</p>
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06

<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.1009
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.0018
Title	SID information display
Requirement	The CHMIM shall display SID information for each departure aircraft
Status	<validated>
Rationale	<p>The SID information and its corresponding SID separation is required when determining if a departure pair can apply a WDS-D Xw reduced wake separation.</p> <p>It is necessary to take into account the SID separation to check if it is most restrictive than the wake separation calculated by the OSD tool. If so, the latter cannot be applied as the separation required due to SID is most constraining.</p> <p>Note that the SID information should already be provided by the system to support the application of SID separations as is the case of Heathrow where the planned SID is displayed on the FDE of each departure aircraft, so there is no change required to the current system.</p> <p>For other local environments there may be a need to supplement the provision of SID information.</p>
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
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<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0018
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.0020
Title	Aircraft route display for distance-based separation
Requirement	The CHMIM shall present the planned route of each aircraft when applying distance-based separation
Status	<validated>
Rationale	When applying distance-based wake separations the system needs to present the aircraft route to allow the controller to visualise how far along the SID path the lead aircraft needs to progress before giving the take-off clearance to the follower aircraft. This is in order to deliver the required distance-based wake separation when the follower aircraft becomes airborne.
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0020
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.0034
Title	Different MRS and SID timer and WT timer

Requirement	The HMI shall display the countdown time differentiating between MRS and SID separation support and WT support
Status	<validated>
Rationale	This requirement applies when the OSD tool is providing informative support for SID and MRS constraints that the ATCO has the discretion to interpret and issue an earlier take-off clearance. This is so as to clearly distinguish from the WT separation support that the ATCO is required to apply.
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0034
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.0041
Title	SID information on the HMI
Requirement	The HMI shall display SID information with the adequate prominence
Status	<validated>
Rationale	<p>SID information prominence was identified as a preventative mitigation against CF "ATCO fails to take into account a SID separation constraint within the departure clearance (even though appropriate wake separation applied)".</p> <p>Due to the new HMI element (OSD tool) being "easy to follow", controllers might omit to include the SID separation constraints, when applicable, into the departure clearance.</p>
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0041
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.0042
Title	Display of wake separations for each departure pair
Requirement	The OSD tool shall display the wake separation time or the non-wake pair information for each departure pair on all its HMI elements
Status	<validated>
Rationale	If no separation is displayed for a pair, that means that the tool is unable to provide information, thus there is an OSD tool failure
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0042
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.0043
Title	Distinguish non-wake pair
Requirement	The OSD tool shall distinguish between a wake and a non-wake aircraft pair
Status	<in progress>
Rationale	Aircraft pairs information shall be included in the tool with a field distinguishing if the pair is a wake or a non-wake one
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.0043
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate DDI-D Position (for the WSD) Calculate NBTOT (for the WST) Calculate NBAT (for the WST)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.9043
Title	Unambiguous display of non-wake pair information
Requirement	HMI associated with the NBAT and the value displayed by the Countdown timer for a non-wake pair shall be unambiguous
Status	<in progress>
Rationale	"NONE" was displayed in the NBAT field on the FDE in RTS 5. This signified that there was no wake separation constraint to the preceding departure aircraft. This was instead of displaying "0000" which was considered as confusing.

Category	<HMI>
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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.0043
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.0045
Title	Automatic countdown
Requirement	The OSD tool countdown timer shall automatically start ticking at adequate time.
Status	<in progress>
Rationale	The countdown starts when preceding aircraft either takes off or becomes airborne, depending on whether the calculations are based on take-off time (NBTOT) or airborne time (NBAT)
Category	<Functional> , <HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.0045
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.9045
Title	Distinguishing countdown timer status
Requirement	The HMI should display the countdown timer distinguishing a passive status (ticking has not started yet) from an active status (ticking has started)
Status	<in progress>
Rationale	Errors, mis-seeing or mis-judgement of the displayed information are avoided
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.0045
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.0047
Title	Countdown timer on FDE
Requirement	The OSD tool should include the countdown timer on the FDE
Status	<in progress>
Rationale	The countdown timer on the ADIS display increases heads-up time which is seen as a positive benefit
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.0047
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.2001
Title	SID and other constraints
Requirement	The OSD tool should take into account SID constraints and aircraft type speed considerations for the NBTOT calculations
Status	<in progress>
Rationale	The separation tool should take into consideration all of the constraints related to the separations rather than just the wake turbulence separation constraints.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.2001
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate NBTOT for the SID Separation and MRS (if these are supported)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.2002
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Title	Calculations for traffic in the holding bay
Requirement	The OSD tool should calculate take-off clearance time indicator for all the traffic in the holding bay (for segregated mode operations)
Status	<in progress>
Rationale	The time indicators should be calculated for all the traffic in the holding bay waiting for line-up with respect to the leader aircraft. This helps the controller to prioritise flights when it is possible to alter the sequence order between the aircrafts in the bay.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.2002
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate NBAT (for the WST) Calculate NBTOT (for the WST)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.2902
Title	Time indicators for traffic in the holding bay
Requirement	The HMI should display the take-off clearance time indicator for all the traffic in the holding bay (for segregated mode operations)
Status	<in progress>

Rationale	The time indicators should be calculated for all the traffic in the holding bay waiting for line-up with respect to the leader aircraft. This helps the controller to prioritise flights when it is possible to alter the sequence order between the aircrafts in the bay.
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.2002
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.3003
Title	Alarm for early issued departure clearance
Requirement	The CWP shall trigger an alarm when a departure clearance is issued too early against the timer
Status	<in progress>
Rationale	For Safety purposes (runway is engaged, no departures or crossing are allowed until the departing or arriving aircraft has vacated the runway)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.3003

<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3004
Title	Gap value updates
Requirement	The OSD tool shall deliver gap spacing information in a stable and reliable manner in order to avoid the recalculation and constant updates of the gap values.
Status	<in progress>
Rationale	One potential solution to achieve it could be to use the predicted touch down time based on the standard descend profiles in order to avoid the recalculation and constant updates of the gap values.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3004
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Determine the Largest NBAT Determine the Largest NBTOT Determine the Largest DDI-D
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3005
Title	Gap spacing delivery information

Requirement	The HMI shall display the OSD gap spacing delivery information
Status	<in progress>
Rationale	The information needs to be displayed in a coherent manner for both APP and TWR CWP's
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3005
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information Display WSD and DDI-D Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3006
Title	Arrival flights consideration
Requirement	The OSD tool (DDI-T) shall take into consideration the arrival flights in case of partially segregated/mixed mode runway operations
Status	<in progress>
Rationale	This could be done by integrating information on the arrivals such as from an arrival management tool into the OSD tool
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06

<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3006
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate DDI-D Position (for the WSD)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3009
Title	Required time elapsed
Requirement	The OSD tool could indicate that the required time had elapsed to enable a subsequent departure event
Status	<in progress>
Rationale	The indication would be presented even though an arriving aircraft was imminent, and no departures should be allowed on the runway until the arriving aircraft had landed and exited the runway. This indication aims to increase efficiency and enhance situation awareness.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3009
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS.DEP0.3010
Title	Vertical and lateral separation for MRS

Requirement	The OSD tool should take into account the 1000ft vertical separation and the 3NM lateral separation constraint between the departing aircrafts when determining the DDI-T and DDI-D values for MRS minima if applicable
Status	<in progress>
Rationale	To ensure an appropriate separation is maintained during the departure phase, under the condition that it is also achieved on hand-over to the next sector.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3010
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate DDI-D for the SID Separation and MRS (if these are supported) Calculate NBAT for the SID Separation and MRS (if these are supported) Calculate NBTOT for the SID Separation and MRS (if these are supported)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3906
Title	Line-up support
Requirement	The OSD tool shall indicate the controller when to line up a departure only when it is safe to do so
Status	<in progress>
Rationale	When an arrival is imminent the OSD tool should indicate that no departures are allowed to be cleared for line-up.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3006
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3007
Title	Mixed mode
Requirement	The OSD tool shall have an additional HMI support to visualize the planned arrivals and departures sequence on the runway in partially segregated/mixed mode
Status	<in progress>
Rationale	This could be done using electronic flight strips, or with an AMAN/DMAN or with a bespoke sequencing tool.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3007
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3008
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Title	Separation calculations buffer
Requirement	The OSD tool shall integrate the adequate buffers to the separation calculations
Status	<in progress>
Rationale	<p>To accommodate for variability related to aircraft performance on the runway and airborne (on the climb profile) and prevent any separation infringement.</p> <p>The size of the buffer should be based on the analysis of the aircraft performance data derived from operational data collected from the local airport where the OSD is to be implemented.</p>
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3008
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Determine the Largest DDI-D Determine the Largest NBTOT Determine the Largest NBAT
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3011
Title	Automatic take-off detection

Requirement	The OSD tool should automatically detect the aircraft take-off based on the aircraft rolling speed in case it is missed to input the take-off instruction in the EFS system. The DDI for the next departure should adapt accordingly.
Status	<in progress>
Rationale	To ensure efficiency as well as to ensure appropriate separations are maintained during the departure phase, lowering the potential of human error.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3011
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3911
Title	Adapt DDI according to take-off detection
Requirement	The OSD tool should adapt the DDI accordingly when the aircraft take-off is automatically detected
Status	<in progress>
Rationale	To ensure efficiency as well as to ensure appropriate separations are maintained during the departure phase, lowering the potential of human error.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier

<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3011
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3012
Title	Timestamping of instructions
Requirement	The OSD tool/ CWP HMI should timestamp the time of the instructions given/inputted by the controllers.
Status	<in progress>
Rationale	The automatic timestamp prevents controllers from having to write down times of instruction.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3012
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3014
Title	FTD display constraint
Requirement	The HMI should not display the FTD unless ROT is a prevailing constraint
Status	<in progress>

Rationale	To ensure there is not additional clutter on the screen.
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WSD and DDI-D Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3016
Title	Mixed mode operations warning messages
Requirement	The HMI should display a warning message to show whether sequence changes are possible in mixed mode operations
Status	<in progress>
Rationale	For instance, highlighted in red in case the proposal is not accurate
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3016
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3017
Title	Distinguishing wake separations
Requirement	The HMI should display the wake separations in a different manner depending on whether they are based on wake minima compared to MRS or SID constraints
Status	<in progress>
Rationale	In order to ensure it is clearly shown which factor is most constraining
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3017
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information Display WSD and DDI-D Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3018
Title	Runway entry points
Requirement	The OSD tool should consider different runway entry points
Status	<in progress>
Rationale	To be applicable in complex environments
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3018
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate DDI-D Position (for the WSD) Calculate NBTOT (for the WST) Calculate NBAT (for the WST)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3918
Title	TMA exit points
Requirement	The OSD tool should consider regulations related to the TMA exit points
Status	<in progress>
Rationale	To be applicable in complex environments
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3018
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3019
Title	AMAN/DMAN integration

Requirement	The ORD and OSD integration (including the DDI-T, DDI-D and gap spacing management tool) should be merged with the AMAN / DMAN
Status	<in progress>
Rationale	To synchronize all data and ensure the ATCO does not have redundant information or different displays.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3019
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3020
Title	OSD in mixed mode
Requirement	The OSD tool shall not display the departure separation to be applied to the preceding departure aircraft when the immediately preceding aircraft in the sequence is an arrival aircraft, unless the departure aircraft is given a line-up clearance behind the arrival aircraft in partially segregated/mixed mode operations
Status	<in progress>

Rationale	<p>If the OSD tool is not taking into account the arrivals in mixed mode, when the DDI-T starts counting down or if the DDI-D is shown, it might suggest to the controller that the follower a/c to use the runway could be a departure.</p> <p>This requirement could be achieved via a procedure, by not starting the countdown timer unless the next a/c has been given line-up clearance so separation will be displayed always for a departure pair, or via the system by making the OSD tool take into account the arrival sequence. The exact solution is to be determined at local level.</p>
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3020
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information Display WSD and DDI-D Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3022
Title	A/C outside the climb envelope considered by the tool
Requirement	The Monitoring Aids shall alert when an a/c is outside the climb profile envelope used by the OSD tool, prior to the follower aircraft being given a take-off clearance
Status	<in progress>
Rationale	If the local airport departure route structure permits catch-up situations
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.3022
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEPO.3023
Title	Separation calculation between multiple aircraft
Requirement	The OSD tool shall take into account the separation between the leader and the other aircraft in the sequence (e.g. 1sr and 3rd) and not only between the first pair, when calculating SID, MRS and Wake separations.
Status	<in progress>
Rationale	This is to mitigate the case when there is still some separation/spacing to be applied between e.g. the first and the third departure, after the separation/spacing between the second the third departure has been achieved. I.e. if given take-off clearance, the third departure will be separated with the second departure but it will not be separated compared with the first departure (e.g. MRS constraint between 1st and 2nd a/c and between 2nd and 3rd aircraft but at the same time there is a SID constraint between the 1st and 3rd a/c)
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEPO.3023
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate NBTOT for the SID Separation and MRS (if these are supported)

		Calculate NBAT for the SID Separation and MRS (if these are supported) Calculate DDI-D for the SID Separation and MRS (if these are supported)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3923
Title	Display of separation between multiple aircraft
Requirement	The HMI shall display the separations calculated by the OSD tool between the leader and the other aircraft in the sequence
Status	<in progress>
Rationale	This is to mitigate the case when there is still some separation/spacing to be applied between e.g. the first and the third departure, after the separation/spacing between the second the third departure has been achieved. I.e. if given take-off clearance, the third departure will be separated with the second departure but it will not be separated compared with the first departure (e.g. MRS constraint between 1st and 2nd a/c and between 2nd and 3rd aircraft but at the same time there is a SID constraint between the 1st and 3rd a/c)
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3023
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WSD and DDI-D Information Display WST and NBAT/NBTOT Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP1.0001
Title	PWS-D wake separation minima calculation
Requirement	The OSD tool shall calculate the PWS-D wake separation minima to apply between pairs taking into account each aircraft type
Status	<validated>
Rationale	This calculation is done based on the predefined PWS-D wake separation matrices.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP1.0001
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate DDI-D Position (for the WSD) Calculate NBTOT (for the WST) Calculate NBAT (for the WST)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-42a_Airport ATC Runway Usage Management sub-system enhanced for processing static wake-turbulence information

[REQ]

Identifier	REQ-02.01-TS-DEP1.9001
Title	PWS-D wake separation minima presentation
Requirement	The CHMIM shall present the PWS-D wake separation minima to apply between pairs
Status	<validated>
Rationale	This calculation is done based on the predefined PWS-D wake separation matrices.
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP1.0001
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WSD and DDI-D Information Display WST and NBAT/NBTOT Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-42a_Airport ATC Runway Usage Management sub-system enhanced for processing static wake-turbulence information

[REQ]

Identifier	REQ-02.01-TS-DEP1.0005
Title	PWS-D wake separation rules
Requirement	The OSD tool shall base PWS-D wake separation calculations on PWS-D wake separation rules, taking into account the pairwise aircraft type rules and the pairwise refined wake category rules on the straight-out initial departure path
Status	<validated>

<p>Rationale</p>	<p>PWS-D wake separation rules shall be provided to the Optimised Separation Delivery tool. These shall and based on be based on the pairwise aircraft type rules and the pairwise refined wake category rules.</p> <p>For the distance-based rules these are the RECAT-EU-PWS distance-based aircraft type pairwise wake separation rules and the distance-based 20-CAT wake separation rules.</p> <p>For the time-based rules, draft rules are defined in SPR-INTEROP/OSED derived from the distance-based rules. Refer to OSED [40] for methodology explaining how time base pairwise wake separation minima are derived</p> <p>Validated in NATS RTS5 for the time-based rules and VALEXE 11 in SESAR 2020 Wave 2</p> <p>ECTL to confirm validation of the distance-based rules.</p>
<p>Category</p>	<p><Functional></p>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP1.0005
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP1.0007
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate DDI-D Position (for the WSD) Calculate NBAT (for the WST) Calculate NBTOT (for the WST)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-42a_Airport ATC Runway Usage Management sub-system enhanced for processing static wake-turbulence information

[REQ]

Identifier	REQ-02.01-TS-DEP2.0001
Title	Departing phase traffic situation picture
Requirement	The CHMIM shall display for all departing flights during their initial climb phase: <ul style="list-style-type: none"> • Identification • Position • Optionally, horizontal and vertical speed
Status	<validated>
Rationale	This information conforms the traffic situation picture and supports the application and monitorization of WDS-D X-Wind concept reduced wake separations
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0001
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP2.0004
Title	Meteorological situation picture display
Requirement	The CHMIM shall present an adequate meteorological situation picture covering the area encompassing the initial climb phase of departing flights
Status	<in progress>

Rationale	<p>The meteorological situation picture includes the presentation of wind conditions.</p> <p>It is not necessary that the system displays the complete picture of wind conditions (nowcast and forecast).</p> <p>Runway and surface crosswind speed with respect to runway direction are required to be displayed for employing the WDS-D reduced separation. There is justifiable confidence in the surface wind speed.</p>
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0004
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display Wind Conditions
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP2.9004
Title	Complete aloft profile consideration
Requirement	The OSD tool shall take into consideration the complete wind aloft profile (nowcast and forecast) when determining the Go/No-Go status for the application of the WDS-D reduced separations
Status	<in progress>
Rationale	The complete wind aloft profile (nowcast and forecast) covering the area encompassing the initial climb phase area is required to determine whether the WDS-D Xw reduced separations are applicable

Category	<Functional>
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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0004
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Assess Wind
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information

[REQ]

Identifier	REQ-02.01-TS-DEP2.0010
Title	WDS-D Xw concept departure planning information
Requirement	The CHMIM shall display the following information for each departing flight: 1. Aircraft type and wake turbulence category 2. Designated runway and SID 3. First cleared flight level
Status	<validated>
Rationale	To support the consistent application of WDS-D Xw concept reduced separations
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0010
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of

		processing initial departure path wind conditions information
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[REQ]

Identifier	REQ-02.01-TS-DEP2.0018
Title	WDS-D Xw concept wake separation minima computation
Requirement	The OSD tool shall calculate the WDS-D Xw concept wake separation minima to be applied between the leader and the follower aircraft
Status	<validated>
Rationale	The system will take into account different inputs such as the leader and follower aircraft type, SID constraints, the application of WDS or the minimum radar separation (MRS) to compute separations between pairs
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0018
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Apply WDS-D mode
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP2.9018
Title	WDS-D Xw concept Applicable wake separation minima
Requirement	The CHMIM shall display the WDS-D separation minima to be applied between the leader and the follower aircraft
Status	<validated>

Rationale	The controllers shall be able to check the separation minima to be applied between pairs in the HMI, as the new mode of operation would make it difficult for the controllers to judge separations taking into account all the concerning factors in its totality
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0018
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information

[REQ]

Identifier	REQ-02.01-TS-DEP2.0022
Title	WDS-D status indication for Controllers
Requirement	The CHMIM shall indicate the WDS-D X-Wind concept reduced separations mode status; activate or non-active, depending on whether the WDS-D Xw concept reduced separations are being applied or not
Status	<validated>
Rationale	<p>Controllers need a clear visual indicator of when the WDS-D Xw concept reduced wake separation is being applied, first to reduce the mental effort and human error risk associated with the controller making the decision about whether or not it is appropriate to apply the reduced wake separation and secondly to help ensure overall compliance with the associated procedures.</p> <p>This could be achieved by highlighting the NBAT and Countdown Time when reduced wake separations are being applied.</p>

Category	<HMI>
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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0022
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0086
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WDS-D Status
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP2.0025
Title	Reduction Factors
Requirement	The CHMIM shall present the specific WDS-D Xw concept wake separation minima reduction factors
Status	<validated>
Rationale	The system shall present data that prove that the system is functioning as expected. Details of WDS-D Xw concept reduction factors such as the aircraft SID have been requested to be presented.
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0025
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WDS-D Status

<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation
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[REQ]

Identifier	REQ-02.01-TS-DEP2.0029
Title	WDS-D Xw concept departure planning system support for standard departure information
Requirement	The CHMIM shall present standard departure information: 1. Departing flights 2. Allocated runway 3. SID 4. First cleared flight level
Status	<validated>
Rationale	<p>The level of support which is currently given would need to be enhanced in the new operating environment (i.e. the allocation of the task between human actors and technical systems would shift to placing the onus on the technical system). This should help to mitigate any risks associated with reduced or lost information processing capacity.</p> <p>In SESAR 2020 WDS-D Xw concept the departure planning system support includes the A-CDM/DMAN support to formulate and optimise a departure sequence order and departure rate for coordinating the TOBTs and TSATs and for managing the taxi-out flow of the departure aircraft to the runway holding points (see REQ-02.01-SPRINTEROP-DEP0.001). This system support may also be extended to formulating an optimised sequence plan for line-up and take-off, taking into account departure aircraft readiness constraints at the runway holding points (see REQ-02.01-SPRINTEROP-DEP0.002).</p>
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0029

<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP2.9029
Title	WDS-D Xw concept departure planning system support for WDS-D Xw concept specific information
Requirement	The CHMIM shall present WDS-D Xw concept specific information: 1. Aircraft types, wake turbulence categories and changes to these categories depending on WDS-D Xw concept reduced separation application or suspension 2. Set of available SIDs 3. Advise on SID use for WDS-D Xw concept reduced separations (upwind, downwind)
Status	<validated>
Rationale	The level of support which is currently given would need to be enhanced in the new operating environment (i.e. the allocation of the task between human actors and technical systems would shift to placing the onus on the technical system). This should help to mitigate any risks associated with reduced or lost information processing capacity.
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0029
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP2.0031
Title	WDS-D Xw concept reduced wake separation applicability
Requirement	The CHMIM shall indicate the WDS-D X-Wind concept reduced wake separation mode applicability depending on whether wind conditions are sufficient for it
Status	<validated>
Rationale	A clear indicator of the WDS-Xw concept Go/No-Go status needs to be displayed to reduce mental effort and human error risk associated to the decision about the applicability of the concept and to help ensure overall compliance with the procedure
Category	<Functional> , <HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0031
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WDS-D Status Display WDS-D Activation Proposal
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information

[REQ]

Identifier	REQ-02.01-TS-DEP2.9031
Title	WDS-D Xw concept reduced wake separation applicability for Supervisor
Requirement	The Operational Supervision shall indicate the WDS-D X-Wind concept reduced wake separation mode applicability depending on whether wind conditions are sufficient for it
Status	<validated>

Rationale	A clear indicator of the WDS-Xw concept Go/No-Go status needs to be displayed to reduce mental effort and human error risk associated to the decision about the applicability of the concept and to help ensure overall compliance with the procedure
Category	<Functional> , <HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0031
<ALLOCATED_TO>	<Functional block>	Operational Supervision Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WDS-D Activation Proposal
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information

[REQ]

Identifier	REQ-02.01-TS-DEP2.0048
Title	WDS-D Xw concept deviation alert
Requirement	The Aerodrome ATC system should alert through audio and/or visual signal when a deviation from planned trajectory is detected for an aircraft when applying WDS-D Xw concept reduced wake separation
Status	<validated>
Rationale	The Controller should need to know when an aircraft is deviating from the planned SID, for any reason, since when applying the WDS-D Xw concept reduced wake separation the conditions to ensure the crosswind transport of the wake vortices out of the path of the follower may no longer be guaranteed and as a consequence this could lead to a risk of a wake encounter with significantly stronger wake vortices compared with standard separation (RECAT-EU or RECAT-EU-PWS) in reasonable worst case conditions.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0048
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0092
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3013
Title	Initial climb airspeed profile deviation alert
Requirement	The Aerodrome ATC system shall alert in case there is a deviation of the lead aircraft from the anticipated initial climb airspeed profile
Status	<in progress>
Rationale	To give the Controller awareness of any deviation of the lead aircraft airspeed profile when applying the distance-based WDS-Xw concept.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3013
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP2.0067
Title	Configurable wind threshold

Requirement	The OSD tool shall include a configurable wind threshold that will allow the applicability of WDS-D X-Wind concept reduced separations or will force the de-activation of this mode
Status	<in progress>
Rationale	The WDS-D Xw concept wind threshold shall be based on specificities of the local traffic aircraft performance, local weather conditions over the straight-out common initial departure path
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0067
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Assess WDS-D Status Deactivate WDS-D Propose WDS-D Application
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information

[REQ]

Identifier	REQ-02.01-TS-DEP2.0070
Title	WDS-D Xw concept to standard separation transition
Requirement	The OSD tool shall allow the transition from applying WDS-D Xw concept wake separation reductions to applying standard wake separations if requested.
Status	<in progress>
Rationale	The transition is invoked by the Tower Runway Controller in coordination with the Tower Supervisor when circumstances require it (due to weather avoidance or intruder traffic)

Category	<Functional>
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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0070
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Deactivate WDS-D
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP2.0076
Title	WDS-D Xw concept application
Requirement	The WDS-D tool shall apply WDS-D Xw concept
Status	<validated>
Rationale	WDS-D Xw concept applies weather dependent wake turbulence separation rules for departures, over the straight -out initial common departure path until aircraft diverge on to wake independent paths after the first SID turn, defined as minimum crosswind condition with an associated time separation minimum and associated SID pair constraints to be defined locally.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0076
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Apply WDS-D mode

<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information
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[REQ]

Identifier	REQ-02.01-TS-DEP2.0078
Title	WDS-D Xw concept wake separation rules
Requirement	The Enhanced OSD tool shall include the WDS-D Xw concept wake separation rules
Status	<in progress>
Rationale	The system shall take into account the rules that define the WDS-D Xw concept reduced wake separations in order to apply safely and successfully the new reduced wake separations
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0078
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Apply WDS-D mode
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information

[REQ]

Identifier	REQ-02.01-TS-DEP2.0087
Title	WDS-D reduced wake separations authorisation
Requirement	The WDS-D tool shall support the authorisation of the application of WDS-D reduced wake separations
Status	<in progress>

Rationale	When the wind parameters are met.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0087
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Propose WDS-D Application Display WDS-D Activation Proposal
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information

[REQ]

Identifier	REQ-02.01-TS-DEP2.0088
Title	Automatic de-activation of WDS-D mode
Requirement	The WDS-D tool shall automatically de-activate the application of WDS-D Xw concept reduced wake separations if the pre-defined parameters for applicability are no longer met
Status	<in progress>
Rationale	To ensure the correct delivery of wake separations
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0088
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)

<ALLOCATED_TO>	<Function>	Deactivate WDS-D
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information

[REQ]

Identifier	REQ-02.01-TS-DEP2.0089
Title	Upwind SID determination
Requirement	The OSD tool shall determine whether the follower aircraft departure SID is upwind of all applicable preceding aircraft departure SIDs (e.g. this may be also the second preceding departure aircraft in the case of an A380 – Light – Light departure sequence)
Status	<in progress>
Rationale	WDS-D Xw reduced wake separations shall be applied when this condition is fulfilled, and controllers are not expected to be responsible for self-determining this.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0089
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP2.0090
Title	Monitoring the conformance of the flight path of the departure aircraft when applying a WDS-D reduced wake separation

Requirement	The WDS-D tool shall provide wake vortex warning(s) when crosswind transport is not assured due to divergence of either the preceding, or follower, aircraft from the straight-out initial common departure path
Status	<in progress>
Rationale	Lateral deviation shall be monitored in order to alert when a deviation is detected that could lead to a risk regarding the WDS-D Xw reduced wake separations applicability
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0090
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Assess Wind
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information

[REQ]

Identifier	REQ-02.01-TS-DEP2.0093
Title	Positioning of the displayed crosswind speed
Requirement	The HMI shall display the crosswind speed in the centre of/within the regular scanning pattern of the controller
Status	<validated>
Rationale	It is recommended that the displayed crosswind speed should be positioned closer to the centre of controller view.
Category	<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP2.0093
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display Wind Conditions
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information

[REQ]

Identifier	REQ-02.01-TS-DEP3.0003
Title	Flight data inputs
Requirement	The OSD tool shall receive the aircraft type and the corresponding RECAT-EU Wake Turbulence Category of each one of the departing aircraft pairs, including subsequent updates for new aircraft types
Status	<validated>
Rationale	Validated in NATS RTS5 with respect to inputs to the industry prototype OSD tool provided by Indra for the time-based "airborne time" separation procedures.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0003
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate NBTOT (for the WST) Calculate DDI-D Position (for the WSD) Calculate NBAT (for the WST)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0013
Title	Wind profile data provision to the OSD tool for supporting distance-based separation
Requirement	The OSD tool shall be provided with the wind profile data along the SID route of each departure runway out to the maximum wake separation distance from the rotation positions of the follower aircraft types that it is required to support distance-based separation
Status	<in progress>
Rationale	These data are required to calculate the Dynamic Departure Indicator - Distance (DDI-D) position
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0013
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0028
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Assess Wind
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information

[REQ]

Identifier	REQ-02.01-TS-DEP3.0015
Title	Airspeed profile data provision to the OSD tool for supporting distance-based separation

Requirement	The OSD tool shall be provided with the airspeed profile data for each aircraft type over the departure SID routes out to the maximum distance-based separation that is required to be supported when required for supporting distance-based separation
Status	<in progress>
Rationale	These data are required to calculate the position of the Dynamic Departure Indicator - Distance (DDI-D)
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0015
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Assess Wind
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0016
Title	Take-off roll time data provision to the OSD tool for supporting distance-based separation
Requirement	The OSD tool shall be configured with take-off roll time data for each aircraft time when required to support distance-based separation
Status	<in progress>
Rationale	These data are required to calculate the position of the Dynamic Departure Indicator - Distance (DDI-D)
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0016
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.9016
Title	Dynamic Departure Indicator - Distance (DDI-D) calculation
Requirement	The OSD tool shall calculate the Dynamic Departure Indicator - Distance (DDI-D) in order to support the optimal separation delivery between aircraft pairs
Status	<in progress>
Rationale	<p>The DDI-D is the position the lead aircraft needs to reach before the Tower Runway Controller should issue the clearance to take-off in order to satisfy the required separation when the follower aircraft becomes airborne.</p> <p>The OSD tool calculates the position of the Dynamic Departure Indicator - Distance (DDI-D) taking into account the airspeed profile and associated ground speed impact of the prevailing wind profile over the departure SID route of the lead aircraft out to the required distance-based separation from the anticipated initial airborne position of the follower aircraft.</p> <p>This is so as to calculate the distance the lead aircraft is anticipated to fly over the time the follower aircraft is anticipated to take to become airborne after being given the clearance to take-off. This distance is subtracted from the required wake separation distance to establish the position of where to display the DDI-D.</p>
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0016
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate DDI-D Position (for the WSD) Calculate DDI-D for the SID Separation and MRS (if these are supported) Determine the Largest DDI-D
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.8016
Title	Dynamic Departure Indicator - Distance (DDI-D) presentation
Requirement	The CHMIM shall display the Dynamic Departure Indicator - Distance (DDI-D) in order to support the optimal separation delivery between aircraft pairs
Status	<in progress>
Rationale	<p>The DDI-D is the position the lead aircraft needs to reach before the Tower Runway Controller should issue the clearance to take-off in order to satisfy the required separation when the follower aircraft becomes airborne.</p> <p>The OSD tool calculates the position of the Dynamic Departure Indicator - Distance (DDI-D) taking into account the airspeed profile and associated ground speed impact of the prevailing wind profile over the departure SID route of the lead aircraft out to the required distance-based separation from the anticipated initial airborne position of the follower aircraft.</p> <p>This is so as to calculate the distance the lead aircraft is anticipated to fly over the time the follower aircraft is anticipated to take to become airborne after being given the clearance to take-off. This distance is subtracted from the required wake separation distance to establish the position of where to display the DDI-D.</p>

Category	<HMI>
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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0016
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WSD and DDI-D Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0017
Title	OSD tool assurance/integrity
Requirement	The OSD tool shall ensure a minimum predefined level of assurance/integrity
Status	<in progress>
Rationale	In order to ensure all applicable separations on departure. Assurance/integrity level shall be set as appropriate for total ATCO dependence (e.g. as required for the assurance of radar equipment)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0017
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0018
Title	Provision of departure sequence
Requirement	The OSD tool shall receive the intended departure sequence
Status	<validated>
Rationale	The tool shall receive the intended aircraft take-off order
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0018
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0019
Title	Accurate line-up position
Requirement	The OSD tool shall take into account the accurate line-up position of each departure aircraft
Status	<validated>
Rationale	To allow for automatically adding the 60s for intermediate position line-up.
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06

<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0019
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.9019
Title	Accurate line-up position provision
Requirement	Aerodrome Surveillance shall provide the OSD tool with the accurate line-up position
Status	<validated>
Rationale	The OSD tool needs this information detect when an aircraft is departing from an intermediate position
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0019
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP0.3002
Title	Synchrony between tools
Requirement	The OSD tool shall be synchronized with the other tools (if any) in order to present the same information in a synchronizes way
Status	<in progress>

Rationale	The different tools shall provide the information in the same manner so that appropriate levels of SA are maintained. For instance, displaying "minutes" or "seconds" and not both on different displays.
Category	<IER> , <Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP0.3002
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0020
Title	Provision of SID to the OSD tool
Requirement	The OSD tool shall receive the SID for each departure aircraft (for WDS-D and distance-based)
Status	<validated>
Rationale	SIDs are a constraint factor when calculating separations between aircraft pairs. The tool shall considerate SID of the different departure aircrafts in order to check if the separation based on SID is predominant
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0020
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)

<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation
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[REQ]

Identifier	REQ-02.01-TS-DEP3.0021
Title	Airborne time provision
Requirement	The OSD tool shall receive the accurate airborne time of each departing aircraft (for time based procedures based on airborne times)
Status	<validated>
Rationale	Airborne time can be provided through different methods such as ATCO's input or automatic determination (based on aerodrome surveillance for instance)
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0021
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0022
Title	Wind profile information provision to the WDS-D tool
Requirement	The WDS-D tool shall receive accurate and reliable wind measurements at the rotation positions on the runway surface and aloft along the common straight-out initial departure path (for WDS-D)
Status	<validated>

Rationale	Wind information shall be reliable in order to secure the safe and correct application of the WDS-D mode
Category	<IER> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0022
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Assess Wind
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-19_Runway Usage Management sub-system capable of processing initial departure path wind conditions information

[REQ]

Identifier	REQ-02.01-TS-DEP3.0023
Title	Consideration of staleness criteria for the wind profile information by the WDS-D tool
Requirement	The tool shall take into account staleness criteria with respect to the wind information and the timely suspension of applying associated reduced wake separations (for WDS-D)
Status	<in progress>
Rationale	For Safety purposes
Category	<Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0023
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)

<ALLOCATED_TO>	<Function>	Assess Wind
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0024
Title	Software assurance level for the OSD tool
Requirement	The software assurance level of the tool shall be such that ATCOs may justifiably be reliant on the wake separation information provided by the tool.
Status	<in progress>
Rationale	This facilitates the provision of the wake turbulence separation between each successive departure.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0024
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0025
Title	Accurate display of the wake separation time
Requirement	The HMI shall accurately display the wake separation time calculated by the OSD tool with respect to indicating the applicable wake separation time interval between each successive departure in the case of wake separation time-based procedures
Status	<validated>

Rationale	The wake separation time needs to be clearly displayed to facilitate the ATCO delivering the correct separation between aircraft pairs
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0025
<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WST and NBAT/NBTOT Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0026
Title	Accurate display of the wake separation distance
Requirement	The HMI shall accurately display the wake separation distance calculated by the OSD tool with respect to indicating the applicable wake separation distance interval between each successive departure in the case of wake separation distance-based procedures
Status	<in progress>
Rationale	The wake separation distance needs to be clearly displayed to facilitate the ATCO delivering the correct separation between aircraft pairs
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0026

<ALLOCATED_TO>	<Functional block>	Controller Human Machine Interaction Management Aerodrome ATC (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Display WSD and DDI-D Information
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0027
Title	Take-off roll time provision
Requirement	The OSD tool shall be provided with the accurate start of take-off roll time of each departing aircraft
Status	<in progress>
Rationale	For start of take-off roll procedures
Category	<IER> , <Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0027
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0029
Title	Consideration of staleness criteria for the wind profile information by the OSD-D tool
Requirement	The OSD tool shall take into account staleness criteria with respect to determining the DDI-D position for distance-based separation procedures
Status	<in progress>

Rationale	For Safety purposes
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0029
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Function>	Calculate DDI-D Position (for the WSD)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0030
Title	Informing the OSD tool of late/tactical changes to the departure sequence
Requirement	The Departure Sequence Management system shall inform the OSD tool of late/tactical changes to the departure sequence
Status	<in progress>
Rationale	Tactical rearrangements of the departure sequence are available and OSD tool shall be informed when this happens in order to maintain the fully efficient wake separation calculation
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0030
<ALLOCATED_TO>	<Functional block>	Departure Sequence Management (PJ.02-01-06)

<ALLOCATED_TO>	<Function>	Clear Stale Displayed Information and Reformulate Sequence
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

[REQ]

Identifier	REQ-02.01-TS-DEP3.0031
Title	OSD tool ensuring the correctness of the information presented
Requirement	The OSD tool shall ensure the correctness of the wake turbulence separation information presented when there is a late/tactical change to the departure sequence
Status	<in progress>
Rationale	The OSD Tool shall ensure the correctness of the wake turbulence separation information presented to the controller when there is a late/tactical change to the departure sequence
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-01-06
<SATISFIES>	< ATMS Requirement>	REQ-02.01-SPRINTEROP-DEP3.0031
<ALLOCATED_TO>	<Functional block>	Departure Separation Management (PJ.02-01-06)
<ALLOCATED_TO>	<Enabler>	AERODROME-ATC-69_ATC system to support optimised departure separation

5 Recommendation for Implementation

Intentionally left blank

6 Assumptions

N/A

7 References and Applicable Documents

7.1 Applicable Documents

Content Integration

- [1] EATMA Guidance Material, Project PJ19-W2-CI, Deliverable ID D2.15, Edition 01.00.00, 2020;
- [2] EATMA Community pages;
- [3] SESAR ATM Lexicon;

Content Development

- [4] SESAR 2020 Concept of Operations 2019;

System and Service Development

- [5] 08.01.01 D52: SWIM Foundation v2;
- [6] 08.01.01 D49: SWIM Compliance Criteria;
- [7] 08.01.03 D47: AIRM v4.1.0;
- [8] 08.03.10 D45: ISRM Foundation v00.08.00;
- [9] B.04.03 D102 SESAR Working Method on Services;
- [10] B.04.03 D128 ADD SESAR1;
- [11] B.04.05 Common Service Foundation Method;

Performance Management

- [12] D4.7 SESAR Performance Framework, Edition 01.00.01 – 2019;
- [13] PJ19-W2: Validation Targets – SESAR 2020 Wave 2 &3, Edition 00.01.00;
- [14] B.05 D86 Guidance on KPIs and Data Collection support to SESAR 2020 transition;
- [15] 16.06.06-D68 Part 1 –SESAR Cost Benefit Analysis – Integrated Model;
- [16] 16.06.06-D51-SESAR_1 Business Case Consolidated_Deliverable-00.01.00 and CBA;
- [17] Method to assess cost of European ATM improvements and technologies, EUROCONTROL (2014);
- [18] ATM Cost Breakdown Structure_ed02_2014;
- [19] Standard Inputs for EUROCONTROL Cost Benefit Analyses;
- [20] 16.06.06_D26-08 ATM CBA Quality Checklist;

[21] 16.06.06_D26_04_Guidelines_for_Producing_Benefit_and_Impact_Mechanisms;

Validation

[22] 03.00 D16 WP3 Engineering methodology;

[23] VALS SESAR 2020, Deliverable ID D2.6, Project PJ.19-CO, Edition 00.01.00, 2019;

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

[25] European Operational Concept Validation Methodology (E-OCVM) – Version 3.0, Volume II, February 2010;

System Engineering

[26] SESAR 2020 Requirements and Validation Guidelines;

Safety

[27] SESAR, Safety Reference Material, Deliverable ID D4.0.060, Edition 00.04.01, December 2018;

[28] SESAR, Guidance to Apply the Safety Reference Material, Deliverable ID D4.0.050, Edition 00.03.01, December 2018;

[29] SESAR, Final Guidance Material to Execute Proof of Concept, Deliverable ID 16.01.04-D07, Edition 00.04.00, August 2015;

[30] SESAR, Resilience Engineering Guidance Final Deliverable, May 2016;

Human Performance

[31] 16.06.05 D 27 HP Reference Material D27;

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

Environment Assessment

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

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

Security

[35] 16.06.02 D103 SESAR Security Ref Material Level;

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

[37] 16.06.02 D131 Security Database Application (CTRL_S).

7.2 Reference Documents

- [38]ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.²
- [39]OFA 01.03.01 Enhanced Runway Throughput Consolidated Final Step 1 OSED
- [40]D1.1.01 – PJ.02-01-06 OSED-SPR-INTEROP (Final) Part I – 01.00.00
- [41]D1.1.01 – PJ.02-01-06 OSED-SPR-INTEROP (Final) Part II – 01.00.00
- [42]D1.1.01 – PJ.02-01-06 OSED-SPR-INTEROP (Final) Part IV – 01.00.00
- [43]D1.1.01 – PJ.02-01-06 OSED-SPR-INTEROP (Final) Part V – 01.00.00
- [44]D1.1.03 – PJ.02-01-06 VALP (Final) Part I – 00.01.00
- [45]D1.1.03 – PJ.02-01-06 VALP (Final) Part II – 00.01.00
- [46]D1.1.03 – PJ.02-01-06 VALP (Final) Part IV – 00.01.00
- [47]D1.1.04 – PJ.02-01-06 VALR (Final) – 01.00.00
- [48]D1.1.05 – PJ.02-01-06 CBA – 01.00.00

²

Appendix A Service Description Document (SDD)

N/A

Appendix B Service Technical Design Document (STDD)



SESAR Technical
Service Contract Tem

Appendix C Optimised Separation Delivery in Mixed Mode Operations

Background

During the Real Time Simulation exercise RTS03a, the ORD and OSD tools showed certain limitations to operate mixed mode of operations as they worked separately with no integration. As a result, it was decided to further explore the optimisation of this mode of operations through a set of features to integrate the ORD and OSD data and provide it as support information to the controller. The aim is to enable an optimal and easy coordination between arrival and departure operations by optimizing the gap spacing using this set of information.

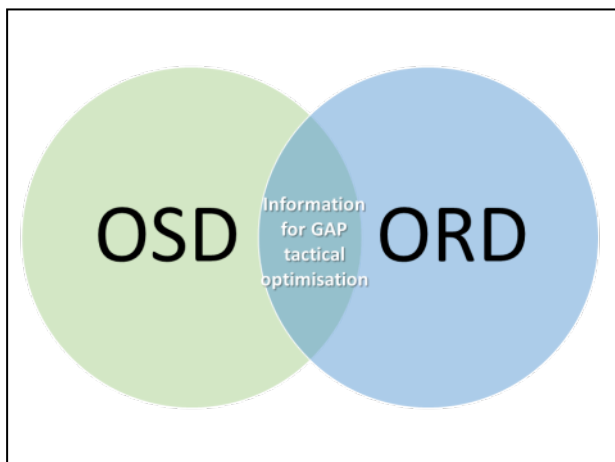


Figure 8: High level view of GAP information between ORD and OSD tools

Description

To cover the tactical management of runway throughput by fully optimizing the gap spacing when mixed mode is in operation on a runway at the airport support information is needed. The assessment of the actual situation of arrivals (on final leg) and the departures (moving to holding point) is assessed and compared to the requested spacing making use of the ORD and OSD separation data. The resulting information is transmitted to Approach and Tower controller as dynamic assistance for a more efficient coordination to optimize gap spacing

In order to give a clear overview of both arrival and departure runway operations at the airport, the Tower ATCO needs to have the integrated arrivals and departures information in a single list. This list shall provide as a minimum:

- The planned sequence of incoming arrivals and departures
- The separation to be applied between each departure pair based on the aircraft performance (OSD input)
- The position and value of the gaps that are inserted with the ORD tool between arrivals pair to insert a certain number of departures (ORD input).

Further information that can help the ATCO when assessing the spacing are:

- The estimated time to touchdown for each arrival

- The spacing (in time) between arrivals pairs determined by the ORD tool not only for the GAP but also for the other constraints (Wake, MRS, ROT, ...)
- The information about the nature of the constraints both on arrivals and departures

It shall be noted that the list contains the planned sequence order; how this list is built and managed is not in scope of PJ02.01, this topic is treated in the SESAR Solution PJ02.08. The planned sequence order is an input for the Tower ATCO that can further review it by assessing the actual situation on the ground and in the air. The optimisation of the spacing (e.g. reducing a gap originally planned for 2 departures to 1 departure) might impact the sequence order. Thus it is requested to maintain updated the correct sequence order (e.g. automatically with a system support or manually with ATCO interactions over the system) in the list.

The sequence information should be provided to the ATCO early enough to be usable for the tower controller, at the same time the ATCO needs to receive information that is accurate and stable. In PJ02.01 RTS a look-ahead window of 10-15 minutes is envisaged knowing that there are many factors that can impact the stability of the sequence and the accuracy of the estimation.

Figure 9 represents an HMI example of the list used for the optimisation of separation delivery in Mixed Mode.

Gap	SEP	Callsign	Arr/Dep	AC Type	WTC	SID
Planning View						
		EZY23UF	A	B733	M	
Tactical View						
		AUA291B	D	A319	M	LEDVA3D
	1:00	BER463K	D	A320	M	KOXER1D
		LGL8857	A	DH8D	M	
	1:02	DLH64B	D	A319	M	LEDVA3D
	0:51	IBE88AE	D	B752	M	LEDVA3D
	0:57	AUA326D	D	DH8D	M	DITIS1D
	1:27	EZY24YF	D	B733	M	DITIS1D

Figure 9: Example of the list operating in Mixed Mode

This list in PJ02.01 RTS is coupled / integrated with the arrival sequencing tool (used by the ORD tool) and is divided in two:

- Planning view: in this block only arrivals aircraft are displayed ordered by the time of arrival and based on the input of the arrival sequencing tool.
- Tactical view: in this block arrivals and departures are merged together but are easily distinguished due to different colours.

In this list:

- The arrival aircraft will be displayed/inserted Planning View once they are inserted into the arrival sequence list of ORD and according to its order. Any changes in this list will trigger an update. Once they have exited their landing runway, they will disappear.
- Departures will be displayed/inserted when they entered a defined area of the airport (see picture below as example). Departures will be removed from the list after they are transferred from the Tower ATCO or are above a certain altitude threshold.

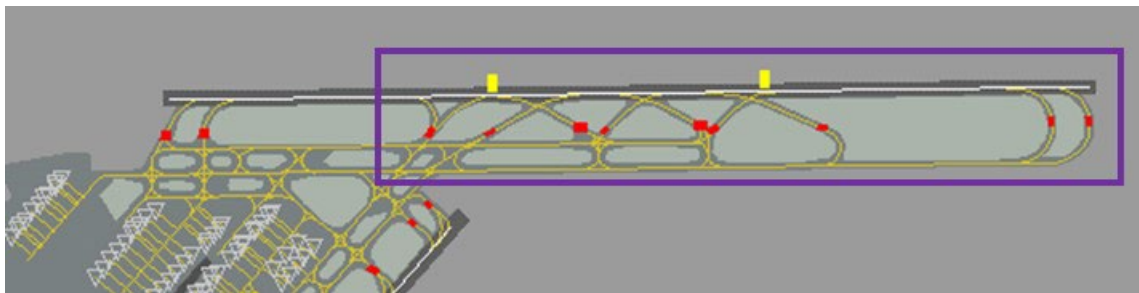


Figure 10: Example of a Runway Departure Detection Area

The ATCO receives an automatic sequence order; however, for optimising tactically the gap spacing he can change the order of the sequence list by dragging and dropping the departures entries.

Interactions between list and ATCO

Figure 11 presents a high-level overview of the interactions of the ATCO in Mixed Mode while managing the Gap and the automatic reactions to the ATCO manual actions that are provided as information support in the list.

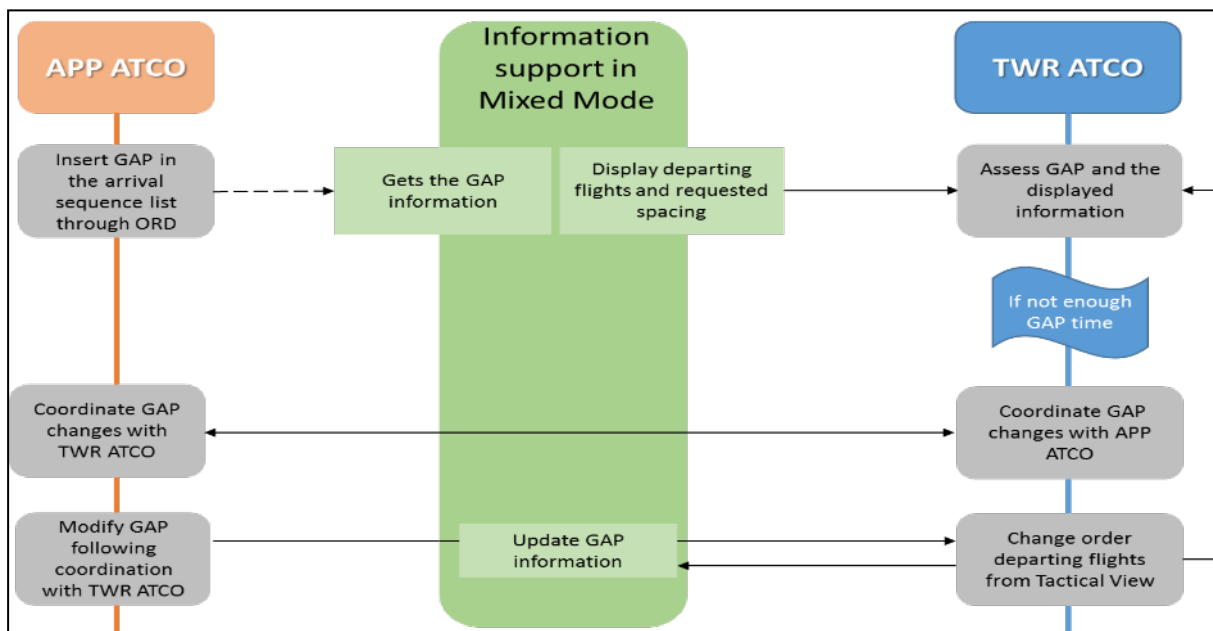


Figure 11: Overview of the ATCO interaction with the list

As Figure 11 reflects, the only ATCO that directly interacts with the list is the Tower Runway controller. Any change on the Gap spacing requires an initial coordination between the Tower Runway controller and the Approach controller that may be via different means (e.g. phone). Consequently, any change that approach control may perform to the GAP in the arrival sequence list (via the ORD tool) is reflected in the list available for the ATCO. This allows the Tower Runway controller to obtain a live update of the upstream actions and react accordingly.

The Tower ATCO has the capability to move a departure row earlier or further in the list to cover the following operational cases

- The runway controller desires to make space for one or more departures between two consecutive arrivals, by inserting the departure(s) between the two arrivals in the list he obtains obtaining the requested spacing. This might lead to request to the approach controller to increase GAP enough to make space for one or more departures.
- The runway controller detects that will not be possible to depart one or more aircraft. This might lead to request to the approach controller to reduce/cancel GAP.
- A departure could be moved further in the sequence list when we have a departure that is supposed to be cleared for line-up that is not ready / replying in time to your instruction (e.g. aircraft communicates they have a last-minute problem). So the controller decides to switch the next departure (which is coming from a different holding point) ahead in the sequence
- The runway controllers applies tactical vectoring after take-off to a couple of aircraft to manage their spacing constraint (e.g. SID) by giving to the departing sequence an order that is not considered feasible by the support information provided by the list.

To further explain the last bullet point, it is important to note that the list is a mere support tool for the ATCO which provides indications through the display of the information but does not consider the future actions that the ATCO may perform. For instance, after detecting a loss of separation for a departing pair on the same SID, the TWR ATCO could have in mind providing lateral deviations from the SID to both aircraft in order to avoid the infringement (see Figure 12).

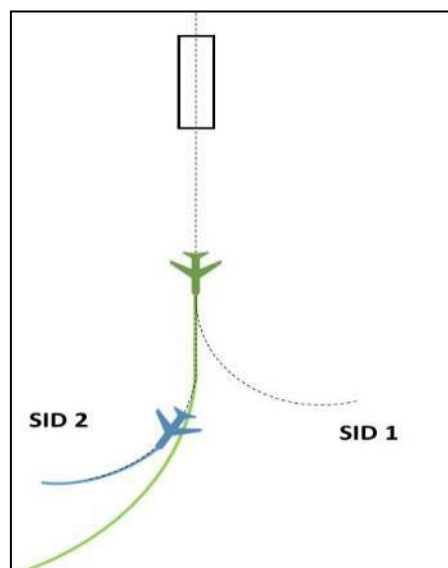


Figure 12: Example of a tactical ATCO action not considered by the list

Note that at this moment, there are still discussions whether it could be useful to introduce features related to alerting monitoring for the Tower ATCO (e.g. for loss of separation).

Manual interactions and associated information support

Each time that the ATCO performs a manual action through ‘drag and drop’ the order of the sequence is automatically checked for inconsistencies between the moved aircraft and the aircraft above and below the Tactical View. The system will generate warnings if it determines that the Gap is not sufficient or if departures are in the wrong order.

Departing A/C moved to	Warning message
Behind arrival	Need XXXs GAP (Insufficient GAP time with preceding arrival)
Behind departure*	Departure is not the first at the runway holding point
	Need XXXs GAP (Insufficient GAP time with preceding departure)
In front of arrival	Need XXXs GAP (Insufficient GAP time with next arrival)
In front of departure*	Departure is not the first at the runway holding point
	Need XXXs GAP (Insufficient GAP time with next departure)

Table 15: Manual sequence warnings

To generate such warnings, the list considers the following parameters:

- The Estimated time taxiing to reach the Holding point
- The Estimated Take Off Time
- The Estimated Landing Time
- The Separation time between departures computed by the OSD tool.

Based on the warning and the information received, (e.g. the amount of GAP in time necessary to adhere to the sequence selected) the Tower contacts the approach ATCO to verify whether is feasible to apply the proposed change to the GAP spacing Based on the coordination feedback the change could be applied or not. Using as example the request from the Tower ATCO to increase the GAP time from 180s to 195s in order to allocate two departures several cases could be possible:

- The approach ATCO confirms that the spacing can be increased and the change is applied
- The approach ATCO cannot apply the proposed change. It is then suggested to reduce the spacing from 180s to 120s (sufficient for 1 departure).
- The approach ATCO cannot apply the proposed change and nothing is done.

-END OF DOCUMENT-

