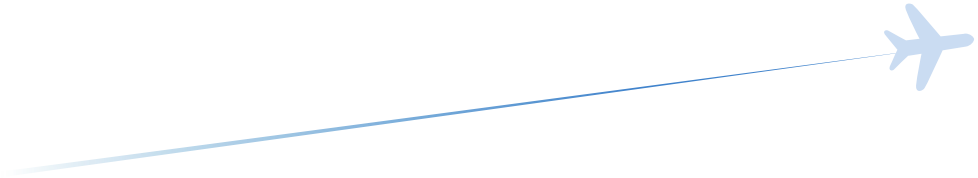

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Copyright Statement

PJ02 EARTH

INCREASED RUNWAY AND AIRPORT THROUGHPUT

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

Abstract

This SPR-INTEROP/OSED presents the concept of Minimum Pair Separations Based on Required Surveillance Performance (RSP) in support of a reduction of the in-trail Minimum Radar Separation from 2.5 NM to 2 NM on final approach so as to provide a direct positive impact on runway throughput (Capacity, Efficiency and Resilience).

The Concept starts in SESAR2020 W1 as V2 and target V3 at the end of SESAR2020 W1, all materials has been developed to reach the V3 maturity level.

Table of Contents

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

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

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1 Executive Summary

This SPR-INTEROP/OSED presents the operational concept of Minimum Pair Separations Based on Required Surveillance Performance (RSP) in support of a reduction of the in-trail Minimum Radar Separation (MRS). MRS reduction is foreseen from 2.5 NM to 2 NM on final approach so as to provide a direct positive impact on runway throughput (Capacity, Efficiency and Resilience).

The Concept starts in SESAR2020 W1 as V2 and target V3 at the end of SESAR2020 W1, all materials has been developed to reach the V3 maturity level.

The in-trail MRS constraint on final approach is currently typically 3 NM, or can be 2.5 NM under certain conditions as prescribed by local regulations. The benefits that can be gained from the wake turbulence separation optimisation concepts for arrivals, including Time Based Separation (TBS), Static Pair Wise Separation (S-PWS) and Time Based Static Pairwise Separation (TB S-PWS), are limited by the in-trail 2.5 NM MRS on final approach. This solution aims to address this issue by facilitating a reduction of the in-trail MRS on final approach to 2 NM.

The Air Traffic Controllers retain responsibility for spacing and delivery on final approach, application of the in-trail 2 NM MRS on final approach will be dependent on the surveillance service being employed and of course satisfying the RSP requirements for 2 NM separation. The spacing required between arrival pairs will also be constrained by other factors such as satisfying the Runway Occupancy Time (ROT) requirements for clearance to land, which is being addressed by the Optimised Runway Delivery (ORD) ATC tool support being developed and validated in SESAR Solution PJ02-01.

The RSP requirements for 2 NM separation on final approach will need to be established in such a way that the requirements can be applied to the changing technological and operational environments of the future. As such, all requirements are to be general performance requirements that are disengaged from a specific technological implementation. The proposed approach to establishing these RSP requirements for 2 NM separation is the expert judgement and modelling extrapolation of the RSP requirements that have been set in Europe for the 5 NM and 3 NM horizontal separations.

Overall cost efficiency will be ensured by considering revision of the MRS on the basis of the performance of currently deployed surveillance technology options for final approach at large and medium airports.

The proposed application of the in-trail 2 NM MRS on final approach is to be demonstrated as safe in design and in application by the controllers responsible for setting up and delivering the arrival aircraft spacing on final approach.

The main development and validation needs include establishing the RSP requirements for 2 NM separation on final approach with particular focus on the safety assurance evidence, the characterisation of the actual performance of currently deployed surveillance technologies employed on final approach at large and medium airports, the validation of the impact of the in-trail 2 NM MRS on the controller delivery of the arrival spacing on final approach with particular focus on the human performance and safety assurance evidence, and the development and validation of the business case with particular focus on the benefits evidence.

2 Introduction

2.1 Purpose of the document

This document[1] provides the requirements specification, covering functional, non-functional and interface requirements related to SESAR Solution PJ02-03.

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

2.2 Scope

This is the SPR-INTEROP/OSED for SESAR Solution PJ02-03 for the V3 pre-industrial development & integration maturity phase.

2.3 Intended readership

The intended readership is the SESAR Solution PJ02-03 project members, the other solutions in SESAR Project PJ02 Increased Runway and Airport Throughput, the related solutions in SESAR Project PJ01 Enhanced Arrivals and Departures, the related solutions in SESAR Project PJ04 Total Airport Management, the related solutions in SESAR Project PJ09 Advanced Demand & Capacity Balancing, the related transversal SESAR Projects PJ19 and PJ22, and all impacted and interested stakeholders.

2.4 Background

RSP has been established for 5 NM and 3 NM horizontal separations through the EUROCONTROL specification [46].

A Separation Minima Model has been developed in the EC-6FP RESET Project [47], and applied to investigate and propose preliminary RSP requirements for the reduced minimum pair arrival separation of 2 NM [48].

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

The impact of employing the in-trail 2 NM MRS on final approach on the controller delivery performance was investigated in SESAR 1 P06.08.01 in the context of employing Time Based Static Pairwise Separation with Optimised Runway Delivery on final approach [44][45].

The proposed RSP requirements and the results of the validation on the controller delivery performance to the in-trail 2NM MRS on final approach have been consolidated into the SESAR 1 OFA 01.03.01 deliverables [41][42][43].

2.5 Structure of the document

The SPR-INTEROP/OSED consists of five parts:

- Part I, this part, providing the Safety and Performance Requirements (SPR) and Interoperability Requirements (INTEROP) related to SESAR Solution PJ02-03 Minimum Pair Separations Based on Required Surveillance Performance (RSP), that have been developed and validated during SESAR Solution PJ02-03. They are presented in the context of the Operational Service and Environment Definition (OSED) which, describes the environment, assumptions and other issues that are applicable to the SPR and INTEROP requirements.
- Part II: The Safety Assessment Report which describes the results of the safety assessment work for the SESAR Solution PJ02-03 concept solution that justify the associated SPR and INTEROP requirements in the Part I.
- Part IV: The Human Performance Assessment Report which describes the results of the Human Performance Assessment Report which describes the results of the Human Performance assessment work for the SESAR Solution PJ02-03 concept solution that justify the associated SPR and INTEROP requirements in the Part I.
- Part V: The Performance Assessment Report (PAR) that consolidates the performance results obtained across the different validation activities at the SESAR Solution PJ02-03 concept solution level.

This part of the SESAR Solution PJ02-03 SPR-INTEROP/OSED (Part I) consists of five main sections and an appendix. Each section, and the appendix, addresses the SESAR Solution PJ02-03 Minimum Pair Separations Based on Required Surveillance Performance (RSP) concept solution.

- Section 1: Executive Summary of the brief description of the concepts solutions and the associated research needs gaps and issues.
- Section 2: Introduction covering the purpose of the document, the scope, the intended readership, the background to the V2 feasibility maturity level of the concept at the end of SESAR 1, the glossary of terms and the list of acronyms.
- Section 3: The Operational Service and Environment Definition detailing the concept solution and the improvements, expected benefits, allocated validation targets, key features and capabilities, any dependencies on other SESAR 2020 solutions, operational characteristics, roles and responsibilities, technical characteristics, applicable standards and regulations, previous operating method, new operating method, use cases, and differences between the new and previous operating methods.

- Section 4: The Safety, Performance and Interoperability Requirements (SPR-INTEROP) established developed and validated in SESAR Solution PJ02-03.
- Section 5: References and Applicable Documents
- Appendix A: Costs and Benefits Mechanisms including stakeholders identification and expectations, benefits mechanisms and costs mechanisms.

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 [41]
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 [41]
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 [41]
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 [41]
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 [41]
TBS	Refers to the generic TBS concept that was developed in SESAR 1 Project P06.08.01 which	OFA 01.03.01 Enhanced Runway Throughput

	included tool support to show the Controller the required separation.	Consolidated Final Step 1 OSED [41]
WDS (arrivals)	There are two versions: WDS (total wind) and WDS (crosswind). 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. 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.	OFA 01.03.01 Enhanced Runway Throughput Consolidated Final Step 1 OSED [41]

Table 1: Glossary of terms

2.7 List of Acronyms

Acronym	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

Acronym	Definition
AROT or aROT	Arrival Runway Occupancy Time
ATC	Air Traffic Control
ATCo	Air Traffic Controller
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
DDI-D	Dynamic Departure Indicator - Distance
DDI-T	Dynamic Departure Indicator - Time
DER	Departure End of the Runway
DF	Deceleration Fix (for landing stabilisation)
DLR	Deutsches Zentrum für Luft- und Raumfahrt

Acronym	Definition
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 6th 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
HIRO	High Intensity Runway Operations
HMI	Human Machine Interface
HPAR	Human Performance Assessment Report
Hz	Hertz
IAF	Initial Approach Fix

Acronym	Definition
ICAO	International Civil Aviation Organisation
IAS	Indicated Air Speed
ILS	Instrument Landing System
INTEROP	Interoperability Requirements
ITD	Initial Target Distance
kg	kilograms
KIAS	Knots Indicated Air Speed
KPA	Key Performance Area
kt or kts	knots
KTAS	Knots True Air Speed
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

Acronym	Definition
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

Acronym	Definition
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
SME	Subject Matter Expertise
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

Acronym	Definition
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
WTC	Wake Turbulence Category
WTE	Wake Turbulence Encounter
WVE	Wake Vortex Encounter

Table 2: List of acronyms

3 Operational Service and Environment Definition

3.1 SESAR Solution PJ02-03: Minimum Pair Separation Based on RSP: a summary

SESAR Solution PJ02-03 aims to develop and validate the concept of Minimum Pair Separation Based on Required Surveillance Performance (RSP) in support of a reduction of the in-trail Minimum Radar Separation from 2.5 NM to 2 NM on final approach so as to provide a direct positive impact on runway throughput (Capacity, Efficiency and Resilience).

SESAR Solution PJ02-03 is part of the High Performing Airport Operations Project PJ02.

As airports remain one of the most significant bottlenecks in the ATM, the reduction of the in-trail Minimum Radar Separation from 2.5 NM to 2 NM on final approach represents great potential for system wide improvements.

- **Runway Capacity:** The reduction of separation has a direct impact on runway throughput and therefore runway capacity.
- **Efficiency:** The reduction of the separation will have a big impact in the efficiency of using the runway, the increase in the runway throughput resulting in the more efficient use of the runway.
- **Resilience:** The change introduced by this solution is based on the non-constraining wake factor, if the headwind conditions on final approach change for example the ATCO will be informed and the separation will be adapted accordingly. Thus the time separation for non-wake constrained pairs may be stabilised beyond that of the current in-trail 2.5 NM MRS constraint to that of the new 2 NM MRS constraint.
- **Human Performance:** The change of the separation will have manageable impact on ATCO workload; the main change will impact the ATCO training.
- **Cost efficiency:** The implementation of the new separation in congested large and medium airports can be seen as an increase in cost, with the gain in the runway throughput more than off-setting this increase in cost. It is not expected that this solution will provide benefits to small and very small airports.

There is a dependency on the Optimised Runway Delivery tool support being developed and validated in SESAR Solution PJ02-01 taking into account the runway occupancy time related clearance to land spacing when calculating the required spacing between each arrival pair to be delivered to the runway landing threshold in the forecast prevailing runway surface and final approach wind conditions. It is insufficient to just deliver to the in-trail 2 NM MRS without due consideration of the required runway occupancy time related clearance to land spacing in the forecast prevailing runway surface and final approach wind conditions for each arrival pair.

From the PJ19, D4.5, Validation Targets (2018) **Error! Reference source not found.** the following validation targets are allocated to SESAR Solution PJ02-03:

KPA/Sub-Operating Environment	Sub-Operating Environment 1 V Large Airports	Sub-Operating Environment 2 Large Airports	Sub-Operating Environment 3 Medium Airports
CAPACITY	Validation target 1 1.299%	Validation target 2 1.299%	Validation target 3 1.299%
KPA2 FEFF	Validation target 1 2.512kg/flight	Validation target 2 2.094kg/flight	Validation target 3 1.466kg/flight
KPA3 CEF	Validation target 1 0.276%	Validation target 2 0.230%	Validation target 3 0.161%
KPA4 RESILIENCE	Validation targets not defined – Resilience is considered to be a design goal		
KPA5/TA SAFETY	Validation target 1 -2.32%	Validation target 2 -2.32%	Validation target 3 -2.32%
TA HUMAN PERFORMANCE	Validation targets not defined – Human Performance is considered to be a design goal		

Table 3: SESAR Solution PJ02-03 Validation targets

The scope and related OI steps for SESAR Solution PJ02-03 are summarised Table 4.

OI Step code	OI Step title	OI Step coverage
AO-0309	Minimum Radar Separations based upon Required Surveillance Performance (RSP)	
The runway capacity is improved thanks to the application (by ATC) of a non-wake turbulence separation down to 2 NM for arrivals on final approach (at the point that the leading aircraft in the pair crosses the runway threshold), based upon Required Surveillance Performance (RSP). This Minimum Radar Separation (MRS) could be applied when separation is not constrained by wake turbulence, either because of favourable weather conditions (e.g. cross wind) or simply when the pair-wise wake turbulence separation is shorter than MRS.		

Table 4: SESAR Solution PJ02-03 Scope and related OI steps

Table 5 summarizes the High Level Operational Requirements applicable to the SESAR Solution in the CONOPS maintained by PJ19.

Id	High Level CONOPS Requirement Description	CONOPS section
S02-03-HLOR-01	The Reduced Minimal-pair Separation shall Increase runway throughput by: • reducing the arrival separation of non-wake turbulence constrained aircraft pairs to 2.0 NM through: • the implementation of appropriate Required Surveillance Performance standards	Airport Operational Scenario Execution Phase: Arrival Airport Operational Scenario Long Term Planning

Table 5: Link to CONOPS

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

No Deviation

3.2 Detailed Operational Environment

3.2.1 Operational Characteristics

Operational interactions per context (NOV-2)	Operating Environment
[NOV-2] MRS	Airport;
Comment	
SESAR Solution PJ02-03 aims to develop and validate the concept of Minimum Pair Separation Based on Required Surveillance Performance (RSP) in support of a reduction of the in-trail Minimum Radar Separation from 2.5 NM to 2 NM on final approach of Large and Medium Airports and TMA Very High Complexity, TMA High Complexity and TMA Medium Complexity sub-operational environments so as to provide a direct positive impact on runway throughput (Capacity, Efficiency and Resilience) during periods of capacity constrained operations. It is not anticipated that this concept will be applied to Small Airports and TMA Low Complexity sub operational environments (see [13]) as it is not anticipated that these types of sub operational environments will have periods of capacity constrained operations. The runway configurations and modes of operations employed at Large and Medium Airports include: • Single runway operating in mixed mode operations • Independent parallel runways operating in segregated mode operations • Dependent parallel runways operating in segregated mode operations with the option of some arrival aircraft landing on the designated departure runway • Closely spaced parallel runways operating in segregated mode operations	

- Closely spaced parallel runways operating in mixed mode operations

In an operational environment without the ORD tool, a 2.5 NM separation/spacing minimum may be provided until a defined fix other than the runway threshold (under certain wind conditions). This remains a 2.5 NM procedure with a 2.5 NM MRS; furthermore, as such it is not treated as a case of 2 NM MRS procedure (reference this to all studies done in REDSEP).

Final Approach Characteristics

Final approach segment is described in ICAO Doc 8168 [47]. For precision approach, the final approach segment begins at the Final Approach Point (FAP). This is a point in space on the final approach track where the intermediate approach altitude / height intercepts the Instrument Landing System (ILS) / Microwave Landing System (MLS) glide path elevation angle.

Typically, the intermediate approach altitude / height generally intercepts the ILS / MLS glide elevation angle at heights from 300 m (1,000 ft) to over 1,200 m (4,000 ft) above runway elevation. In this case, for a 3° ILS / MLS glide path angle, interception occurs between 6 km (3 NM) and 37 km (20 NM) from the runway landing threshold.

In TMA controlled airspace, runway glideslope interception by arrivals can occur up to over 4,000 ft and up to 20 NM from runway threshold.

Figure 1 provides an illustration of a typical final approach segment with different possible altitudes of glide path interception and approach speeds.

A variety of local procedural airspeed profiles are employed on final approach as illustrated for the specimen final approach segment below. These are typically between 220 knots and 160 knots on joining the final approach localizer, reducing to between 180 knots and 160 knots to the start of landing speed stabilization, with landing speed stabilization starting from between 6 NM and 4 NM from the runway landing threshold.

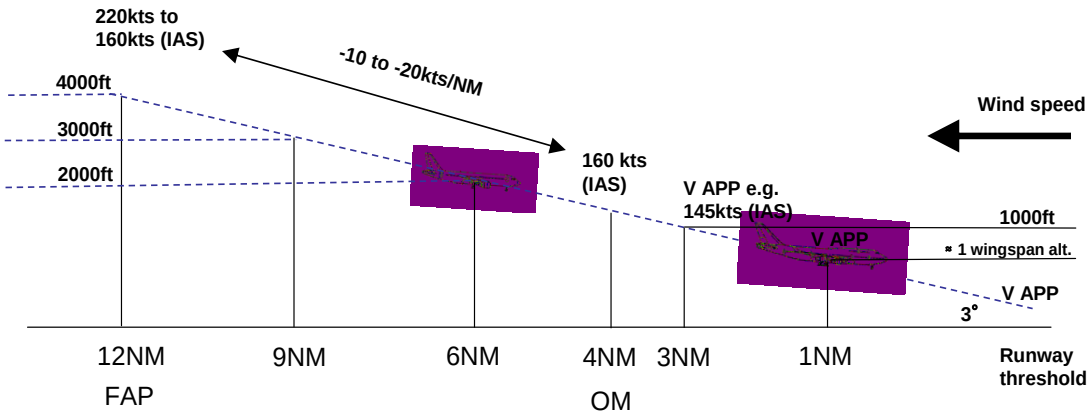


Figure 1: Example Final Approach

The landing stabilization speed profiles, starting from around 6 NM to 4 NM from the runway landing threshold until touchdown, vary considerably depending on aircraft type, landing weight, stabilization altitude, stabilization mode, and the associated airline operator cockpit procedures. The range of stabilization airspeeds varies from under 100 knots for some Light wake category aircraft types to over 160 knots for some Heavy wake category aircraft types.

During the final approach phase all distance separations tend to reduce due to the global reduction of the arrival aircraft airspeed from the interception of the glideslope until crossing the runway landing threshold to touchdown. There can be pull-away conditions where the distance spacing increases particularly when there are very strong headwinds on interception changing to moderate crosswinds by the runway landing threshold due to the headwind reducing more than the reduction in the airspeed of the lead aircraft and so the ground speed increasing.

In a first phase covering interception of the glideslope until commencing the landing stabilization procedures starting at the Deceleration Fix (DF) usually at 4 NM from the runway landing threshold, the airspeed variations are coherent for all aircraft and dictated by the procedural airspeed profiles. In this phase the compression is relatively predictable. The final approach controller anticipates the compression to reach the initial spacing at the DF. During this phase, there is no or very limited time separation variation.

In a second phase, the separation distances continue globally to reduce but in different proportions as a function of the leader and follower final approach airspeed profiles. The time separations may vary significantly in this phase. The follower is gaining or loosing time compared to the leader aircraft. At the first order, the time lost or gained is driven by the final approach airspeeds of the leader and follower and therefore by the pair of aircraft types. However, if one observes the time variation for a given pair for a large range of headwind profiles along the glide, it appears that the wind has a second order effect that cannot be neglected.

As well as considering the applicable separation (WT or MRS) and the effect of compression, the final approach controller may also need to allow for addition spacing due to the ROT (for example A380-A380 pairs will be constrained by ROT) through the application of associated Spacing Minima or more refined pairwise ROT Spacing.

Table 6: Operational Characteristics

3.2.2 Roles and Responsibilities

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

Operational interactions per context (NOV-2)		Operating Environment
[NOV-2] MRS		Airport;
Node	Node instance	Node instance description
En-Route/Approach ATS	Approach Supervisor	Is aware of the wind conditions, and for deciding and agreeing to the application (if required) of in-trail Spacing Minima below 2.5 NM enabled by the in-trail 2 NM MRS in consultation with the Tower Supervisor. Responsible for ensuring the separation policy information, and associated planned changes, is available, set up, and maintained consistently in the arrival Separation Delivery tool support for Approach ATC.

		Responsible for ensuring that flight crew are informed of the application of the in-trail Spacing Minima below 2.5NM (if required) for example, through D-ATIS.
En-Route/Approach ATS	Final Approach Control	Responsible for ensuring that the arrival aircraft information used by the Separation Delivery tool to calculate the TDIs is correct. This includes the arrival sequence order intent, and the flight specific aircraft information such as the aircraft type, the landing speed intent, and in the case of parallel active duty runways-in-use, the landing runway intent of each aircraft. Uses the Separation Delivery tool to ensure final approach separations are set up consistently and efficiently. Uses the Separation Delivery tool to monitor that separations remain consistent as aircraft descend on final approach, so as to enable timely intervention action to be taken when there is separation infringement.
Flight Deck	Flight Crew Follower Aircraft	Is aware of the applicable Spacing Minimum in operation and the impact on the distance separation set up on final approach. Is informed of when an in-trail Spacing Minima of less than 2.5 NM enabled by the in-trail 2 NM MRS is being employed on final approach (if required), for example, through D-ATIS. Reports critical weather and WT information to ATC.
Flight Deck	Flight Crew Leader Aircraft	Is aware of the applicable Spacing Minimum in operation and the impact on the distance separation set up on final approach. Is informed of when an in-trail Spacing Minima of less than 2.5 NM enabled by the in-trail 2 NM MRS is being employed on final approach (if required), for example, through D-ATIS. Reports critical weather and WT information to ATC.
En-Route/Approach ATS	Initial Approach Control	Responsible for ensuring that the arrival aircraft information used by the Separation Delivery tool to calculate the TDIs is correct. This includes the arrival sequence order intent, and the flight specific aircraft information such as the aircraft type, the landing speed intent, and in the case of parallel active duty runways-in-use, the landing runway intent of each aircraft. Uses the Separation Delivery tool to ensure final approach separations are set up consistently and efficiently. Uses the Separation Delivery tool to monitor that separations remain consistent as aircraft descend on final approach, so as to enable timely intervention action to be taken when there is separation infringement.
Aerodrome ATS	Tower Runway Control	Uses the Separation Delivery tool to monitor that separation / spacing remain consistent as aircraft descend on final approach, so as to enable timely intervention action to be taken when there is separation infringement.

		Monitors runway occupancy, and runway conditions, and ensures separation/spacing minima policy is consistently maintained to support the runway conditions, and changes to the runway conditions. Receives, from different sources, and disseminates to the flight deck, critical WT and weather information, when needed.
Aerodrome ATS	Tower Supervisor	Is aware of the wind conditions, and for determining and deciding on the application (if required) of in-trail Spacing Minima below 2.5 NM enabled by the in-trail 2 NM MRS. Responsible for ensuring the separation/spacing minima policy information, and associated planned changes, is available, set up, and maintained consistently in the arrival Separation Delivery tool support for Tower ATC. Responsible for ensuring runway conditions, and planned and forecast changes to the runway conditions, are reflected in the separation/spacing minima policy information.

Table 7: Roles and Responsibilities

3.2.3 Technical Characteristics

Technical constraint	description
2 NM MRS	This section describes the technical characteristics and constraints that define the context in which the technical requirements are applicable for delivering in-trail separation and spacing on final approach with a 2 NM MRS. In order to be able to apply the in-trail 2 NM MRS on final approach the Final Approach Controller and the Tower Runway Controller will need to be provided with and utilise the surveillance service that has a safety case the conforms to the Required Surveillance Performance (RSP) requirements for the 2 NM separation. Candidate surveillance services include the Primary & Secondary Surveillance services, the Wide Area Multilateration (WAM) Service, and the ADS-B Surveillance Service. The approach procedures that the in-trail 2 NM MRS is required to be applied include the precision ILS / MLS approach procedures, the GBAS approach procedures and the RNAV/GNSS non-precision approach procedures. It is envisaged that the in-trail 2 NM MRS is being applied in conjunction with the TBS, S-PWS and WDS concepts for arrivals and thus with the ORD support tool. This includes in conjunction with the consideration of the Spacing Minima and Runway Occupancy Time (ROT) spacing for clearance to land. The ORD support tool assists Controllers in coping with the effect of compression on final approach by providing support to show the

	Controllers the spacing that needs to be delivered at the Deceleration Fix (DF) in order to achieve the required separation/spacing on final approach to the runway landing threshold. The support tool will require to be enhanced to support the in-trail 2 NM MRS and associated additional Spacing Minima on final approach. As already being addressed in SESAR Solution PJ02-01 the ORD support tool requires a reliable approach arrival sequence service that includes support for mixed mode operations. The ORD support tool also requires a reliable wind forecasting and monitoring service at the runway surface and along the final approach path for supporting the resilient delivery to both time based wake separation and time based runway occupancy time spacing for clearance to land by calculating the associated distance spacing in the forecast prevailing wind conditions. The reliable wind forecasting and wind monitoring service is also required for supporting consistently managing the spacing compression on final approach by calculating the anticipated distance spacing compression in the forecast prevailing wind conditions. For enabling delivery of in-trail separation and spacing on final approach to a 2NM MRS the following is needed for operational deployment: • Surveillance Service provision to the Final Approach Controller and the Tower Runway Controller with a safety case that conforms to the Required Surveillance Performance (RSP) requirements for the 2 NM separation • ORD tool support that includes consideration of the runway occupancy time spacing for clearance to land • Local environment weather information and wind forecasting capabilities for the associated services required by the ORD support tool

Table 8: Technical characteristics

3.2.4 Applicable standards and regulations

3.2.4.1 RSP Requirements for 2 NM Separation on Final Approach

The RSP requirements for 2 NM separation on final approach will need to be established in such a way such that the requirements can be applied to the changing technological and operational environments of the future and thus are required to be general performance requirements that are disengaged from a specific technological implementation. The proposed approach to establishing these RSP requirements for 2 NM separation is the expert judgement and modelling extrapolation of the RSP requirements that have been set in Europe for the 5 NM and 3 NM horizontal separations.

A Separation Minima Model has been developed in the EC-6FP RESET Project [47], and applied to investigate and propose preliminary RSP requirements for the reduced minimum pair arrival separation of 2 NM [48]. Further consideration has resulted the proposed preliminary RSP requirements in Table 9.

Candidate surveillance services include the Primary & Secondary Surveillance services, the Wide Area Multilateration (WAM) Service, and the ADS-B Surveillance Service.

The approach procedures that the in-trail 2 NM MRS is required to be applied include the ILS / MLS precision approach procedures, the GBAS approach procedures and the RNAV/GNSS non-precision approach procedures.

	Metric Description	3 NM Target	2 NM Target
R1	Measurement interval for PU assessments	≤ 5 seconds	≤ 4 seconds
R2	PU of horizontal position	97% for 100% of flights, any below 97% to be investigated	97% for 100% of flights, any below 97% to be investigated
R3	Ratio of missed 3D position in long gaps	<0.5%	<0.25%
R4	Horizontal position RMS error	300m global	200m global
	Number of Investigations	330m for 100% flights any above 330m to be investigated	220m for 100% flight, any above 220m to be investigated
R7	PU of correct pressure altitude	96% global	96% global
R8	Forwarded pressure average data age	< 2.5 seconds	< 2.5 seconds
R10	Ratio of incorrect forwarded pressure altitude	< 0.1%	< 0.1%
R11	Pressure altitude unsigned error	98.5 percentile less than 300 ft. (climbing/descending)	98.5 percentile less than 300 ft. (climbing/descending)
		99.9 percentile less than 300 feet (stable)	99.9 percentile less than 300 feet (stable)
R12	Emergency Code Changes delayed > 7.5 seconds	0	0
	SPI indicator delayed >7.5 seconds	0	0
R13	Number of aircraft identity changes delayed > 15 seconds	0	0
	Number of Mode S callsign changes delayed > 15 seconds	0	0
R14	PU of correct ac identity	> 98% global	> 98% global
R15	Ratio of incorrect ac identity	< 0.1%	< 0.1%

Table 9: Extrapolated targets for 2 NM compared to 3 NM targets (PU = Probability of Update)

3.3 Detailed Operating Method

3.3.1 Previous Operating Method

3.3.1.1 Scope

The operating method covers from the arrival aircraft crossing the Initial Approach Fix (IAF) until the aircraft vacates the runway. This is in the context of current operations employing the 3 NM and 2.5 NM MRS on final approach. There exists also a possibility at certain airports, of applying defined visual based procedures allowing a Reduced Separation in the Vicinity of the Aerodrome below the 2.5 NM MRS.

It is foreseen that a 2 NM MRS can be applied on final approach in one of the following two operational environments:

- By incorporating the utilisation of the ORD tool and encompassing spacing requirements including the ROT Spacing and associated Spacing Minimum and the Wake based separation (RECAT EU, WDS, PWS and TBS).
- Without the ORD tool: RECAT EU with 2 NM MRS under headwind condition to cover the required ROT Spacing and associated Spacing Minimum and the ICAO Wake based separation under headwind condition (high headwind component) for all possible ICAO Medium-Medium wake category pairs and their required ROT Spacing

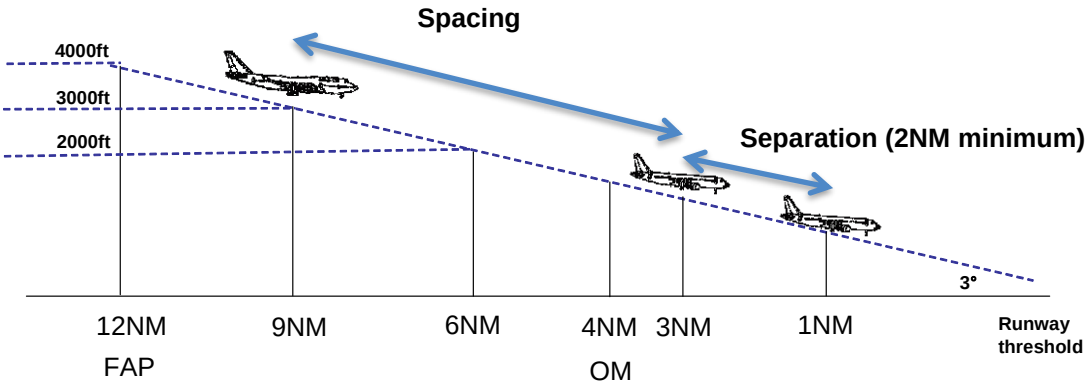
Spacing is a concept where a requirement is defined to consider a planned landing rate with respect to the mode of runway operation (e.g. mixed mode or segregated) and including other parameters such as LVP requirements and potentially additional buffers to include increased or a variable required ROT Spacing and associated Spacing Minima on the runway.

Separation is defined with a minimum and thus even 0.1 NM less than the minimum defined separation is subsequently defined as an infringement of the separation requirement.

The ORD tool will take in to account the winds and deceleration aspects of the leading aircraft to ensure that the FTD Indicator for the following aircraft will never display less than the greater of the defined spacing or minimum separation and the ITD Indicator for the follower aircraft will display the FTD Indictor distance plus the remaining anticipated landing stabilisation deceleration phase distance spacing compression until the lead aircraft crosses the runway landing threshold.

Without the ORD tool, ATC must provide for additional spacing further back on final approach so as to ensure either at a defined deceleration fix or the runway threshold regardless of wind and realised required ROT Spacing and associated Spacing Minimum on landing, the minimum separation will be respected as far as is practical given the uncertainties being managed.

The following image illustrates the differences in concepts of spacing vs. minimum separation.



The Air Traffic Control (ATC) procedures for an aircraft approaching an aerodrome will be specific to each airport. This section summarises the standard procedures used to transition an arriving aircraft through the TMA and approach to landing and vacating the runway.

The following illustrates current operations at three European Primary Airports and identify requirements for spacing i.e. planned runway throughput, realised AROT, departure intervals and LVPs. Along with spacing requirement legal MRS separations are identified as well as secondary requirements such as land after clearances.

3.3.1.1.1 Separation and spacing – Paris CDG

- In CDG the MRS is 3 NM until 12 NM on final Approach. After 12 NM the MRS is reduced to 2.5 NM. It can go below this separation only with visual separation between the two aircraft (visual separation with pilot responsible, in CDG visual separation by tower is not allowed, see later point), which requires a heavy phraseology, as described by the ATCOs. As a result, the procedure is rarely used in CDG.

- CDG - MRS is 2.5 NM. Separation delivery point is the runway threshold. 2.5 NM MRS separation at any point on the path from 12 NM. Not allowed to go below 2.5 NM MRS at any point, a go-around is instructed otherwise. Controllers add buffer and so target more than 2.5 NM to ensure that the 2.5 NM MRS is not infringed.

- STCA: active down to 500ft AGL, displayed to both APP and TWR ATCO. Is triggered based on time projection (actual separation might be slightly infringed without trigger if trajectories are diverging or as a result of the speed of the a/c that would keep the required separation). It is tuned such as to avoid infringements of more than 0.25 NM.

- If the STCA alert occurs and there is still time to apply a visual separation, the ATCOs could request responsibility for visual separation by the pilot. In this case, although the STCA will be triggered, they won`t take it into account but they will have to file a report (as the alert is seen as well by the Safety team).

- The TWR controller has to check if the RWY is vacated in so far as runway separation (actual resulting separation on the runway between subsequent arrivals or departures) can be maintained with actual AROT's. The approach controller can initiate a request with the aircraft for visual separation however; the CDG TWR controller cannot assume responsibility for longitudinal separation on approach even if in visual conditions.

- In CDG in today's operations a 2.5 NM Spacing Minimum is applied if leader is a Medium (upper and lower). Can't do it with a Heavy as a lead because of the ROT Spacing requirements of Heavy lead aircraft. In RECAT-EU wake separation table it`s possible for CAT-C – CAT-B to be 2.5 NM and CAT-B – CAT-B to be 3NM wake separations but this is not currently possible in CDG operations due to regulatory requirements. Need to do a safety case to allow RECAT-EU wake separation of less than the ICAO 4 NM when Heavy is a lead.

- Multiple clearances for landing: up to 3 consecutive aircraft can be instructed (but responsibility is with ATC, if needed Go Around will be instructed

3.3.1.1.2 Separation and spacing – London Heathrow

- The MRS of 2.5 NM may be applied between specific individual pairs of aircraft following the same final approach track or between an individual aircraft on base leg and a preceding aircraft on the final approach track, provided that:
    - The second aircraft of any given pair is within 20 NM of the threshold.
    - The radar source being used must have an update rate of 5 seconds or less.
    - Appropriate wake turbulence separation is not required between the specific individual pairs of aircraft.
    - The specific individual pairs of aircraft are closely monitored and when necessary speed adjusted by the final approach controller to ensure that spacing does not erode below the MRS of 2.5 NM.

- The standard final approach spacing requirement to be employed will be 3 NM. However, without compromising safety, it is incumbent on the Tower Supervisor to utilise runway capacity to its best effect.

- Therefore, subject to operational constraints and after co-ordination with the Tower Runway Controller, the Tower Supervisor may offer Approach ATC a reduction in final approach spacing below 3 NM.

- At all times, the Tower Runway Controller is the final arbiter when determining final approach spacing requirements.

- The Tower Supervisor shall only offer a reduction in standard final approach spacing below 3 NM when the conditions detailed below are met:

- The Tower Runway Controller is able to provide reduced separation in the vicinity of an aerodrome when the following aircraft passes 6.5 NM from touchdown
- Braking Action is good. The final approach spacing outside 4 DME should not be reduced below 3 NM if reports of adverse braking action have been received or if runway occupancy times are adversely affected by runway contaminants such as slush, snow or ice.
- The Aerodrome Traffic Monitor (ATM) is serviceable.
- The key runway exits must be open and available for use.

- Theoretically can reduce the final approach spacing to 2.5 NM at 4NM to get 2 NM at the runway threshold, this is okay under certain wind conditions (strong headwind) when the resulting ground speed of the follower aircraft is such that 2 NM provides for sufficient time for clearance to land, and in visual conditions where RSVA can be applied from the VCR from when the lead aircraft crosses 4 DME and the follower aircraft is 6.5 NM from touchdown.

- Approach ATC have a Separation Monitoring Function (SMF), a warning is produced when the separation between a/c reduces below 2 NM on final approach before the lead aircraft crosses the DF at 4 DME. Additionally the Approach ATCOs are responsible for providing sufficient contingency for spacing compression inside the DF, therefore the ATCOs sometimes aim for a 2.7 NM spacing as the lead aircraft crosses the DF at 4DME to allow for a sufficient buffer for accommodating the spacing compression.

- Tower ATC has no Separation Monitor Function, they have an Approach Funnel Deviation Alert System to the limits of low level SSR coverage on final approach which is typically around 1NM from the runway landing threshold.

- Tower ATC can accept responsibility for separation management on final approach (RSVA) but only under VMC and when the follower aircraft is within 6.5 NM from touchdown.

- The “land after” instruction is used, being UK specific, not ICAO. It is instructed only in daytime, not based on distance and only when the ATCO is confident that the a/c ahead will clear the runway as expected.

- In LHR under Tactically Enhanced Arrivals Mode (TEAM) a 2 NM MRS is applied between not-in-trail arrivals aircraft established on their respective final approach tracks.

- The Heathrow final approach separation scheme takes into consideration both the wake separation requirements, and the ROT Spacing requirements for lead CAT-A, B and C pairs. For lead CAT-D, E and F pairs without a wake separation requirement the final approach spacing minimum is applied. See comments below under HIRO, the most constraining separation is applied (Wake Separation, ROT Spacing, Final Approach Spacing Minimum or MRS).

3.3.1.1.3 Separation and spacing – Vienna

- Vienna TMA use 3 NM MRS then on final approach have 2.5 NM MRS. 2.5 NM MRS is applied from 18 NM from the RWY threshold. The Leader has to be established and follower at 45 degrees from intercept.

- TWR controller can have visual control under VMC, without asking the pilot. This is done by non-verbal communication by HMI, there is visual indication on meteo screen HMI of a highlighted pair of binoculars when TWR can assume visual control. In these conditions MRS aircraft can be delivered with 1.8 NM spacing at the runway threshold. Therefore if spacing is below 2.5 NM MRS within 4NM than it is OK as TWR has the control. Transfer of control to the TWR is at 4 NM. 2.5 NM MRS is applied from 18 NM from the RWY threshold.

- In case of RWY contamination (e.g. snow), after realising the first or second a/c is slow to vacate, the ATCO reports to Supervisor who requests a greater spacing from approach.

- STCA is a trajectory based projection for converging aircraft.

3.3.1.2 Transition from TMA to Approach

Aircraft approaching one or more aerodrome(s) from surrounding sectors typically follow a number of Standard Arrival Routes (STARs) – each aircraft follows one STAR - providing the transition from the En-route structure and are progressively merged into a single flow for each active landing runway.

The separation of arrivals and departures is facilitated by strategic segregation of flows through airspace structures. The separation of arrivals from other arrivals is often closely related to the building and maintenance of the sequence. These tasks are performed through the use of open loop vectoring, issuing a large number of headings, speeds and level instructions.

Holding patterns may be used for arrivals, subject to local practices, either when the TMA capacity is exceeded at peak times, or more systematically to maintain the pressure at the runway.

RNAV Procedures have been defined to replace open-loop vectors. In such procedures ideally the principle is to keep aircraft on their routes; the procedures are designed so that the trajectory can be stretched or shortened through pre-defined/fixed route modifications if this is needed for the merging of arrival flows; these procedures are generally fully applied only under low to medium traffic loads.

An “efficient landing sequence” refers both to an optimised sequence order (e.g. according to wake turbulence constraints), and to the achievement of appropriate spacing between flights, both aspects contributing to maintain the throughput as close as possible to the available runway capacity. This involves:

- Planning the sequence (i.e. allocate landing runway if needed, and define sequence order);
- Building the sequence (including order and appropriate spacing);
- Maintaining the sequence (including optimisation of inter-aircraft spacing).

The Controller is the authority for assuring safe operations in the TMA / Approach and issues information and instructions to aircraft under control in order to assist pilots to navigate safely and timely in the TMA / Approach.

Voice communication is the primary Air / Ground communication in the TMA / Approach.

The Ground / Ground connection is ensured through an overall network approach using common protocols such as Aeronautical Fixed Telecommunication Network (AFTN). It covers exchanges of surveillance, trajectory data and other flight planning information.

Navigation services using conventional terrestrial navigation aids (such as VOR/DME/NDB and ILS for the final approach phase) are the primary form of ground-based navigation aid, however there is an increased usage of developing technologies such as GPS and GNSS. A large range of airborne navigation capability exists, usually based on multi-sensor navigation systems.

Surveillance Coverage is provided by the use of SSR (Secondary Surveillance Radar) in combination with PSR (Primary Surveillance Radar).

3.3.1.3 Separation Standards

Radar separation standards for arrivals include MRS which prevents aircraft collision and WT separation which is intended to protect aircraft from adverse WTEs. In current day operations WT separations are defined between categories of aircraft which are grouped based on their MTOW. Examples of WT category schemes include ICAO, RECAT-EU 6 category and UK 6 category. When no WT separation is applicable then a Spacing Minimum is applied appropriate to the operating conditions (visual conditions, runway braking conditions, final approach headwind conditions) and which conforms to the MRS. The MRS is typically 3 NM although can be 2.5 NM under certain conditions. Radar separations in current operations are defined in distance for arrival aircraft.

If Tower ATC can apply visual separation procedures from the VCR, the separation mode changes, and reduced separation in the vicinity of the aerodrome (RSVA) may be applied for pairs where no WT separation is applicable. This is currently employed by pressured capacity constrained operations to deliver spacing significantly more efficiently in headwind conditions where the 2.5 NM MRS results in unneeded additional spacing being delivered across the runway landing threshold. For example, at Heathrow, RSVA below the 2.5 NM MRS can be applied from the Deceleration Fix (DF) at 4 NM from the runway landing threshold from the Tower VCR provided visual separation procedures can be applied to aircraft on final approach out to 6 .5 NM from the runway landing threshold.

If the Flight Crew perform a visual approach, the separation mode changes, and the responsibility lies with the Flight Crew to determine the spacing.

Radar separation is applied by observing the headings, distances, and speeds, between consecutive aircraft. The Final Approach Controller knows the locally applied wake turbulence radar separation table (i.e. ICAO). From the respective aircraft wake turbulence categories from the flight strips, or from the target labels, the Controller establishes the wake turbulence radar separation required between the respective aircraft.

The separation distance limits are determined by the Controller by the use of scales on the radar map and through the observation of catch-up from the separation distance progression observed between the follower aircraft and the lead aircraft. In case of possible infringement, the Controller will first use speed instructions, and then use vectoring, or order a go-around. Inside of 4 NM from the runway threshold no speed instructions are advised.

3.3.1.4 Runway Layout Configuration

Runway direction is chosen, based on many criteria, but the main one is the wind direction. Headwind conditions at the runway surface are the preferred wind for arrivals and departures, compared to crosswind conditions or tailwind conditions.

3.3.1.5 Runway Modes of Operation

In a large airport, you can distinguish between two main runway operations. One is the segregated mode, where one duty runway-in-use is used for arrivals, and another duty runway-in-use is used for the departures. The other configuration is mixed mode, where the arrival and departure streams are interlaced on to a duty runway-in-use.

If operating in mixed mode, the penalty of having to apply distance-based separation is less, since Controllers are typically able to reduce the 'Gap' size required to depart one aircraft between two arrivals, as the headwind increases, without becoming constrained by the wake turbulence separation minimum.

The two modes can also be combined, so that a few arrivals will land on the departure runway, or vice versa.

3.3.1.6 Arrival Management

In current operations, an Arrival Manager (AMAN) is often used for the TMA approach sector. The AMAN organises the arriving traffic, so that it can be merged and sequenced to one or more runways, as efficiently as possible. The AMAN can integrate wake turbulence categories (and distance needed) for each aircraft pair and allocate them accordingly into the sequence. Aircraft speeds are taken into account, as well as wind speeds.

The arrival Controllers will, as far as is feasible, accommodate the AMAN proposed sequence order. Normally, the sequence order in AMAN is not updated after aircraft have passed the IAF. This means that the sequence order intent can be changed by the Approach Controllers without any update input into the associated system support. Through procedural coordination the Approach Controllers know the changed sequence order, which can also be deduced by looking at the relative display positions of the aircraft lined up on intermediate and final approach. As a consequence, there is currently no need for the Approach Controllers to update the associated system support.

For the Tower Runway Controller, the same logic applies, since there will in most cases be a slave radar display in the Tower. For other actors, it is not as clear what the real sequence actually is or will be.

Different airports have developed different solutions, in order to provide the airport with correct landing estimates, and the correct landing runway for each aircraft.

When aircraft approach final approach, the Final Approach Controller will separate, sequence and merge all arrivals to a specific runway. This task is very precise and requires skills in determining the correct headings and speeds to be applied, in order to be both efficient and remain safely separated.

3.3.1.7 Planning

In current operations at an airport, one important aspect of the short-term planning, and reiterative planning done during the execution phase, is to select the most appropriate runway combination and configuration. This takes into account many criteria, such as weather forecast, infrastructure status, traffic demand and traffic mix.

For arrivals, the planning horizon is at least 20-30 minutes, in order to smoothly change the runway for landing, when in high traffic demand. Even so, a runway change will often lead to disruptions and delays.

3.3.1.8 Runway Arrival Control

In current operations, the Tower Runway Controller is responsible for providing landing clearance to arriving aircraft. In order to do this, the arrival traffic is transferred to the Tower Runway Controller a few nautical miles from the threshold, and the Tower Runway Controller monitors that the runway occupancy of preceding aircraft is progressing as expected. The Tower Runway Controller monitors the speed and position of the next approaching arrival, in order to determine when to give a landing clearance, or to order a go-around, if the previous aircraft runway occupancy exceeds the applied separation. Both visual out of the window, and surveillance equipment, is used.

If in mixed mode, the Tower Runway Controller also has to deliver line-up and take-off clearances to departing aircraft, and time this so that the gap between the two associated arrivals can be used.

The accuracy of planning and execution of runway and surface movements is constrained by the degree of uncertainty of aircraft behaviour in the landing, roll-out and taxi phases. Tower Runway Controllers apply additional margins to take account of aircraft behaviour during these phases, in terms of predictability of performance. Margins to absorb the uncertainty over the AROT are factored into the final approach spacing applied.

Observations at congested airports indicate that depending on runway and taxiway layout and airline operating procedures, an excess of time can be spent on the runway by individual aircraft as the current aircraft auto-brake systems apply predetermined braking deceleration to the aircraft. If braking is left to the auto-brake system, the aircraft will stop on the runway. However, in practise, the Flight Crew disconnect the auto-brake on the roll out and use pedal braking to arrive at the runway exit at an appropriate speed.

Existing auto-brake systems reduce pilot workload by providing deceleration at a set rate. The auto-brake setting will ensure a consistent rate of deceleration as selected by the pilot and assuming the required braking friction coefficient is obtainable.

With a limited number of auto-brake settings available, the deceleration is not customised to the specific runway exit. In theory this variation can lead to the AROT being extended.

As there are many factors that influence AROT it is not possible to predict an accurate AROT or guarantee the runway exit.

This situation is further negatively impacted in low visibility conditions when CAT II/III operations are in force and after landing, the auto-brake decelerates the aircraft according to the predetermined setting until the Flight Crew disconnect the auto-brake system. Flight Crew have to cope with reduced visibility and must locate the runway exit in constrained visibility conditions and this may take considerably longer than would be the case in better visibility conditions (CAT I or better). As a result, this is one reason why reductions in runway capacity are declared during CAT II/III operations which can lead to significant delays.

3.3.2 New SESAR Operating Method

3.3.2.1 Scope

This section presents the application of the reduced 2 NM MRS on final approach in the context of the wake turbulence separation optimisation concepts for arrivals, including Time Based Separation (TBS), Static Pair Wise Separation (S-PWS) and Time Based Static Pair Wise Separation (TB S-PWS).

It is not anticipated that the 2 NM MRS will be applied without the support of a Separation Delivery tool. The advantage with Separation Delivery tool support is that all runway spacing requirements can be considered and thus providing an optimised separation with all arrivals until over the runway landing threshold. Additionally, the 2 NM MRS could in theory, be applied regardless of tool support and furthermore at a Separation Delivery point other than the runway landing threshold. Without Separation Delivery tool support, the 2 NM MRS can be assured until a point prior to aircraft deceleration. Additionally, this is without consideration of other spacing requirements. This secondary application of the 2 NM MRS can be utilised within the context of DBS.

The ORD concept been developed and validated by SESAR Solution PJ02-01 and will provide the Separation Delivery tool support to assist Controllers in delivering the required minimum separation by considering the effect of compression to the runway landing threshold. This is achieved through an additional visualisation in the Separation Delivery tool to show Controllers the required spacing to deliver at the DF (typically 4-6 NM from the runway landing threshold) in order to deliver the required minimum separation at the delivery point (usually the runway landing threshold).

The separation to be delivered to the runway landing threshold for each arrival pair will need to incorporate the required wake separation, the MRS, the required runway occupancy time clearance to land spacing and required spacing minimum for the operating conditions, and any other spacing constraint that is required to be observed such as a scenario specific spacing constraint or the provision of gap spacing for departure aircraft. The largest of these constraints is the minimum separation to be delivered between aircraft arriving over the runway landing threshold.

3.3.2.2 Proposed Application of 2 NM MRS on Final Approach

It is foreseen that the 2 NM MRS can be applied in one of the following two operational environments:

- By incorporating the utilisation of the ORD tool and encompassing spacing requirements including required ROT Spacing or Spacing Minimum and the required Wake based separation (RECAT EU, WDS, PWS and TBS).
- Without the ORD tool: RECAT EU with 2 NM MRS under headwind condition to cover the required ROT Spacing or Spacing Minimum and the ICAO Wake based separation under headwind condition (high headwind component) for all possible ICAO Medium-Medium wake category pairs and associated required ROT Spacing.

The scope of the proposed application of the 2 NM MRS on final approach with ORD tool support is as follows:

- From the lead aircraft crossing the DF (typically 4-6 NM from the runway landing threshold). This is so as to extend being able to deliver spacing below the current 2.5 NM MRS inside of the DF in visual conditions when Instrumented Flight Rule (IFR) procedures are required to be applied inside the DF. This will provide benefits when the headwind conditions are such that unneeded additional spacing is delivered when applying the current 2.5 NM MRS to the runway landing threshold and the visual conditions are such that RSVA cannot be applied.

- From both the lead and follower aircraft established on the final approach extended runway centre line inside of 10 NM from the runway threshold. This is so as to extend being able to deliver spacing below the current 2.5 NM MRS in moderate and strong headwind conditions on final approach outside of the DF. This will provide benefits in moderate and strong headwind conditions outside of the DF when unwanted additional spacing is delivered to the runway landing threshold when applying the current 2.5 NM MRS to the DF. This will align with the distance for the runway landing threshold constraints for applying the 2.5 NM MRS in ICAO Document 4444 [40].

- From both the lead and follower aircraft established on the final approach extended runway centre-line beyond 10 NM from the runway threshold and potentially out to 20 NM from the runway landing threshold depending on local procedures. This is so as to extend being able to deliver spacing below the current 2.5 NM MRS in strong headwind conditions outside of 10 NM when this will result in unwanted additional spacing is delivered to the runway landing threshold when applying the current 3 NM or 2.5 NM MRS to 10 NM from the runway landing threshold depending on local procedures.

- From the lead aircraft established on the final approach extended runway centre-line and the follower aircraft established on a stable intercept for merging on to the extended runway centre-line. This is as to further enable more efficient delivery to a required spacing below 2.5 NM across the DF in wind conditions on final approach when there is pull-away or no or little distance spacing compression after the follower aircraft has merged onto the final approach extended runway centre-line.

The approach procedures that the in-trail 2 NM MRS is required to be applied include the ILS / MLS precision approach procedures, the GBAS approach procedures and the RNAV/GNSS non-precision approach procedures.

In the case of the ILS / MLS precision approach procedures it is anticipated that the 2 NM MRS can be applied from the lead aircraft established on the localiser along the final approach extended runway centre-line and the follower aircraft established on a stable intercept for merging on to the extended runway centre-line.

In the case of GBAS approach procedures it is anticipated that the 2 NM MRS can be applied from the lead aircraft established on the GBAS approach path along the extended runway centre-line and the follower aircraft established on a stable intercept for merging on to the extended runway centre-line.

In the case of the RNAV/GNSS non-precision approach procedures it is anticipated that the 2 NM MRS can only be applied once both lead and follower aircraft are established on the RNAV/GNSS approach path along the extended runway centre-line, which is after the Intermediate Fix of the RNAV/GNSS approach procedure. This is due to the uncertainties in the approach path being employed in an RNAV/GNSS non-precision approach until the aircraft has merged on to the extended runway centre-line at the Intermediate Fix. The Intermediate Fix is typically at or inside of 10 NM from the runway landing threshold depending on local procedures.

3.3.2.3 Controller Procedures for Supporting the Application of the 2 NM MRS on Final Approach

The controller procedures for consistently and efficiently delivering to a required spacing below 2.5 NM across the DF are an important consideration for the application of the 2 NM MRS on final approach.

A particular challenge is managing the transition from the 3 NM MRS applied on intermediate approach to the 2.5 NM MRS and 2NM MRS that are to be applied when merging on to the final approach extended runway centre-line. There is a need to manage the potential consequences from being constrained by the 3 NM MRS until the lead aircraft is established on the final approach extended runway centre-line as per the current 2.5 NM transition constraints when delivering to a required spacing below 2.5 NM across the DF.

The final approach controller found this a particularly challenging issue that impacted the consistency and efficiency with which they could deliver a required spacing below 2.5 NM across the DF. To address this challenge the final approach controllers suggested to being able to reduce below the 3 NM MRS once the lead aircraft is established on a stable intercept track for merging on to the final approach extended runway centre-line rather than required to wait until the lead aircraft has established on the final approach extended runway centre-line. This is can potentially be achieved by extending the application of the 2.5 NM MRS.

With respect to the separation delivery tool support and in particular the displaying of the Target Distance Indicator (TDI) of the spacing to be delivered behind the lead aircraft as the lead aircraft crosses the DF, an issue when the required spacing to be delivered across the DF is below the 2.5 NM MRS, and to some extent below the 3 NM MRS, is that the final approach controller may be drawn into delivering to the TDI and reducing below the 2.5 NM MRS and the 3 NM MRS before the transition procedures allow. This is in the context that the TDI is usually displayed by at least the time at which the follower aircraft turns on to their base leg, and maybe before the follower aircraft begins their turn on to base leg, which is before being able to reduce to the 2 NM MRS and 2.5 NM MRS. The final approach controllers have indicated that the transition to the 2.5 NM MRS is self-managed in current operations without TDI support, and is addressed through training, and that they would prefer this to continue to be self-managed and addressed by training with TDI support for the 2 NM MRS transition. Suppressing the displaying of the TDI until the required MRS can be applied was prototyped and evaluated in SESAR 1 and was shown to have an unfavourable impact on the workload of the final approach controller.

3.3.2.4 Application of RSVA with the MRS on Final Approach

The need to apply RSVA will be reduced but not necessarily eliminated when being able to apply a 2 NM MRS and thus ROT Spacing and associated Spacing Minima below 2.5 NM down to 2 NM on final approach.

There are still final approach strong wind conditions and follower aircraft type related slow landing stabilisation airspeeds for which the 2 NM MRS may result in additional extra time spacing being delivered across the runway landing threshold. With the current application of RSVA less than 2 NM spacing is delivered across the runway landing threshold for some arrival pairs.

Because of this there is still a potential need to support RSVA procedures on final approach from when the lead aircraft crosses the DF, usually at 4 NM from the runway landing threshold, and so from when the lead aircraft is at the DF + 2 NM from the runway landing threshold.

3.3.2.5 Impact on the Separation Monitor Function on Final Approach

Some local operations have a Separation Monitor Function (SMF) on final approach which alerts the Approach Supervisor and also possibly the Final Approach Controller of a significant separation infringement on final approach before the lead aircraft crosses the DF.

The criteria for alerting for the current 2.5 NM MRS is when the spacing between arrival aircraft on final approach reduces to below 2 NM. There is thus a spacing minimum margin of 0.5 NM before triggering the SMF alert.

With the application of the 2 NM MRS on final approach consideration is required as to whether the SMF alerting criteria will need to be revised. This may be in conjunction with the application of an additional spacing minimum margin above the 2 NM MRS, such as a 0.2 NM additional spacing margin, which will be incorporated into the displayed TDI distance.

With TDIs controllers should be delivering more consistently to the required spacing on final approach to 4DME than is the case without displayed TDIs which may impact the spacing minimum margin required before triggering the SMF alert.

3.3.2.6 Consideration of the Impact on the Missed Approach Procedure

There is a need to consider the impact on the missed approach procedure of applying the 2 NM MRS on final approach.

For spacing minimum pairs there is a need to increases the spacing to the intermediate approach 3 NM MRS horizontal separation or the 1,000 ft vertical separation as the missed approach aircraft airspeed increases and the aircraft climbs when executing the missed approach.

For aircraft on short final being controlled by the Tower Runway Controller, there is a need to safely attain the intermediate approach radar separation before transferring the aircraft to an Approach Controller.

With IFR conditions inside the DF, the 2 NM MRS applies until the lead aircraft crossing the runway landing threshold. This is compared to the 2.5 NM MRS that applies in IFR conditions in current operations. There

is a need to consider the impact of this with respect to the Tower Runway Controller safely attaining the intermediate approach radar separation in IFR conditions.

Consideration is needed for both the single missed approach scenarios and the multiple missed approach scenarios (for example due to an unplanned blocked runway).

With the multiple missed approach scenarios there is a need to take into consideration the timing of when aircraft may be directed on to the missed approach, for example in the case of an unplanned blocked runway and the controllers have some discretionary control over this timing, and what procedure each aircraft should be directed to execute in order to safely manage the transition to the intermediate approach 3 NM MRS or 1,000 ft vertical separation.

A potential exceptional scenario is when the flight crew of successive arrival aircraft on short final need to execute a missed approach, for example due to both aircraft independently experiencing unstable approaches, and simultaneously autonomously invoking the missed approach procedure without any prior coordination with the final approach controller.

With the 2 NM MRS there is a need consider the potential increase in the number of aircraft on final approach and on intermediate approach and the impact this has on the safe dispersal of aircraft into the radar manoeuvring area in the unplanned blocked runway scenario when no aircraft can be switched to land on the parallel departure runway when this option exists. The number of aircraft on the straight-in final approach track could be similar, with the possibility of one or two more aircraft, to the stream of spacing minimum pairs being delivered under RSVA procedures in current 2.5 NM MRS operations.

3.3.2.7 Impact on the Separation Delivery Tool Support

The Separation Delivery Tool support is being developed and validated is SESAR Solution PJ02-01 and is described in the associated SPR-INTEROP/OSED Part I [50].

The Separation Delivery tool support will need to be enhanced to support the 2 NM MRS and also to support the associated additional Spacing Minimum below 2.5 NM to be applied up to the lead aircraft crossing the DF (and so applied as an Initial Target Distance (ITD) constraint) or up to the lead aircraft crossing the runway landing threshold runway landing threshold (and so applied as a Final Target Distance (FTD) Constraint).

The Separation Delivery tool support will need to be enhanced to support the runway occupancy time clearance to land spacing requirements of all arrival pairs.

The Separation Delivery tool support may need to be enhanced to support the application of RSVA with the 2 NM MRS whereby the 2 NM MRS only applies up to the lead aircraft crossing the DF and does not apply when the lead aircraft is closer to the runway landing threshold than the DF.

3.3.2.8 Controller Procedures

Controllers shall remain responsible for monitoring for separation infringements and for timely intervention actions to resolve them.

The Final Approach Controller shall take into account any non-standard procedures or abnormal approach speeds as reported by the Flight Crew when setting up the spacing on final approach.

The Tower Supervisor in coordination with the Approach Supervisor shall ensure the separation and spacing constraints remain up to date including planned changes.

3.3.2.9 Airspace Users

Flight Crews shall be briefed on the application of the 2 NM MRS to ensure sufficient understanding. Airspace Users and Flight Crews shall be made aware of the mode of operation at the airport which can be achieved through the Aeronautical Information Publication (AIP) for the airport or through the Digital Automatic Terminal Information Service (D-ATIS).

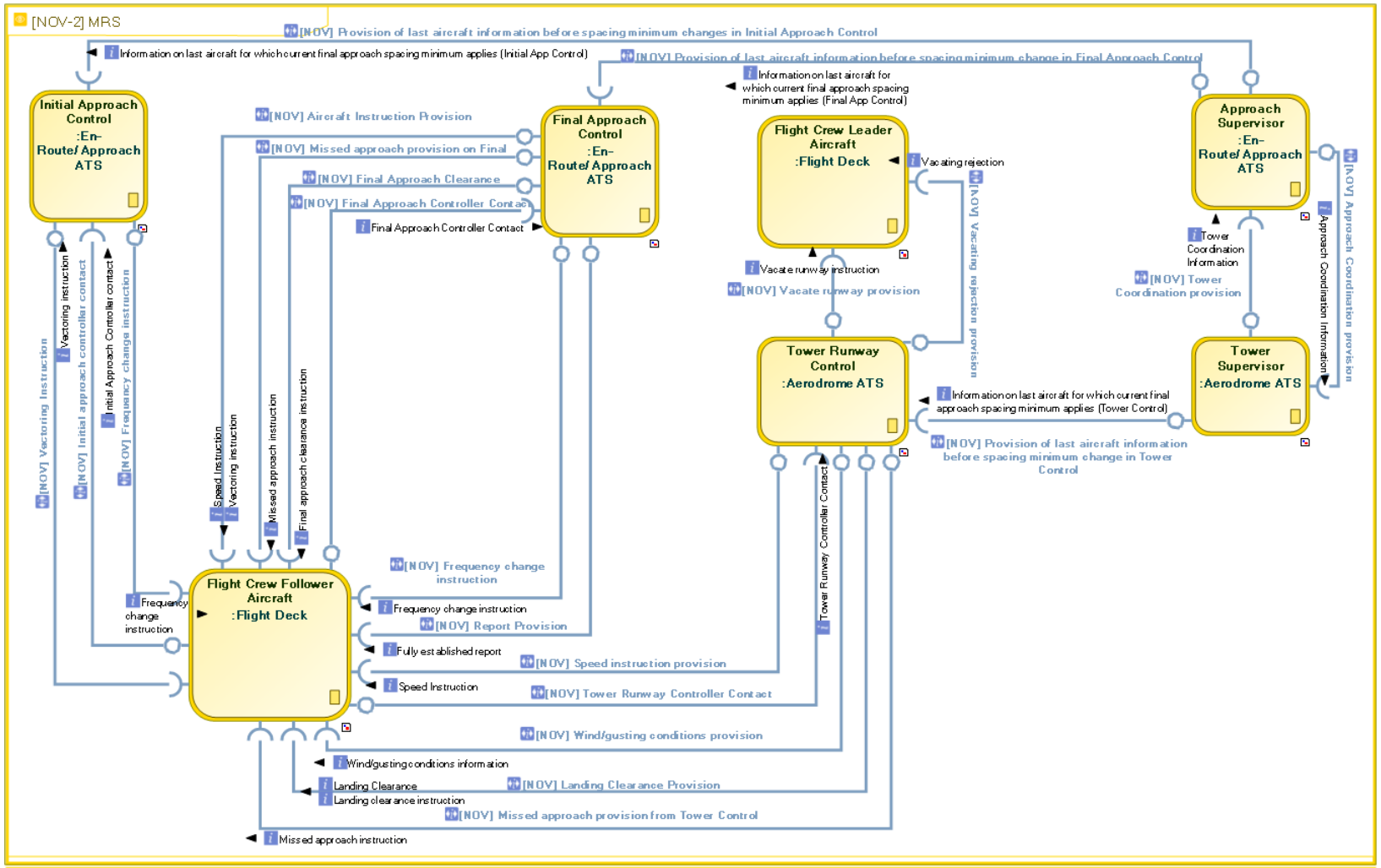
Flight Crew shall notify the Approach Controller of an inability to fly the standard procedure or of any non-conformant final approach speeds.

The aircraft type is an important input into the Separation Delivery tool due to the possible implications of an error. The Flight Crew could be required to confirm aircraft type on first call to allow the Controllers to cross check it. If this is not feasible then an alternative method to reduce the chance of aircraft type errors will need to be found (i.e. via Datalink).

3.3.2.10 Use Cases for [NOV-2] MRS

This NOV-2 View summarizes the information exchange for PJ02.03 concepts described in the following Use Cases:

- Use case-1: Planned Change of Final Approach Spacing Minimum
- Use case-2a: MRS 2NM with ORD Tool
- Use case-2b: MRS 2NM without ORD tool



[NOV-5][MRS-1] Planned Changes of Final Approach Spacing Minimum [Approach Supervisor, Final Approach Control, Initial Approach Control, Tower Runway Control, Tower Supervisor]
[NOV-5][MRS-2a] MRS 2NM with ORD Tool [Final Approach Control, Flight Crew Follower Aircraft, Flight Crew Leader Aircraft, Initial Approach Control, Tower Runway Control]
[NOV-5][MRS-2b] MRS 2NM without ORD tool [Final Approach Control, Flight Crew Follower Aircraft, Flight Crew Leader Aircraft, Initial Approach Control, Tower Runway Control]

1

Use case	[NOV-5][MRS-1] Planned Change of Final Approach Spacing Minimum
Use case	[NOV-5][MRS-2a] MRS 2NM with ORD Tool
Use case	[NOV-5][MRS-2b] MRS 2NM without ORD tool

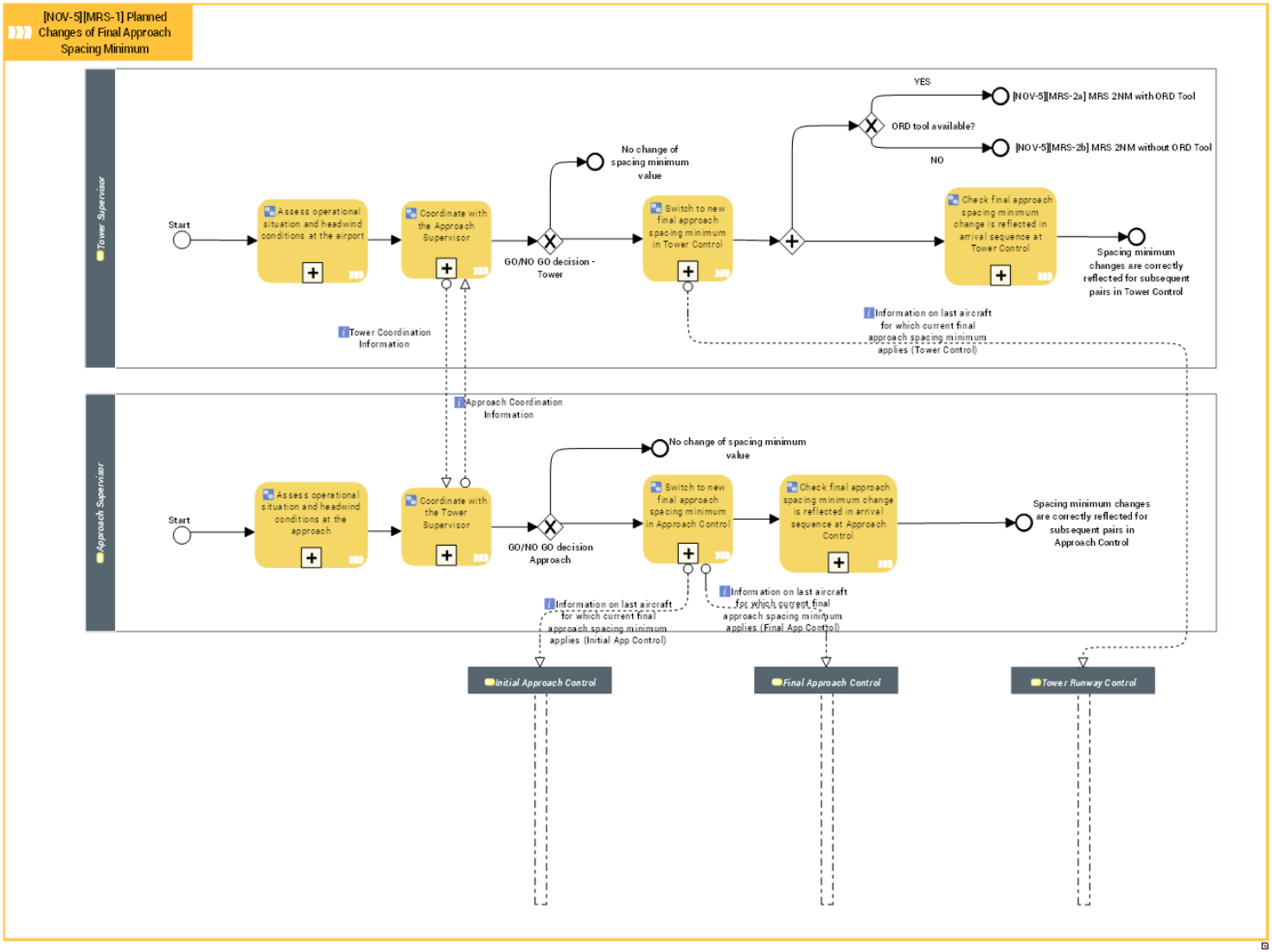
3.3.2.10.1 [NOV-5][MRS-1] Planned Change of Final Approach Spacing Minimum

The planned change of final approach spacing minimum describes how the tower and approach supervisors coordinate between each other to decide which final approach spacing minimum should be employed (used).

In particular they check and coordinate on:

- if the weather conditions are met
- the planning and timing
- the last/first applicable aircraft

Once applied, they communicate the information to other actors, Approach control, Final approach control and Tower approach control, as well as check that the correct value is applied.


[NOV-5][MRS-1] Planned Changes of Final Approach Spacing Minimum
Tower Supervisor
Start
Assess operational situation and headwind conditions at the airport
Coordinate with the Approach Supervisor
GO/NO GO decision - Tower
No change of spacing minimum value
Switch to new final approach spacing minimum in Tower Control
ORD tool available?
YES
[NOV-5][MRS-2a] MRS 2NM with ORD Tool
NO
[NOV-5][MRS-2b] MRS 2NM without ORD Tool
Check final approach spacing minimum change is reflected in arrival sequence at Tower Control
Spacing minimum changes are correctly reflected for subsequent pairs in Tower Control
Tower Coordination Information
Information on last aircraft for which current final approach spacing minimum applies (Tower Control)
Approach Supervisor
Approach Coordination Information
Start
Assess operational situation and headwind conditions at the approach
Coordinate with the Tower Supervisor
GO/NO GO decision Approach
No change of spacing minimum value
Switch to new final approach spacing minimum in Approach Control
Check final approach spacing minimum change is reflected in arrival sequence at Approach Control
Spacing minimum changes are correctly reflected for subsequent pairs in Approach Control
Information on last aircraft for which current final approach spacing minimum applies (Initial App Control)
Information on last aircraft for which current final approach spacing minimum applies (Final App Control)
Initial Approach Control
Final Approach Control
Tower Runway Control

1

Activity	Description
Assess operational situation and headwind conditions at the airport	The Tower Supervisor assesses the need and check that the required conditions are met to change the final approach spacing minimum.
Assess operational situation and headwind conditions at the approach	The Approach Supervisor assesses the need and check that the required conditions are met to change the final approach spacing minimum.
Check final approach spacing minimum change is reflected in arrival sequence at Approach Control	The Approach supervisor checks that the planned final approach spacing minimum change is reflected into the Approach Arrivals Sequence Display from the sequence position of the planned change.
Check final approach spacing minimum change is reflected in arrival sequence at Tower Control	The Tower supervisor checks that the planned final approach spacing minimum change is reflected into the Approach Arrivals Sequence Display from the sequence position of the planned change.
Coordinate with the Approach Supervisor	The Tower Supervisor and Approach Supervisor coordinate on the need and timing for a planned change of final approach spacing minimum.
Coordinate with the Tower Supervisor	The Tower Supervisor and Approach Supervisor coordinate on the need and timing for a planned change of final approach spacing minimum. The Approach Supervisor coordinates with the Initial Approach Controller the identification of the last aircraft, for each arrival runway, for which the current final approach spacing minimum shall be applied.
Switch to new final approach spacing minimum in Approach Control	The Approach Supervisor (or the Initial Approach Controller) selects the last aircraft in the Approach arrival sequence and adds the planned change of final approach spacing minimum via a system input for each arrival runway.
Switch to new final approach spacing minimum in Tower Control	The planned change of final approach spacing minimum is reflected to Tower Runway Control.

Issuer	Info Exchange	Addressee	Info Element	Info Entity
Approach Supervisor	Switch to new final approach spacing minimum in Approach Control o--> Final Approach Control	Final Approach Control	Information on last aircraft for which current final approach spacing minimum applies (Final App Control)	

Issuer	Info Exchange	Addressee	Info Element	Info Entity
Approach Supervisor	Switch to new final approach spacing minimum in Approach Control o--> Initial Approach Control	Initial Approach Control	Information on last aircraft for which current final approach spacing minimum applies (Initial App Control)	
Tower Supervisor	Switch to new final approach spacing minimum in Tower Control o--> Tower Runway Control	Tower Runway Control	Information on last aircraft for which current final approach spacing minimum applies (Tower Control)	
Tower Supervisor	Coordinate with the Approach Supervisor o--> Coordinate with the Tower Supervisor	Approach Supervisor	Tower Coordination Information	
Approach Supervisor	Coordinate with the Tower Supervisor o--> Coordinate with the Approach Supervisor	Tower Supervisor	Approach Coordination Information	CoordinationMessage

3.3.2.10.2 [NOV-5][MRS-2a] MRS 2NM with ORD Tool

General Conditions (Scope and Summary)

This Use Case describes in detail the steps involved in sequencing and delivering arrival aircraft using the applicable concept (TBS, PWS-A, ORD and / or WDS-A) on final approach with the aid of TDIs displayed on the extended runway centreline of the Final Approach Control's radar display and Tower Runway Control's air traffic monitor display.

This Use Case takes place during the phase of flight where the arrival aircraft is being metered through the TMA and towards the IAF. This Use Case end upon arrival and the aircraft vacates the runway.

Pre Conditions

Airport Medium / Short Term Planning and Balance Demand and Capacity have established a flow of arrival aircraft for the aerodrome into the TMA that matches the runway capacity in the prevailing operating conditions.

The approach arrival sequence into the IAFs is optimised as far as reasonable and if applicable is reflected in the AMAN.

The Separation Delivery tool and all applicable alerting / monitoring tools and the Approach Arrival Sequence Service are operational.

Within the context of locally defined HIRO procedures all components are considered valid for sustained high runway throughput. This shall include but is not limited to a suitable Runway surface and availability of appropriate runway exits.

The Flight Crew are aware of the runway in use and the approach type along with the utilisation of HIRO procedures.

Post Conditions

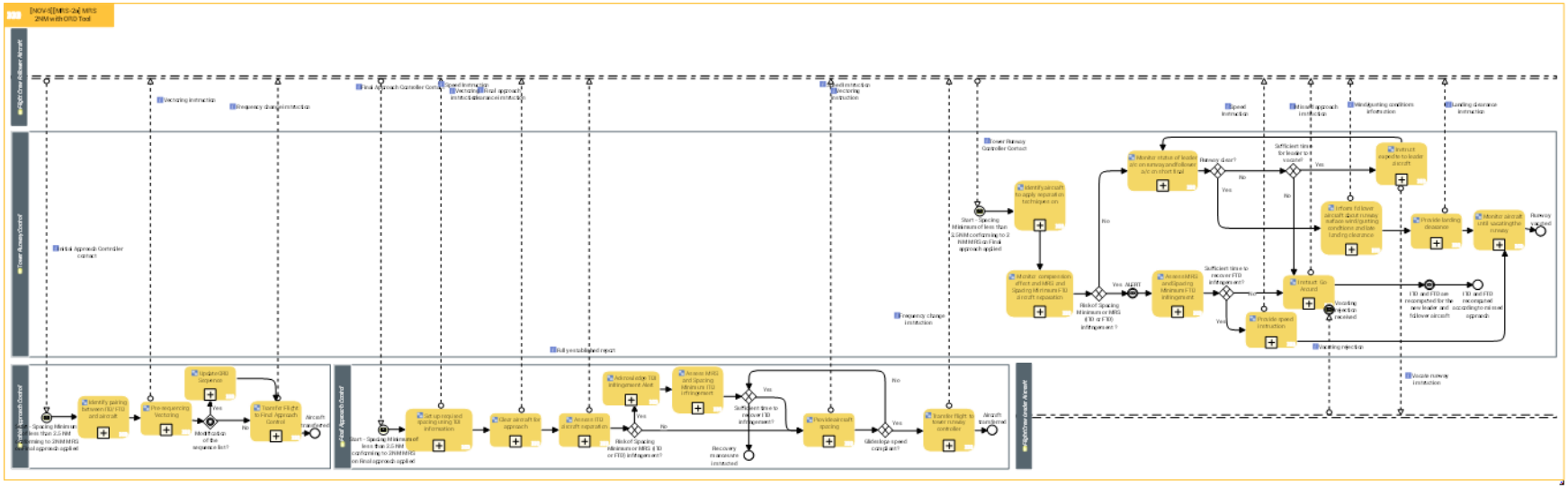
The arrival aircraft have landed and vacated the runway.

Actors

Approach Supervisor, Tower Supervisor, Initial Approach Control, Final Approach Control, Tower Runway Control, Flight Crew.

Trigger

Coordination of an arrival aircraft into the assigned IAF between the TMA Sector Controller and the Intermediate Approach Controller.



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Activity	Description
Provide landing clearance	The Tower Runway Controller provides landing clearance to the aircraft as per local procedures with some assurance that the lead aircraft will vacate the runway in time, or when it has been confirmed that the lead aircraft has vacated the runway. Or if the aircraft ahead is a departure then clearance to land will be provided after the departure is airborne or there is some assurance the aircraft will be airborne on time.
Provide speed instruction	If there is sufficient time to recover the FTD infringement, the Tower Runway Controller gives speed instructions.
Transfer flight to tower runway controller	When satisfied that an appropriate stable separation has been obtained the Final Approach Controller instructs the Flight Crew to transfer to the Tower Runway Controller.
Acknowledge TDI infringement Alert	When the infringement alert is available, the Controller takes into account this alert and act accordingly, this alert increases the ATCO situation awareness and implies that an action may be taken to avoid loss of separation.
Assess ITD aircraft separation	Nominal workflow The Final Approach Controller shall assess the resulting separation from the aircraft ahead and judge any required refinement action. In particular, the controller will decide when to reduce, maintain or even cancel any speed instructions. This may happen before or after the aircraft has intercepted the localiser. Alternative flows ITD catch-up alert on final approach 1. The ITD catch-up alert is triggered as an aircraft is predicted to cross the ITD within a defined time limit if the speed remains the same. 2. The Final Approach Controller issues a speed instruction to prevent the aircraft from crossing the ITD indicator. 3. Without ORD support tool, the final approach controller monitors the resulting ground speeds and separation catch up with modifications are possible. 4. The Use Case resumes from the step it was invoked between step 12 and 18. Insufficient spacing on final approach (Final Approach or Tower Runway Controller) 1. This means the aircraft is crossing or about to cross the FTD indicator. 2. The Final Approach Controller assesses the impact of the insufficient spacing and determines what intervention actions to take which can include speed change instructions new headings and manoeuvres and include managing the impact on subsequent aircraft in the arrival sequence. Without ORD support tool, the Final Approach Controller

	does not have an FTD indicator but monitors the resulting separation between aircraft. 3. The Final Approach Controller carries out the required intervention actions. 4. The Use Case resumes at step 12 when the aircraft continues the approach.
Assess MRS and Spacing Minimum FTD infringement	When the MRS and Spacing Minimum FTD are infringed by the aircraft, the Tower Runway Controller assesses if there is sufficient time to amend the situation. If there is, the Tower Runway Controller will provide corresponding aircraft spacing instructions to the follower aircraft. Otherwise a go-around will be required.
Assess MRS and Spacing Minimum ITD infringement	When the MRS and Spacing Minimum ITD are infringed by the aircraft, the Final Approach Controller assesses if there is sufficient time to amend the situation. If there is, the controller will provide corresponding aircraft spacing instructions to the follower aircraft. Otherwise, a manoeuvre will be required.
Clear aircraft for approach	Final Approach Controller issues, at the appropriate time, approach clearance to the aircraft.
Identify aircraft to apply separation techniques on	As part of the current operations, the controller identifies the aircraft that will have to be moved in order to penalize to the minimum the overall traffic.
Identify pairing between ITD/FTD and aircraft	Nominal Workflow Once the aircraft enters the TDI (target distance indicator) area, the corresponding ITD (Initial Target Distance) indicator and FTD (Final Target Distance) indicators are computed in HMI for Initial Approach Controller use according to the Spacing Minimum that applies. At that moment, the Initial Approach Controller matches the entering aircraft with its corresponding ITD to follow the progression of the trajectory until the transfer to Final Approach. The TDI represents the FTD and ITD. TDIs for the aircraft may be displayed on the extended runway centreline at this time depending on the horizon of the approach arrival sequence service. If not, then another form of system support will be available to provide information about the expected separation to be applied on final approach. Alternatives flow Aircraft type / wake category incorrect on FPS 1. The Initial Approach Controller ensures that the aircraft type / wake category is corrected in the system flight plan data. 2. The Initial Approach Controller checks that the corrected aircraft type / wake category is propagated through to the Approach Arrival Sequence Display. 3. The Use Case resumes at step 2.

	Change in sequence order 1. If an automatic sequence detection solution is implemented no action is needed as a change of sequence will be correctly reflected in the TDIs. Without ORD tool support, the Initial Approach Controller will manually follow and adapt the arrival sequence. 2. The Use Case resumes at the step it was invoked
Inform follower aircraft about runway surface wind/gusting conditions and late landing clearance	The Tower Runway Controller informs the Flight Crew of the runway surface wind conditions (including gusts) and to expect a late landing clearance.
Instruct expedite to leader aircraft	If the runway is occupied and the Tower Runway Controller is about to instruct follower aircraft to land but yet again there is enough time for the leader aircraft to vacate the runway via a specific exit taxiway, the Tower Runway Controller will instruct the leader aircraft to expedite and exit via that taxiway.
Instruct Go-Around	If there is not enough time to recover the risk of spacing infringement in the short final approach or not sufficient time for the leader to vacate the runway on time, the Tower Runway Controller instructs the aircraft to go around. Tower Runway Controller assures appropriate separation from other traffic and instructs the aircraft to turn on to a heading away from the final approach centre-line or simply to follow the missed approach procedure.
Monitor aircraft until vacating the runway	Monitor the aircraft touching down, rolling out, proceeding to the assigned/appropriate exit taxiway and vacating the runway The FTD will remain displayed until the lead aircraft lands
Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation	If the system provides the FTD indicator only, the Controller will need to consider the effect of compression when determining the required separation to be applied on final approach.
Monitor status of leader a/c on runway and follower a/c on short final	If there is no risk of MRS and Spacing Minimum FTD infringement, the Tower Runway Controller monitors the positions of the leader and follower aircraft on short final, assessing whether the runway is clear and safe for the follower to land and for the leader to expedite.
Pre-sequencing Vectoring	Nominal workflow: · The Initial Approach Controller confirms the aircraft is in Approach Arrival Sequence Display and confirms landing runway intent. · The Initial Approach Controller issues necessary heading and altitude instructions to vector the aircraft or provides a clearance to

	the appropriate Point Merge RNAV waypoint while maintaining the applicable separation with other aircraft. The pre-sequencing is further managed to develop the appropriate stream of arrival aircraft for the Final Approach Controller. Alternative flows: Aircraft type / wake category incorrect on FPS 1. The Initial Approach Controller ensures that the aircraft type / wake category is corrected in the system flight plan data. 2. The Initial Approach Controller checks that the corrected aircraft type / wake category is propagated through to the Approach Arrival Sequence Display. 3. The Use Case resumes at step 2. Change in sequence order 1. If an automatic sequence detection solution is implemented no action is needed as a change of sequence will be correctly reflected in the TDIs. 2. The Use Case resumes at the step it was invoked
Provide aircraft spacing	If there is sufficient time to recover from a MRS and Spacing Minimum ITD infringement, the Final Approach Controller will provide separation instructions (heading and speed changes) to the follower aircraft.
Set up required spacing using TDI information	Nominal Workflow The Final Approach Controller shall use the turn onto base leg and intercept as well as use appropriate procedural airspeeds (possibly airport specific) to set up the required spacing on final approach based on the information supplied via the TDIs or other turn on support. Alternative Flows Change in sequence order 1. If an automatic sequence detection solution is implemented no action is needed as a change of sequence will be correctly reflected in the TDIs. 2. The Use Case resumes at the step it was invoked Wrong aircraft turned onto TDI 1. In case the wrong aircraft are turned onto the TDI, an alert is triggered informing the Final Approach Controller via the HMI which aircraft is out of sequence and hence being put behind the incorrect TDI. 2. The Final Approach Controller checks whether it is safe to proceed with merging the impacted aircraft on final approach and if not, breaks the aircraft off from merging on to final approach.

	3. The Final Approach Controller checks whether it is safe to proceed with merging the impacted aircraft on to final approach and if not breaks the aircraft off from merging on to final approach. 4. If it is safe to proceed, the Final Approach Controller amends the sequence order in the Approach Arrival Sequence Display and checks the update is correctly reflected in the Approach Arrival Sequence Display. The Final Approach Controller checks the TDIs are correctly updated. 5. If it is not safe to proceed the Final Approach Controller decides on the path stretching action to take to separate the aircraft from other traffic and to set up the aircraft such that it can be merged back on to final approach. 6. If there is an impact to the sequence order on final approach the Final Approach Controller amends the arrival order in the Approach Arrival Sequence Display and checks the update is correctly reflected in the Approach Arrival Sequence Display. The Final Approach Controller checks the TDIs are correctly updated. 7. The Use Case resumes at step 9 if the aircraft continues the approach. 6. The Use Case resumes at the appropriate step between 7 and 9 if the aircraft discontinues the approach.
Transfer Flight to Final Approach Control	At appropriate time and operational conditions (around Final Approach Fix), the Initial Approach Controller · hands over and transfers the control of the flight to the Final Approach Control · instructs the Flight Crew to contact Final Approach Controller
Update ORD Sequence	When available, the ORD sequence shall reflect the current sequence of arrival, if the controller changes the sequence, they need to update the ORD sequence accordingly, the monitoring of the ORD sequence is one of the tasks of the controller to ensure that the ORD computation is correct.

Issuer	Info Flow	Addressee	Info Element	Info Entity
Initial Approach Control	Transfer Flight to Final Approach Control o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Frequency change instruction	FrequencyChangeInstruction
Initial Approach Control	Pre-sequencing Vectoring o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Vectoring instruction	OpenLoopInstruction

Issuer	Info Flow	Addressee	Info Element	Info Entity
Flight Crew Leader Aircraft	Flight Crew Leader Aircraft o--> Vacating rejection received	Tower Runway Control	Vacating rejection	
Final Approach Control	Assess ITD aircraft separation o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Fully established report	
Final Approach Control	Set up required spacing using TDI information o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Vectoring instruction	OpenLoopInstruction
Final Approach Control	Set up required spacing using TDI information o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	IncreaseSpeedToSpeed
Final Approach Control	Set up required spacing using TDI information o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	ReduceSpeedToSpeed
Final Approach Control	Set up required spacing using TDI information o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	SpeedConstraint
Final Approach Control	Provide aircraft spacing o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Vectoring instruction	OpenLoopInstruction
Final Approach Control	Provide aircraft spacing o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	IncreaseSpeedToSpeed
Final Approach Control	Provide aircraft spacing o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	ReduceSpeedToSpeed

Issuer	Info Flow	Addressee	Info Element	Info Entity
Final Approach Control	Provide aircraft spacing o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	SpeedConstraint
Tower Runway Control	Provide landing clearance o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Landing clearance instruction	
Tower Runway Control	Instruct expedite to leader aircraft o--> Flight Crew Leader Aircraft	Flight Crew Leader Aircraft	Vacate runway instruction	
Tower Runway Control	Inform follower aircraft about runway surface wind/gusting conditions and late landing clearance o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Wind/gusting conditions information	
Flight Crew Follower Aircraft	Flight Crew Follower Aircraft o--> Start - Spacing Minimum of less than 2.5 NM conforming to 2 NM MRS on Final approach applied	Tower Runway Control	Tower Runway Controller Contact	ATCInstruction
Final Approach Control	Transfer flight to tower runway controller o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Frequency change instruction	FrequencyChangeInstruction
Tower Runway Control	Provide speed instruction o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	IncreaseSpeedToSpeed
Tower Runway Control	Provide speed instruction o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	ReduceSpeedToSpeed

Issuer	Info Flow	Addressee	Info Element	Info Entity
Tower Runway Control	Provide speed instruction o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	SpeedConstraint
Final Approach Control	Clear aircraft for approach o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Final approach clearance instruction	
Tower Runway Control	Instruct Go-Around o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Missed approach instruction	
Flight Crew Follower Aircraft	Flight Crew Follower Aircraft o--> Start - Spacing Minimum of less than 2.5 NM conforming to 2 NM MRS on Final approach applied	Final Approach Control	Final Approach Controller Contact	
Flight Crew Follower Aircraft	Flight Crew Follower Aircraft o--> Start - Spacing Minimum of less than 2.5 NM conforming to 2 NM MRS on Final approach applied	Initial Approach Control	Initial Approach Controller contact	

3.3.2.10.3 [NOV-5][MRS-2b] MRS 2NM without ORD tool

General Conditions (Scope and Summary)

This Use Case describes in detail the steps involved in sequencing and delivering arrival aircraft without using ORD Tool.

This Use Case takes place during the phase of flight where the arrival aircraft is being metered through the TMA and towards the IAF. This Use Case end upon arrival and the aircraft vacates the runway.

Pre-conditions

Airport Medium / Short Term Planning and Balance Demand and Capacity have established a flow of arrival aircraft for the aerodrome into the TMA that matches the runway capacity in the prevailing operating conditions.

The approach arrival sequence into the IAFs is optimised as far as reasonable and if applicable is reflected in the AMAN.

Within the context of locally defined HIRO procedures all components are considered valid for sustained high runway throughput. This shall include but is not limited to a suitable Runway surface and availability of appropriate runway exits.

The Flight Crew are aware of the runway in use and the approach type along with the utilisation of HIRO procedures.

Post Conditions

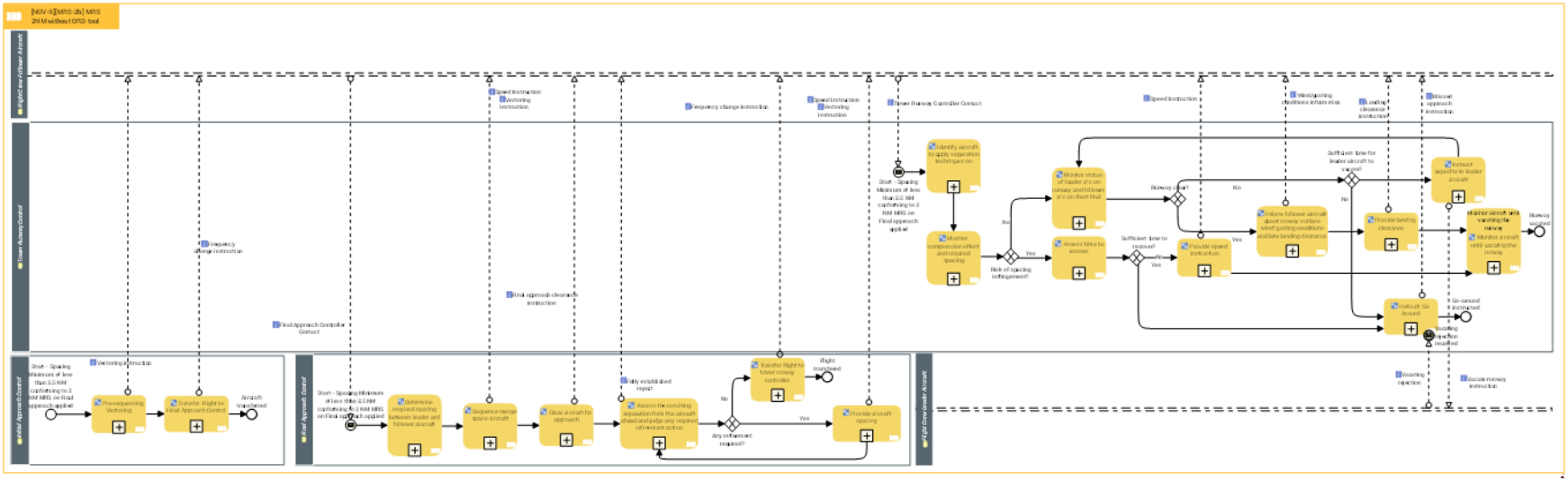
The arrival aircraft have landed and vacated the runway.

Actors

Approach Supervisor, Tower Supervisor, Initial Approach Control, Final Approach Control, Tower Runway Control, Flight Crew.

Trigger

Coordination of an arrival aircraft into the assigned IAF between the TMA Sector Controller and the Intermediate Approach Controller.



3

Activity	Description
Clear aircraft for approach	Nominal Flow Final Approach Controller issues, at the appropriate time, approach clearance to the aircraft.
Pre-sequencing Vectoring	Nominal workflow: · The Initial Approach Controller confirms the aircraft is in Approach Arrival Sequence Display and confirms landing runway intent. · The Initial Approach Controller issues necessary heading and altitude instructions to vector the aircraft or provides a clearance to the appropriate Point Merge RNAV waypoint while maintaining the applicable separation with other aircraft. The pre-sequencing is further managed to develop the appropriate stream of arrival aircraft for the Final Approach Controller. Alternative flows: Aircraft type / wake category incorrect on FPS 1. The Initial Approach Controller ensures that the aircraft type / wake category is corrected in the system flight plan data. 2. The Initial Approach Controller checks that the corrected aircraft type / wake category is propagated through to the Approach Arrival Sequence Display. 3. The Use Case resumes at step 2. Change in sequence order 1. If an automatic sequence detection solution is implemented no action is needed as a change of sequence will be correctly reflected in the TDIs. 2. The Use Case resumes at the step it was invoked
Provide aircraft spacing	If there is space refinement required to ensure safe separation between the leader and the follower on final approach the final approach controller provide aircraft spacing via vectoring and speed instructions
Provide landing clearance	The Tower Runway Controller provides landing clearance to the aircraft as per local procedures with some assurance that the lead aircraft will vacate the runway in time, or to when it has been confirmed that the lead aircraft has vacated the runway. Or if the aircraft ahead is a departure then clearance to land will be provided after the departure is airborne or there is some assurance the aircraft will be airborne on time.
Provide speed instruction	The Final Approach Controller carries out an intervention by providing speed instructions according to space infringement magnitude
Transfer Flight to Final Approach Control	At appropriate time and operational conditions (around Final Approach Fix), the Initial Approach Controller · hands over and transfers the control of the flight to the Final Approach Controller · instructs the Flight Crew to contact Final Approach Control

Transfer flight to tower runway controller	When an appropriate stable separation has been obtained the Final Approach Controller instructs the Flight Crew to contact the Tower Runway Controller.
Assess the resulting separation from the aircraft ahead and judge any required refinement action	Nominal Workflow The Final Approach Controller shall assess the resulting separation from the aircraft ahead and judge any required refinement action. In particular, the controller will decide when to reduce, maintain or even cancel any speed instructions. This may happen before or after the aircraft has intercepted the localiser.
Assess time to recover	The Final Approach Controller assesses the impact of the insufficient spacing and determines what intervention actions to take which can include speed instructions, new heading and manoeuvre instructions (for path stretching) and if necessary missed approach instruction, and include managing the impact on subsequent aircraft in the arrival sequence. The Final Approach Controller carries out the required intervention actions.
Determine required spacing between leader and follower aircraft	Nominal flow: The Final Approach Controller takes control of the follower aircraft and determines the required spacing from the leader aircraft on the sequence list. The required spacing will be either the compulsory wake separation or the applicable MRS and Spacing Minimum, whichever is greater. It will include departure gaps, LVP separation, AROT requirements and wind data. Alternative flows: Change in sequence order 1. The Initial Approach Controller manually follow and adapt the arrival sequence 2. The Use Case resumes at the step it was invoked
Identify aircraft to apply separation techniques on	As part of the current operations, the controller identifies the aircraft that will have to be moved in order to penalize to the minimum the overall traffic.
Inform follower aircraft about runway surface wind/gusting conditions and late landing clearance	The Tower Runway Controller informs the Flight Crew of the runway surface wind conditions (including gusts) and to expect a late landing clearance.
Instruct expedite to leader aircraft	If the runway is occupied and the Tower Runway Controller is about to instruct follower aircraft to land but yet again there is enough time for the leader aircraft to vacate the runway via a specific exit taxiway, the Tower Runway Controller will instruct the leader aircraft to expedite and exit via that taxiway.
Instruct Go-Around	If there is not enough time to recover the risk of spacing infringement in the short final approach or not sufficient time for the leader to

	vacate the runway on time, the Tower Runway Controller instructs the aircraft to go around. Tower Runway Controller assures appropriate separation from other traffic and instructs the aircraft to turn on to a heading away from the final approach centre-line or simply to follow the missed approach procedure.
Monitor aircraft until vacating the runway	Monitor the aircraft touching down, rolling out, proceeding to the assigned/appropriate exit taxiway and vacating the runway The FTD will remain displayed until the lead aircraft lands
Monitor compression effect and required spacing	When the Controller separate two aircrafts, he needs to consider the effect of compression, the required separation shall take into account this factor.
Monitor status of leader a/c on runway and follower a/c on short final	If there is no risk of MRS and Spacing Minimum FTD infringement, the Tower Runway Controller monitors the positions of the leader and follower aircraft on short final, assessing whether the runway is clear and safe for the follower to land and for the leader to expedite.
Sequence merge space aircraft	Nominal Flow The Final Approach Controller shall use the base leg turn and use appropriate procedural airspeeds to set up the required separation on the final turn. The required spacing is the same as in previous step however the margin is increased to allow for compression effect due to all aircraft reducing to final approach speed and configuration change. Alternative Flow Change in sequence order 1. If an automatic sequence detection solution is implemented no action is needed as a change of sequence will be correctly reflected in the TDIs. 2. The Use Case resumes at the step it was invoked

Issuer	Info Flow	Addressee	Info Element	Info Entity
Tower Runway Control	Instruct expedite to leader aircraft o--> Flight Crew Leader Aircraft	Flight Crew Leader Aircraft	Vacate runway instruction	
Initial Approach Control	Transfer Flight to Final Approach Control o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Frequency change instruction	FrequencyChangeInstruction

Issuer	Info Flow	Addressee	Info Element	Info Entity
Final Approach Control	Clear aircraft for approach o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Final approach clearance instruction	
Final Approach Control	Sequence merge space aircraft o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Vectoring instruction	OpenLoopInstruction
Final Approach Control	Sequence merge space aircraft o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	IncreaseSpeedToSpeed
Final Approach Control	Sequence merge space aircraft o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	ReduceSpeedToSpeed
Final Approach Control	Sequence merge space aircraft o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	SpeedConstraint
Initial Approach Control	Pre-sequencing Vectoring o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Vectoring instruction	OpenLoopInstruction
Flight Crew Leader Aircraft	Flight Crew Leader Aircraft o--> Vacating rejection received	Tower Runway Control	Vacating rejection	
Tower Runway Control	Provide speed instruction o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	IncreaseSpeedToSpeed
Tower Runway Control	Provide speed instruction o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	ReduceSpeedToSpeed
Tower Runway Control	Provide speed instruction o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	SpeedConstraint
Tower Runway Control	Instruct Go-Around o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Missed approach instruction	

Issuer	Info Flow	Addressee	Info Element	Info Entity
Final Approach Control	Assess the resulting separation from the aircraft ahead and judge any required refinement action o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Fully established report	
Flight Crew Follower Aircraft	Flight Crew Follower Aircraft o--> Start - Spacing Minimum of less than 2.5 NM conforming to 2 NM MRS on Final approach applied	Final Approach Control	Final Approach Controller Contact	
Final Approach Control	Transfer flight to tower runway controller o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Frequency change instruction	FrequencyChangeInstruction
Tower Runway Control	Provide landing clearance o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Landing clearance instruction	
Final Approach Control	Provide aircraft spacing o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Vectoring instruction	OpenLoopInstruction
Final Approach Control	Provide aircraft spacing o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	IncreaseSpeedToSpeed
Final Approach Control	Provide aircraft spacing o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	ReduceSpeedToSpeed
Final Approach Control	Provide aircraft spacing o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Speed Instruction	SpeedConstraint

Issuer	Info Flow	Addressee	Info Element	Info Entity
Flight Crew Follower Aircraft	Flight Crew Follower Aircraft o--> Start - Spacing Minimum of less than 2.5 NM conforming to 2 NM MRS on Final approach applied	Tower Runway Control	Tower Runway Controller Contact	ATCInstruction
Tower Runway Control	Inform follower aircraft about runway surface wind/gusting conditions and late landing clearance o--> Flight Crew Follower Aircraft	Flight Crew Follower Aircraft	Wind/gusting conditions information	

3.3.3 Differences between new and previous Operating Methods

OI Step code – title (OI Step CR)		
AO-0309 - Minimum Radar Separations based upon Required Surveillance Performance (RSP) (CR 03516 Update AO-0309 (PJ02-03))		
Activity	Impact	Change
Assess ITD aircraft separation	Introduce	Concept of Initial Target Distance is new compared to current ATS. Moreover, the ITD considers the Spacing Minimum.
Assess operational situation and headwind conditions at the airport	Update	This activity is an update since the applicability of a Spacing Minimum of less than 2.5 NM down to 2 NM relies on a headwind value defined locally.
Assess operational situation and headwind conditions at the approach	Update	This activity is an update since the applicability of a Spacing Minimum of less than 2.5 NM down to 2 NM relies on a headwind value defined locally.
Coordinate with the Approach Supervisor	Update	A coordination already exists between Tower and Approach supervisors. This activity is an update since it introduces a coordination for Spacing Minimum.
Coordinate with the Tower Supervisor	Update	A coordination already exists between Tower and Approach supervisors. This activity is an update since it introduces a coordination for Spacing Minimum.
Determine required spacing between	Update	The Final Approach Control must now consider the Spacing Minimum, which may now be reduced below 2.5 NM and may be reduced to 2 NM, in the determination of the spacing.

leader and follower aircraft		
Inform follower aircraft about runway surface wind/gusting conditions and late landing clearance	Update	The Tower Runway Control informs systematically the follower aircraft that the landing clearance will be provided late.
Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation	Introduce	Concept of Final Target Distance is new compared to current ATS. Moreover, the Final Target Distance considers the Spacing Minimum which may now be less than 2.5NM and may be reduced to 2 NM.
Monitor compression effect and required spacing	Update	The Tower Runway Control must now consider the Spacing Minimum which may now be less than 2.5NM and may be reduced to 2 NM in the spacing including after deceleration.
Pre-sequencing Vectoring	Update	The activity is updated as the Initial Approach Control needs to consider the reduction of separation in the vectoring.
Provide Aircraft Spacing	Update	The Final Approach Control must now consider the Spacing Minimum which may now be less than 2.5NM and may be reduced to 2 NM.
Sequence merge space aircraft	Update	The Final Approach Control must now consider Spacing Minimum which may now be less than 2.5NM and may be reduced to 2 NM in the application of the spacing.
Set up required spacing using TDI information	Introduce	Concept of Target Distance Indicator is new compared to current ATS. Moreover, the Target Distance Indicator considers Spacing Minimum which may now be less than 2.5NM and may be reduced to 2 NM.
Switch to new final approach spacing minimum in Approach Control	Update	This activity is an update since Approach Control currently changes separation minima according to weather conditions.
Switch to new final approach spacing minimum in Tower Control	Update	This activity is an update since Approach Control currently changes separation minima according to weather conditions.

Table 10: Differences between new and previous Operating Methods

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

4.1 2NM MRS Safety, Performance and Interoperability Requirements

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0010
Title	Surveillance system RSP
Requirement	The Approach controllers and, if applicable, Tower controllers shall be supported by a surveillance system that guarantees the required surveillance performance for the safe application of the 2NM minimum radar separation
Status	<validated>
Rationale	To ensure the surveillance system is sufficiently performant for the application of the 2NM minimum radar surveillance concept This requirement has been validated as SR3.001 in the Part II SAR.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Provide aircraft spacing Set up required spacing using TDI information Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0020

Title	Longitudinal position update interval
Requirement	The longitudinal position update interval shall be less than or equal to 4 seconds.
Status	<validated>
Rationale	This requirement is an update to REQ-06.08.01-.01.0960 requirement from SESAR1 with 3.5 seconds updated to 4 seconds. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R1 and 3N_C-R1. This requirement has been validated as SR3.002 in the Part II SAR.
Category	<Safety> <Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Provide aircraft spacing Set up required spacing using TDI information Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0030
Title	Pressure altitude update interval
Requirement	The pressure altitude update interval shall be less than or equal to 4 seconds
Status	<validated>

Rationale	This requirement is an update to the requirement REQ-06.08.01-SPR-OFA1.0970 from SESAR1 with 3.5 seconds updated to 4 seconds. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R2 and 3N_C-R2. This requirement has been validated as SR3.003 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Provide aircraft spacing Set up required spacing using TDI information

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0040
Title	Aircraft identity update interval
Requirement	The aircraft identity update interval shall be less than or equal to 4 seconds.
Status	<validated>
Rationale	This requirement is an update to the requirement REQ-06.08.01-SPR-OFA1.0980 from SESAR1 with 3.5 seconds updated to 4 seconds. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R3 and 3N_C-R3. This requirement has been validated as SR3.004 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Set up required spacing using TDI information Provide aircraft spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0050
Title	Longitudinal position update probability
Requirement	The probability of the longitudinal position update shall be greater than or equal to 97%.
Status	<validated>
Rationale	This is unchanged requirement REQ-06.08.01-SPR-OFA1.0990 from SESAR1. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R4 and 3N_C-R4. This requirement has been validated as SR3.005 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Set up required spacing using TDI information Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Assess ITD aircraft separation Provide aircraft spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0060
Title	Ratio of Missed 3D positions
Requirement	The ratio of missed 3D positions involved in long gaps shall be less than or equal to 0.25%.
Status	<validated>
Rationale	This requirement is an update to requirement REQ-06.08.01-SPR-OFA1.1000 from SESAR1 with 0.5% updated to 0.25%. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R5 and 3N_C-R5. This requirement has been validated as SR3.006 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Provide aircraft spacing Set up required spacing using TDI information

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0070
Title	Longitudinal position RMS error
Requirement	The longitudinal positional RMS error shall be less than or equal to 200 metres per flight.
Status	<validated>

Rationale	This is unchanged requirement REQ-06.08.01-SPR-OFA1.1010 from SESAR1. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R6 and 3N_C-R6. This requirement has been validated as SR3.007 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Provide aircraft spacing Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Assess ITD aircraft separation Set up required spacing using TDI information

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0080
Title	Ratio of incorrect longitudinal position update interval
Requirement	The ratio of longitudinal position update interval involved in a series of at least 3 consecutive errors larger than 0.5 NM shall be less than or equal to 0.003%.
Status	<validated>
Rationale	This requirement is unchanged requirement REQ-06.08.01-SPR-OFA1.1020 from SESAR1. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R7 and 3N_C-R7. This requirement has been validated as SR3.008 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Set up required spacing using TDI information Provide aircraft spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0090
Title	Average data age of the forwarded pressure altitude
Requirement	The average data age of the forwarded pressure altitude shall be less than or equal to 2.5 seconds.
Status	<validated>
Rationale	This requirement is an update to requirement REQ-06.08.01-SPR-OFA1.1030 from SESAR1 with 1.75 seconds changed to 2.5 seconds. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R8 and 3N_C-R8. This requirement has been validated as SR3.009 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Set up required spacing using TDI information Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Provide aircraft spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0100
Title	Ratio of incorrect pressure altitude
Requirement	The ratio of incorrect forwarded pressure altitude shall be less than or equal to 0.01%.
Status	<validated>
Rationale	This is unchanged requirement REQ-06.08.01-SPR-OFA1.1050 from SESAR1. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R10 and 3N_C-R10. This requirement has been validated as SR3.010 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Assess ITD aircraft separation Provide aircraft spacing Set up required spacing using TDI information

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0110
Title	Unsigned pressure altitude error
Requirement	The unsigned pressure altitude error shall be less than or equal to 300ft in 98.5% of the cases.
Status	<validated>

Rationale	This requirement is an update to requirement REQ-06.08.01-SPR-OFA1.1060 from SESAR1 with 98% updated to 98.5%. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R11 and 3N_C-R11. This requirement has been validated as SR3.011 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Set up required spacing using TDI information Provide aircraft spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0120
Title	Emergency indicator change delay
Requirement	The delay in the change in emergency indicator/SPI report shall be less than or equal to 7.5 seconds.
Status	<validated>
Rationale	This requirement is an update to requirement REQ-06.08.01-SPR-OFA1.1070 from SESAR1 with 5.25 seconds updated to 7.5 seconds. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R12 and 3N_C-R12. This requirement has been validated as SR3.012 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Provide aircraft spacing Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Assess ITD aircraft separation Set up required spacing using TDI information

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0130
Title	Aircraft identity change delay
Requirement	The delay in the change in aircraft identity shall be less than or equal to 15 seconds.
Status	<validated>
Rationale	This requirement is an update of the requirement REQ-06.08.01-SPR-OFA1.1080, it is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R13 and 3N_C-R13.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Assess ITD aircraft separation Provide aircraft spacing Set up required spacing using TDI information

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0140

Title	Aircraft identity Probability
Requirement	The probability that the update of the aircraft identity with valid and correct values shall be greater than or equal to 98%.
Status	<validated>
Rationale	This is unchanging requirement REQ-06.08.01-SPR-OFA1.1090 from SESAR1. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R14 and 3N_C-R14. This requirement has been validated as SR3.014 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Set up required spacing using TDI information Provide aircraft spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0150
Title	Incorrect aircraft identity ratio
Requirement	The ratio of incorrect aircraft identity shall be less than or equal to 0.1%.
Status	<validated>
Rationale	This is unchanging requirement REQ-06.08.01-SPR-OFA1.1100 from SESAR1. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R15 and 3N_C-R15. This requirement has been validated as SR3.015 in the Part II SAR.

Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Provide aircraft spacing Set up required spacing using TDI information

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0160
Title	Rate of descent RMS error
Requirement	The rate of descent RMS error should be less than or equal to 500 ft/min.
Status	<validated>
Rationale	This is unchanged requirement REQ-06.08.01-SPR-OFA1.1110 from SESAR1. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R16 and 3N_C-R16. This requirement has been validated as SR3.016 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Set up required spacing using TDI information

		Provide aircraft spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0170
Title	Track velocity RMS error
Requirement	The track velocity RMS error shall be less than or equal to 4 m/s.
Status	<validated>
Rationale	This is unchanged requirement REQ-06.08.01-SPR-OFA1.1120 from SESAR1. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R17 and 3N_C-R17. This requirement has been validated as SR3.017 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Provide aircraft spacing Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Set up required spacing using TDI information

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0180
Title	Track velocity angle RMS error
Requirement	The track velocity angle RMS error shall be less than or equal to 10 degrees.
Status	<validated>

Rationale	This is unchanged requirement REQ-06.08.01-SPR-OFA1.1130 from SESAR1. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R18 and 3N_C-R18. This requirement has been validated as SR3.018 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Assess ITD aircraft separation Provide aircraft spacing Set up required spacing using TDI information

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0190
Title	False target report density
Requirement	The density of uncorrelated false target reports shall be less or equal to 1 false target report per 855 updates.
Status	<validated>
Rationale	This is unchanged requirement REQ-06.08.01-SPR-OFA1.1140 from SESAR1. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R19 and 3N_C-R19. This requirement has been validated as SR3.019 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier

<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Set up required spacing using TDI information Provide aircraft spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0200
Title	Critical failure probability
Requirement	The probability of a critical failure shall be less than or equal to 2.5x10^-5 per hour of operation.
Status	<validated>
Rationale	This is unchanged requirement REQ-06.08.01-SPR-OFA1.1150 from SESAR1. This requirement is part of the Required Surveillance Performance criteria and is derived from the EUROCONTROL Specification for ATM Surveillance System Performance requirements 5N_C-R21 and 3N_C-R21. This requirement has been validated as SR3.020 in the Part II SAR.
Category	<Safety> <Functional>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Set up required spacing using TDI information Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Provide aircraft spacing Assess ITD aircraft separation

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0240

Title	Application of 2 NM MRS in IMC conditions (Regulatory approval)
Requirement	Controllers shall be able to apply 2 NM MRS in IMC conditions without further requirements of visual separation.
Status	<validated>
Rationale	2 NM MRS will be a minimum and after considering aircraft final approach compression. Subsequent spacing requirements will be in preference supported by controller support tools. Needed to improve accuracy of separation / spacing delivery. This regulatory approved separation minimum shall incorporate all safety and human factor performance issues and finally ensuring RPS requirements are sufficient. This has been validated as new requirement SR3.024 in the Part II SAR.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Determine required spacing between leader and follower aircraft Sequence merge space aircraft Provide aircraft spacing Monitor compression effect and required spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0260
Title	Transition on base leg I
Requirement	Local procedures/rules shall be defined in order to ensure safe transition of the aircraft from 3NM to 2NM MRS, such as to avoid loss of separation minima during on base leg
Status	<validated>

Rationale	This is in order to avoid losses of radar separation on the base leg. This has been validated as new requirement SR3.026 in the Part II SAR and as requirement REQ_HP_MRS_10 in the Part IV HPAR.
Category	<Operational> , <Human Performance> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess operational situation and headwind conditions at the airport Assess operational situation and headwind conditions at the approach Coordinate with the Tower Supervisor Switch to new final approach spacing minimum in Tower Control Coordinate with the Approach Supervisor Switch to new final approach spacing minimum in Approach Control

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0330
Title	Managing separation without a Separation Delivery Tool II
Requirement	When operating under 2NM MRS without the Separation Delivery Tool, the APP ATCO shall receive additional training to emphasize the specific use of the IAS and GS indications for managing separation at interception
Status	<validated>
Rationale	This is in order to avoid losses of radar separation on the base leg. This has been validated as new requirement SR3.033 in the Part II SAR and as requirement REQ_HP_MRS_07 in the Part IV HPAR.
Category	<Human Performance> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Determine required spacing between leader and follower aircraft Monitor compression effect and required spacing Provide aircraft spacing Sequence merge space aircraft

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0270
Title	Transition on base leg II
Requirement	When the Separation Delivery Tool is used, the training curricula shall ensure the ATCOs are capable of maintaining the required separations on base leg (horizontal and vertical) despite getting in the habit of working with the TDIs on the axis
Status	<validated>
Rationale	This is in order to avoid losses of radar separation on the base leg. This has been validated as new requirement SR3.027 in the Part II SAR and as requirement REQ_HP_MRS_08 in the Part IV HPAR.
Category	<Human Performance> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Assess ITD aircraft separation Provide aircraft spacing Set up required spacing using TDI information

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0290
Title	STCA to accommodate 2NM MRS
Requirement	If available for the Final Approach Controllers, the Short Term Conflict Alert shall be adjusted to accommodate the 2NM MRS concept
Status	<validated>
Rationale	In some environments STCA will be active on the final approach segment, for example outside 4NM. It is important that STCA does not trigger false positives for the pairs correctly separated at or close to 2NM on the specific segment where STCA is active. This has been validated as new requirement SR3.300 in the Part II SAR and as requirement REQ_HP_MRS_06 in the Part IV HPAR.
Category	<Safety> , <Operational> , <Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Provide aircraft spacing Set up required spacing using TDI information Acknowledge TDI infringement Alert Assess MRS and Spacing Minimum FTD infringement

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0300
Title	ROT conditional application

Requirement	The 2NM MRS shall be applied only when the average ROT at the airport is lower than 35s and when the predefined conditions influencing ROT (e.g. braking action reported as good, no runway contaminants such as lush, snow or ice, etc.) are satisfied.
Status	<validated>
Rationale	This is in order to ensure safe operations in terms of acceptable rate of Go-arounds due to ROT. It is advised that an ORD Tool should be used to support the satisfaction of this requirement. This has been validated as new requirement SR3.030 in the Part II SAR and as requirement REQ_HP_MRS_03 in the Part IV HPAR.
Category	<Operational> , <Human Performance> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess operational situation and headwind conditions at the approach Assess operational situation and headwind conditions at the airport

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0360
Title	Conditional application of 2NM MRS with ICAO WTC Scheme
Requirement	For the case without the Separation Delivery Tool, when using the ICAO WTC scheme, in addition to the satisfaction of ROT (see requirement REQ-02.03-SPRINTEROP-ARR4.0300), 2NM MRS shall be applied only when the runway surface and glide-slope wind threshold is satisfied. The wind threshold is to be defined locally and it will be such that the wake turbulence separation between ICAO M-M pairs drops below 2 NM.
Status	<validated>

Rationale	This is in order to ensure the wake separation for the ICAO WTC M-M pairs permits the application of 2NM MRS for these specific pairs. -To reduce the potential for human error as the ATCOs would be required to mentally calculate the ROT values otherwise -
Category	<Safety> , <Human Performance> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Determine required spacing between leader and follower aircraft Monitor compression effect and required spacing Sequence merge space aircraft Provide aircraft spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0310
Title	Local Collision Risk Model
Requirement	A local Collision Risk Assessment shall be performed to prove that the collision risk of pairs of aircraft concerned by MRS 2NM, is at acceptable safety levels considering the local distribution of the aircraft pairs, wind conditions, etc. See Collision Risk Assessment example from Heathrow Airport.
Status	<validated>
Rationale	This is in order to be protected in case of MRS infringement (e.g. case of radio failure affecting both aircraft). This has been validated as new requirement SR3.301 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier

<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Provide aircraft spacing Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Set up required spacing using TDI information Determine required spacing between leader and follower aircraft Monitor compression effect and required spacing Sequence merge space aircraft

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0340
Title	Leader break-off/go-around in front of follower
Requirement	A generic wake risk assessment shall be performed for the2NM MRS non-wake pairs in the specific case when the leader is performing a break-off/go-around and the follower, separated at or close to the separation minima, continues its descent crossing the leader's descending wake
Status	<validated>
Rationale	This is needed to ensure there are no wake encounters when an a/c pair is separated at or close to 2NM MRS and the leader performs a go-around/break-off. This has been validated as new requirement SR3.302 in the Part II SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Set up required spacing using TDI information Assess ITD aircraft separation

		Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Provide aircraft spacing Determine required spacing between leader and follower aircraft Monitor compression effect and required spacing Sequence merge space aircraft

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0350
Title	APP and TWR radar picture synchronisation
Requirement	If the introduction of 2NM MRS with ORD requires to change the current surveillance system (e.g. for a higher update rate) in local implementation, there shall be a synchronisation of the update rate between the APP and TWR ATCOs radar screens in order to allow smooth radar visualisation upon aircraft transfer from APP to TWR
Status	<validated>
Rationale	This is in order to allow smooth visualisation when aircraft are transferred between APP and TWR. This has been validated as new requirement SR3.035 in the Part II SAR and as requirement REQ_HP_MRS_15 in the Part IV HPAR.
Category	<Safety> , <Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Provide aircraft spacing Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Set up required spacing using TDI information Assess ITD aircraft separation

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0351
Title	Separation Delivery Tool for TB-modes
Requirement	When the 2NM MRS concept is applied in TB-modes, DB PWS-A and/or WDS-A, the Intermediate Approach, Final Approach and Tower Controllers shall be provided with a Separation Delivery Tool displaying Target Distance Indicators (TDI) to enable consistent and accurate application of separation rules on final approach and landing
Status	<validated>
Rationale	The Separation Delivery Tool is mandatory when the 2NM MRS concept is applied in TB-modes, DB PWS-A and/or WDS-A. This has been validated as new requirement SR3.037 in the Part II SAR and as requirement REQ_HP_MRS_11 in the Part IV HPAR.
Category	<Safety> , <Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Provide aircraft spacing Set up required spacing using TDI information

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0354
Title	Separation Delivery Tool for DB-modes

Requirement	When the 2NM MRS concept is applied in DB-modes not including DB PWS-A, the Intermediate Approach, Final Approach and Tower Controllers should be provided with a Separation Delivery Tool displaying Target Distance Indicators (TDI) to enable consistent and accurate application of separation rules on final approach and landing
Status	<validated>
Rationale	The Separation Delivery Tool is not mandatory when the 2NM MRS concept is applied in DB-modes (not including DB PWS-A). his has been validated as REQ_HP_MRS_12 in the Part IV HPAR.
Category	<Human Performance> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Set up required spacing using TDI information Assess ITD aircraft separation Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Provide aircraft spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0352
Title	Glideslope wind monitoring function I
Requirement	For all DB modes with ORD (i.e. displaying ITDs) and TB modes, the Approach and Tower Controllers and Supervisors shall be alerted by the glideslope wind monitoring function about a significant difference between actual glideslope headwind profile and the glideslope headwind profile used for the TDI computation, i.e. when the predicted time-to-fly (based on the headwind profile prediction used for Target Distance Indicator computation) compared to the actual time-to-fly (based on the actual headwind measurement) exceeds a threshold to be determined locally.
Status	<validated>

Rationale	A significant difference between the actual wind profile and the wind profile used by the tool will have an impact of the correctness of the ITDs in any mode of operation and on the FTDs in TB-modes. This can lead to an under-separation. This has been validated as new requirement SR3.238 in the Part II SAR and as requirement REQ_HP_MRS_14 in the Part IV HPAR.
Category	<Human Performance> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess operational situation and headwind conditions at the airport Assess operational situation and headwind conditions at the approach Check final approach spacing minimum change is reflected in arrival sequence at Approach Control Coordinate with the Tower Supervisor Check final approach spacing minimum change is reflected in arrival sequence at Tower Control Switch to new final approach spacing minimum in Approach Control Coordinate with the Approach Supervisor Switch to new final approach spacing minimum in Tower Control

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0357
Title	Working methods
Requirement	A set of working methods/guidelines to cover the MRS concept and the related normal operating procedures (and associated tools) should be locally defined.
Status	<validated>
Rationale	To ensure all actors involved (ATCOs, SUPs etc.) are fully aware of the working methods associated to the 2 NM MRS concept. This has been validated as REQ_HP_MRS_01 in the Part IV HPAR.

Category	<Operational> , <Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Sequence merge space aircraft Monitor compression effect and required spacing Determine required spacing between leader and follower aircraft Provide aircraft spacing Set up required spacing using TDI information Assess ITD aircraft separation

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0358
Title	Working methods II
Requirement	A set of working methods/guidelines to cover the MRS concept and the related abnormal/ degraded operating procedures should be locally defined.
Status	<validated>
Rationale	To ensure all actors (ATCOs, SUPs etc.) involved are fully aware of the working methods associated to the 2 NM MRS concept. However, following the validation activities, the ATCOs believe there will be no significant change compared to the operating methods associated with 2.5NM MRS. This has been validated as REQ_HP_MRS_02 in the Part IV HPAR.
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier

<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Determine required spacing between leader and follower aircraft Assess ITD aircraft separation Monitor compression effect and required spacing Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Sequence merge space aircraft Set up required spacing using TDI information Provide aircraft spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0356
Title	Flight Crew
Requirement	The Flight Crew shall be made aware of the locally applied separation mode and minima via appropriate means (e.g. from ATIS, AIP, NOTAM, information campaigns).
Status	<validated>
Rationale	The pilots participating in the workshop have mentioned that with reduced separations (especially if combined with TBS) it becomes “impossible for the flight crew to be different with the separation minima applicable on airports around the world”. As a result, flight crew shall comply with ATC instructions, which requires high trust in the ATCOs, which would be reinforced by information campaigns which would bring the flight crew the required updates. Additionally, the separation minima values shall be available in the corresponding documentation (e.g. ATIS, NOTAM etc.). This has been validated as REQ_HP_MRS_04 in the Part IV HPAR.
Category	<Operational> , <Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

<ALLOCATED_TO>	<Activity>	Assess ITD aircraft separation Determine required spacing between leader and follower aircraft Sequence merge space aircraft Provide aircraft spacing Monitor compression effect and MRS and Spacing Minimum FTD aircraft separation Monitor compression effect and required spacing

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0355
Title	Regulatory approvals
Requirement	In case a separation reduction of the MRS on the baseleg to 2.5NM MRS is considered, it shall be approved by local regulators.
Status	<validated>
Rationale	Following the EXE-PJ02-03-V3-RTS02, ATCOs consider that “there must be a different separation minima allowed on the base leg, as one would only be comfortable with working so tight, if the currently accepted separation minima of 3NM (on the baseleg) can be infringed”. This has been validated as REQ_HP_MRS_05 in the Part IV HPAR.
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Set up required spacing using TDI information Sequence merge space aircraft

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ARR4.0353
Title	Glideslope wind monitoring function II
Requirement	In case of wind monitoring alert, the Approach and Tower Controllers shall revert to the corresponding Minimum Radar Separation mode (e.g. 2.5NM or 3NM MRS), with or without the FTD and ITD indicators and when needed take corrective actions during the transition phase like instructing go-arounds.
Status	<validated>
Rationale	If the wind monitoring alert shows, this means that there is a significant difference between the actual wind profile and the wind profile used by the tool (with impact on the correctness of the ITDs in any mode of operation and on the FTDs in TB-modes) which means that the mode of operation has be changed. This has been validated as new requirement SR3.239 in the Part II SAR and as requirement REQ_HP_MRS_13 in the Part IV HPAR.
Category	<Human Performance> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess operational situation and headwind conditions at the approach Check final approach spacing minimum change is reflected in arrival sequence at Approach Control Assess operational situation and headwind conditions at the airport Check final approach spacing minimum change is reflected in arrival sequence at Tower Control Coordinate with the Tower Supervisor Coordinate with the Approach Supervisor Switch to new final approach spacing minimum in Approach Control Switch to new final approach spacing minimum in Tower Control

4.2 ORD Tool Requirements Shared from PJ02-01

The joined file details the ORD tool requirements shared with PJ02-01 and applicable to PJ02-03 when an ORD tool is used.


Microsoft Excel
97-2003 Worksheet

4.3 Security Requirements

PJ02-03 is closely linked to PJ02-01 with respect to the provision of the ORD tool support to aid in the consistent delivery final approach spacing to the spacing minimum below 2.5NM down to 2 NM enabled by the reduction of the MRS to 2 NM. As such the high level security requirements provided by security experts for PJ02-01 are applicable to PJ02-03.

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0001
Title	Security Policy (C2.1)
Requirement	The Responsible Organisation shall produce, approve, and adopt a security policy which complies with the Reference ATM Security Policy; this security policy shall be communicated to all relevant parties. Note: it is recommended that this be based upon the principles set out in ISO-270001:2013, or later.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0002

Title	Reviewing Security Policy (C2.2)
Requirement	The Responsible Organisation shall regularly review the security policy and ensure that it remains effective.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0003
Title	Resourcing & Assigning Security Policy Roles (C3.1)
Requirement	The Responsible Organisation shall provide the resources needed for information and ATM services security and assign roles and responsibilities for all security management functions.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0004
Title	Coordinating Security Controls (C3.2)
Requirement	The Responsible Organisation shall ensure that the implementation of information and ATM services security controls is co-ordinated across the organisation.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0005
Title	Information Storage and Exchange Means (C3.3)
Requirement	Information storage and exchange means shall be defined in accordance with the security value of such information.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier

<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0006
Title	Background Security Verification Checks (C4.1)
Requirement	Background verification checks on all staff shall be carried out in accordance with relevant laws, regulation, and ethics. The checks shall be proportional to the roles and responsibilities, in particular in respect to the business requirements (e.g. safety-critical function, developments), the protective marking or classification of information to be accessed, and the perceived risks.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0007
Title	Staff Application of Security (C4.2)
Requirement	Staff shall apply security in accordance with the established policies and procedures.
Status	<in progress>

Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0008
Title	Security Awareness Training (C4.3)
Requirement	Staff shall receive appropriate awareness training and regular updates in organisational policies and procedures, as relevant for their job function.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0009
Title	Staff Security Procedures (C4.4)

Requirement	Staff shall undergo a formal rotation, change, and leaving procedure.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0010
Title	Inventory of Assets (C5.1)
Requirement	All assets shall be clearly identified and an inventory of all important assets drawn up and maintained.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0011
Title	Designated Responsibility (C5.2)
Requirement	All information and ATM services associated with information processing facilities shall be 'owned' by a designated responsible individual or role.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0012
Title	Acceptable Use of Asset Policy (C5.3)
Requirement	Rules for the acceptable use of assets shall be identified, documented, and implemented.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0013
Title	Security Classification (C5.4)
Requirement	All Information and ATM services shall be classified in terms of its value, legal requirements, sensitivity and criticality to ATM, ATM organisations and stakeholders.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0014
Title	Labelling and Handling Procedures (C5.5)
Requirement	An appropriate set of procedures for information and ATM services labelling and handling shall be developed and implemented in accordance with the protective marking or classification scheme adopted.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0001
Title	Removable Media Procedures (C5.6)
Requirement	There shall be procedures in place for the management of removable media.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0002
Title	Media Disposal Procedures (C5.7)
Requirement	Media shall be disposed of securely and safely when no longer required, using formal procedures.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.

Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0003
Title	Procedures for Handling and Storage of ATM Information (C5.8)
Requirement	Procedures for the handling and storage of ATM information shall be established to protect ATM services and information from unauthorised disclosure or misuse.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0015
Title	Protection of ATM System Documentation (C5.9)
Requirement	ATM system documentation shall be protected against unauthorised access.
Status	<in progress>

Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0016
Title	Access Control Policy (C6.1)
Requirement	An access control policy shall be established, documented, and reviewed based on business and security requirements for access.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0017
Title	Access Control Procedure (C6.2)

Requirement	There shall be an access control procedure in place for granting and revoking access to all information systems and services.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0018
Title	Allocation of Access Privileges (C6.3)
Requirement	The allocation of access privileges shall be restricted to users who have been specifically authorised to use ATM facilities, and such privileges should be controlled by a formal management process.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0004
Title	Access Control Policy for Shared ATM Networks (C6.4)
Requirement	For shared ATM networks, especially those extending across the responsible organisation's boundaries, the capability of users to connect to the network shall be restricted, in accordance with the access control policy and requirements of the operational applications.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0005
Title	Utility Programs Policy (C6.5)
Requirement	The use of utility programs that might be capable of overriding system and application controls shall be restricted and tightly controlled.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0006
Title	Sensitive Systems Policy (C6.6)
Requirement	Sensitive systems shall have a dedicated (protected) computing environment.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0007
Title	External Access Policy (C6.7)
Requirement	The Responsible Organisation shall review the security requirements and risks of every external access to information or ATM Services before granting access.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0008
Title	User Security Practices (C6.8)
Requirement	User shall be required to follow good security practices in the protection of authentication information or devices.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0009
Title	Unattended Equipment Procedure (C6.9)
Requirement	Users shall ensure that unattended equipment has appropriate protection.
Status	<in progress>

Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0010
Title	Papers, Media and Information Processing Facilities Policy (C6.10)
Requirement	A security policy for papers and removable storage media and information processing facilities shall be adopted.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0019
Title	Security Perimeter Policy (C7.1)

Requirement	Security perimeters shall be used to protect ATM sensitive areas and ATM processing facilities.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0020
Title	Entry Control Policy (C7.2)
Requirement	ATM secure areas shall be protected by appropriate entry controls which allow access only to authorised personnel and which detect unauthorised access.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0011
Title	Auxiliary Means Policy (C7.3)
Requirement	ATM equipment shall be provided with auxiliary means to compensate for deliberate compromising of power supply, overheating and fire.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0012
Title	ATM Cabling Policy (C7.4)
Requirement	ATM cabling shall be protected from deliberate damage, eavesdropping or interference.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0021
Title	Maintenance and Servicing Policy (C7.5)
Requirement	ATM equipment shall be maintained and serviced to ensure their availability and integrity.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0022
Title	Operating ATM Procedures Policy (C8.1)
Requirement	Operating ATM procedures shall be documented, maintained, and made available to all users who need to know them.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0023
Title	Change Control Procedures Policy (C8.2)
Requirement	Changes to ATM information processing facilities, ATM services and systems shall be controlled.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0013
Title	ATM Software Controls Policy (C8.3)
Requirement	Detection, prevention, and recovery controls to protect ATM software against malicious code and appropriate user awareness procedures shall be implemented.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0014
Title	Back-up Policy (C8.4)
Requirement	Backup copies of ATM information and software shall be taken and tested regularly in accordance with an agreed backup policy.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0015
Title	Monitoring Procedures (C8.5)
Requirement	Procedures for monitoring the use of ATM services and information processing facilities shall be established and the results of the monitoring activities reviewed regularly.
Status	<in progress>

Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03
<ALLOCATED_TO>	<Activity>	Assess operational situation and headwind conditions at the airport Check final approach spacing minimum change is reflected in arrival sequence at Approach Control Coordinate with the Approach Supervisor Check final approach spacing minimum change is reflected in arrival sequence at Tower Control Assess operational situation and headwind conditions at the approach Coordinate with the Tower Supervisor Switch to new final approach spacing minimum in Approach Control Switch to new final approach spacing minimum in Tower Control

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0024
Title	ATM Logging Protection Procedures (C8.6)
Requirement	ATM logging facilities and log information shall be protected against tampering and unauthorised access.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.

Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0025
Title	Fault Logging and Resolution Procedures (C8.7)
Requirement	Faults shall be logged, analysed, and appropriate action taken.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0016
Title	ATM Networks Policy (C9.1)
Requirement	ATM Networks shall be adequately managed and controlled, in order to be protected from threats, and to maintain security for the ATM systems and applications using the network, including information in transit.
Status	<in progress>

Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0017
Title	Formal Exchange Policies (C9.2)
Requirement	Formal exchange policies, procedures, and controls shall be in place to protect the exchange of ATM services and information through the use of all types of communication facilities. Agreements shall be established for the exchange of ATM services and information and software between the responsible organisation and external parties.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0018

Title	Electronic Messaging Protection Policy (C9.3)
Requirement	Information conveyed by electronic messaging shall be appropriately protected.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0026
Title	Security Requirements Policy (C10.1)
Requirement	Every specification for new or updated facilities shall include security requirements.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0027
Title	Change Control Approval Policy (C10.2)
Requirement	An operational process and plan which controls how system changes are approved and implemented, and how security considerations are incorporated in the change process shall be enacted.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0028
Title	Security Testing Policy (C10.3)
Requirement	Security testing shall be performed whenever a system is updated.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier

<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0029
Title	Security Acceptance Criteria Policy (C10.4)
Requirement	Security acceptance criteria for new ATM information systems or services, upgrades, and new versions shall be established, and suitable security tests of the ATM system(s) carried out during development and prior to acceptance. This shall include individual development activities such as specification, design, development and qualification which may have corresponding acceptance criteria.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0030
Title	Reporting of Security Events Policy (C11.1)
Requirement	ATM service and Information security events shall be reported through appropriate management channels as quickly as possible.
Status	<in progress>

Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0031
Title	Reporting of Suspected Security Weaknesses or Malfunctions Policy (C11.2)
Requirement	All employees, contractors and third party users of information systems and services shall be required to note and report any observed or suspected security weaknesses or malfunctions in ATM systems or services.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0032

Title	Responding to Security Incidents Policy (C11.3)
Requirement	Management responsibilities and procedures shall be established to ensure an effective and orderly response to ATM service and information security incidents.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0033
Title	Security Incident Evidence Management Policy (C11.4)
Requirement	Where a follow-up action against a person or organisation after an ATM service or information security incident involves legal action (either civil or criminal), pieces of evidence shall be collected, retained, and presented to the relevant jurisdiction(s).
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0034
Title	Security Incident External Authorities Involvement Policy (C11.5)
Requirement	The responsible organisation shall have procedures in place that specify when and by whom external authorities (e.g. law enforcement, fire department, supervisory authorities) shall be contacted in the event of a security incident.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0035
Title	ATM Business Continuity Security Requirements Policy (C12.1)
Requirement	A managed process shall be developed and maintained that addresses the ATM service and information security requirements needed for ATM business continuity.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0036
Title	Disruptive Events Identification and Risk Assessment Policy (C12.2)
Requirement	Events that can cause interruptions to ATM business processes shall be identified, along with the likelihood and impact of such interruptions and their consequences for ATM information security.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0037
Title	Planning Policy for Restoration from Disruptive Events (C12.3)
Requirement	Plans shall be developed and implemented to maintain or restore operations and to ensure the availability, integrity and confidentiality of information at the required level and in the required time scales following interruption to critical ATM business processes.
Status	<in progress>

Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0038
Title	Policy for Testing and Updating Business Continuity Plans (C12.4)
Requirement	ATM business continuity plans shall be tested and updated regularly to ensure that they are up to date and effective.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0039
Title	Compliance Policy (C13.1)

Requirement	Compliance to statutory, regulatory and contractual requirements shall be checked, and the correct and authorised use of facilities and assets shall be defined.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-ALL4.0040
Title	Compliance to National and European Requirements (C13.2)
Requirement	Any personal or protectively classified information shall be protected in accordance with National and European requirements.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0019
Title	Malicious Software Policy (C8.3 PR1)
Requirement	The software development and production process shall detect and remove malicious software.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0020
Title	Malicious Software Removal on Detection Policy (C8.3 PR2)
Requirement	The software management process shall ensure that all detected malicious software is removed on detection.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0021
Title	Malicious Software User Policy (C8.3 PR3)
Requirement	Once detected users shall be immediately informed of the event and as soon as possible provided with detailed of any effects.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0022
Title	Software Installation Media Policy (C8.3 PR4)
Requirement	Software shall only be installed from verified media.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0023
Title	Software Validation and Verification Testing Policy (C8.3 PR5)
Requirement	Only software which has been the subject of documented validation and verification testing shall be installed.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0024
Title	Related Systems Malicious Software Policy (C8.3 PR6)
Requirement	The software management process shall ensure that related systems are informed of any infection or repulsed malicious software.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0025
Title	Malicious Software Staff Training Policy (C8.3 PR7)
Requirement	Software development, operations, maintenance and management staff shall be proved with periodic training on type of malicious software.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0026
Title	Malicious Software Operational System Fall-Back Policy (C8.3 PR8)
Requirement	The operational system shall retain the most recent (-1) version of software to provide an immediate fall-back if the detected malicious software requires cessation of operations.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.

Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0027
Title	Scanning Policy (C8.3 TR1)
Requirement	The detection and removal system shall scan all software before installation, all data items that are input to the system, all data and software on access and scan all system software in every 7 day period.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0028
Title	Operational Systems Malicious Software Protection Policy (C8.3 TR2)

Requirement	For operational systems, protection against detected malicious software shall be achieved within 10 minutes of detection. If cessation of operations is necessary, this shall be done as soon as operationally safe to do so.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0029
Title	New Form of Malicious Software Protection Policy (C8.3 TR3)
Requirement	In response to information about a new form of malicious software development and operation software shall be reviewed for presence. The detection software shall utilise signature databases from a reputable security source; systems connected to the Internet shall update their detection databases within 12 hours of the availability of new signatures, or within 72 hours if the system has no Internet connection
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0030
Title	Malicious Software User Notification Policy (C8.3 TR4)
Requirement	The system and its management processes must ensure that users are notified of the detection of malicious software or any other security event that may cause perceptible loss of performance or a safety risk; such notification shall be within 1 hour of the identification of the risk.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0031
Title	Malicious Software Alerting Policy (C8.3 TR5)
Requirement	The System shall alert the Security and Software Management processes within 5 minutes of detecting malicious software.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.

Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0032
Title	Verified Media Definition Policy (C8.3 TR6)
Requirement	Verified media shall be defined within the Software Management process
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0033
Title	Validation and Verification Processes Policy (C8.3 TR7)
Requirement	Validation and verification processes to be used shall be based on industry standards e.g. ISO or Def Standards and industry best practices.
Status	<in progress>

Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0034
Title	Malicious Software Staff Training Policy (C8.3 TR8)
Requirement	Training to staff shall ensure that all users understand and practice processes for handling media, are aware of the risks resulting from malicious software and the mechanisms by which such software may be inadvertently introduced into the system, and understand general security requirements and good practice for the protection of security tokens such as passwords and access controls. Users shall demonstrate current knowledge of these issues at intervals of no less than 1 year.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0035
Title	Operational Software Access Restriction Policy (C8.3 TR9)
Requirement	The Security and Software management processes shall maintain an up to date listing of those who have been trained and shall restrict access to operational software to those who have been trained and are current.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

[REQ]

Identifier	REQ-02.03-SPRINTEROP-SYS3.0036
Title	Virus Protection Policy (C8.3 TR10)
Requirement	To achieve the highest protection against virus introduction White Listing (or an acceptable industry standard equivalent) shall be used.
Status	<in progress>
Rationale	The requirement is proposed as a high-level security requirement, appropriate for the current phase, i.e. in absence, currently, of detailed design. This requirement is to be reviewed, updated, and refined, in future phases.
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier

<ALLOCATED_TO>	<SESAR Solution>	PJ.02-03

5 References Documents

5.1 Applicable Documents

Content Integration

[1] B.04.01 D138 EATMA Guidance Material

[2] EATMA Community pages

[3] SESAR ATM Lexicon

Content Development

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

[5] PJ19.02 SESAR 2020 Concept Of Operations Edition 2017, Edition 01.00.00, 28 November 2017

System and Service Development

[6] 08.01.01 D52: SWIM Foundation v2

[7] 08.01.01 D49: SWIM Compliance Criteria

[8] 08.01.03 D47: AIRM v4.1.0

[9] 08.03.10 D45: ISRM Foundation v00.08.00

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

[11]B.04.03 D128 ADD SESAR1

[12]B.04.05 Common Service Foundation Method

Performance Management

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

[14]B.04.01 D42 SESAR2020 Transition Validation

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

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

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

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

[19]ATM Cost Breakdown Structure_ed02_2014

[20]Standard Inputs for EUROCONTROL Cost Benefit Analyses

[21]16.06.06_D26-08 ATM CBA Quality Checklist

[22]16.06.06_D26_04_Guidelines_for_Producing_Benefit_and_Impact_Mechanisms

Validation

[23]03.00 D16 WP3 Engineering methodology

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

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

[26]PJ19 Validation Targets (2018), Edition 01.00.00, 26 February 2018

System Engineering

[27]SESAR Requirements and V&V guidelines

Safety

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

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

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

[31]SESAR, Resilience Engineering Guidance, May 2016

Human Performance

[32]16.06.05 D 27 HP Reference Material D27

[33]16.04.02 D04 e-HP Repository - Release note

Environment Assessment

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

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

Security

[36]16.06.02 D103 SESAR Security Ref Material Level

[37]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[38]16.06.02 D131 Security Database Application (CTRL_S)

5.2 Reference Documents

[39]ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.[2]

[40]ICAO Document 4444 –ICAO Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM), Doc 4444, Fifteenth Edition, 2007.

[41]OFA 01.03.01 Enhanced Throughput Consolidated Final Step 1 OSED, D30, 00.01.00, 31.05.2016

[42]OFA 01.03.01 Enhanced Runway Throughput Consolidated Final Step 1 SPR,D32, 00.01.00,31.05.2016

[43]OFA 01.03.01 Enhanced Runway Throughput Consolidated Final Step 1 Interop, D34, 00.01.00, 25/05/2016

[44]P06.08.01 Operational Service Environment Definition for Time Based Static Pairwise Separation with Optimised Runway Delivery for Arrivals, M156, 00.00.04, 06/06/2016

[45]P06.08.01 TB S-PWS with ORD for Arrivals – Safety Assessment Report, M163, 00.02.00, 05/07/2016

[46]EUROCONTROL Specification for ATM Surveillance System Performance. s.I. : EUROCONTROL, 2012. EUROCONTROL-SPEC-0417

[47]Mosquera-Benitez, Daniel and Groskreutz, Alan Ross and Fucke, Lars. Separation Minima Model. S.I. : Eighth USA/Europe Air Traffic Management Research and Development Seminar (ATM2009)

[48]Groskreutz, Alan R and Dominguez, Pablo Munoz. Required Surveillance Performance for reduced minimal-pair arrival separations. S.I. : Eleventh USA/Europe Air Traffic Management Research and Development Seminar (ATM2015)

[49]ICAO Doc 8168, Aircraft Operations

[50]SESAR Solution PJ02-01 SPR-INTEROP/OSED for V3 – Part I, Edition 00.00.14, 31 October 2019

[51]SESAR2020 PJ02-03 SRAT01-10-646 Surveillance Performance Assessment of 2NM Separations at Heathrow, Issue 1, September 2017

[52]SESAR Solution PJ02-03 SPR-INTEROP/OSED for V3 – Part II – Safety Assessment Report, Edition 00.00.03, 5th September 2019

[53]SESAR Solution PJ02-03 SPR-INTEROP/OSED for V3 – Part IV – Human Performance Assessment Report, Edition 00.00.01, 14 May 2019

[54]SESAR Solution PJ02-03 VALR for V3, Edition 00.00.03, 20 June 2019

[55]SESAR Solution 02-03 Technical Specification (TS/IRS) for V3/TRL6, Edition 00.00.01, 5 April 2019

Appendix A Cost and Benefit Mechanisms

A.1 Stakeholders identification and Expectations

Stakeholder	Involvement	Why it matters to stakeholder
Air Traffic Controllers	Tower and Approach controllers will be required to work with the reduction on the in-trail Minimum Radar Separation from 2.5 NM to 2 NM on final approach. Controllers will participate in the real time simulations plus workshops conducted as part of the safety as human performance assessment.	The controllers are responsible for the safe separation of aircraft. Controller expectations in terms of KPA/TA: Safety: Safety to be maintained or improved. Capacity: Runway throughput to be improved. Resilience: Additional resilience in terms of runway throughput in case of perturbation e.g. due to wind conditions. Human Performance: Controller task performance (in terms of separation delivery), workload and situation awareness must not be negatively impacted. Human Performance: The operational procedures and any associated support tools required to support the controllers in their work, to be usable and acceptable. Human Performance: Changes to end users roles responsibilities and tasks (controllers (tower and approach, supervisors, flight crew) are clear and acceptable.
Flight Crew	Flight crew will fly aircraft with the reduced separations on the final approach and are responsible for ensure the safe operations of the aircraft. The flight crew will be involved in stakeholder workshops conducted as part of the safety and human	Flight crew will be responsible for the safety of their aircraft hence have an interest in understanding a concept which reduces separations. Flight crew expectations in terms of KPA/TA: Safety: Safety will be maintained or improved. Resilience: Additional resilience in terms of runway throughput in case of perturbation e.g. due to weather / wind conditions. Airlines and air space users need evidence to show the reduction on the in-trail Minimum Radar

	performance assessments.	Separation from 2.5 NM to 2 NM on final approach is safe. Environment: Average delay per flight is expected to decrease with the reduction on the in-trail Minimum Radar Separation from 2.5 NM to 2 NM. A reduction in delay will reduce fuel burn in the TMA, this links to Environment, and Fuel Efficiency as well as Flight Efficiency. The reduced fuel burn has a direct link to CO2 emissions which link to Environment. Airlines and airspace users will need evidence to show that the implementation and deployment of the Minimum Radar Separation from 2.5 NM to 2 NM will be cost-effective for them. Flight efficiency: Flight efficiency will be maintained or improved as average delay per flight is expected to decrease as the majority of aircraft separations are expected to decrease. Human performance: Any changes to flight crew tasks will be acceptable. Human performance: The reduction on the in-trail Minimum Radar Separation from 2.5 NM to 2 NM scheme are considered acceptable by the flight crew. Human Performance: Flight crew responsibility for maintaining safe operation is unchanged.
ANSPs	ANSPs will be responsible for the local deployment and operation of the new wake concepts.	ANSPs will want the reduction on the in-trail Minimum Radar Separation from 2.5 NM to 2 NM scheme if it is shown to provide a benefit to their operation. ANSP expectations in terms of KPA/TA: Safety: Safety will be maintained or improved. Cost efficiency: The implementation and deployment will be cost effective.

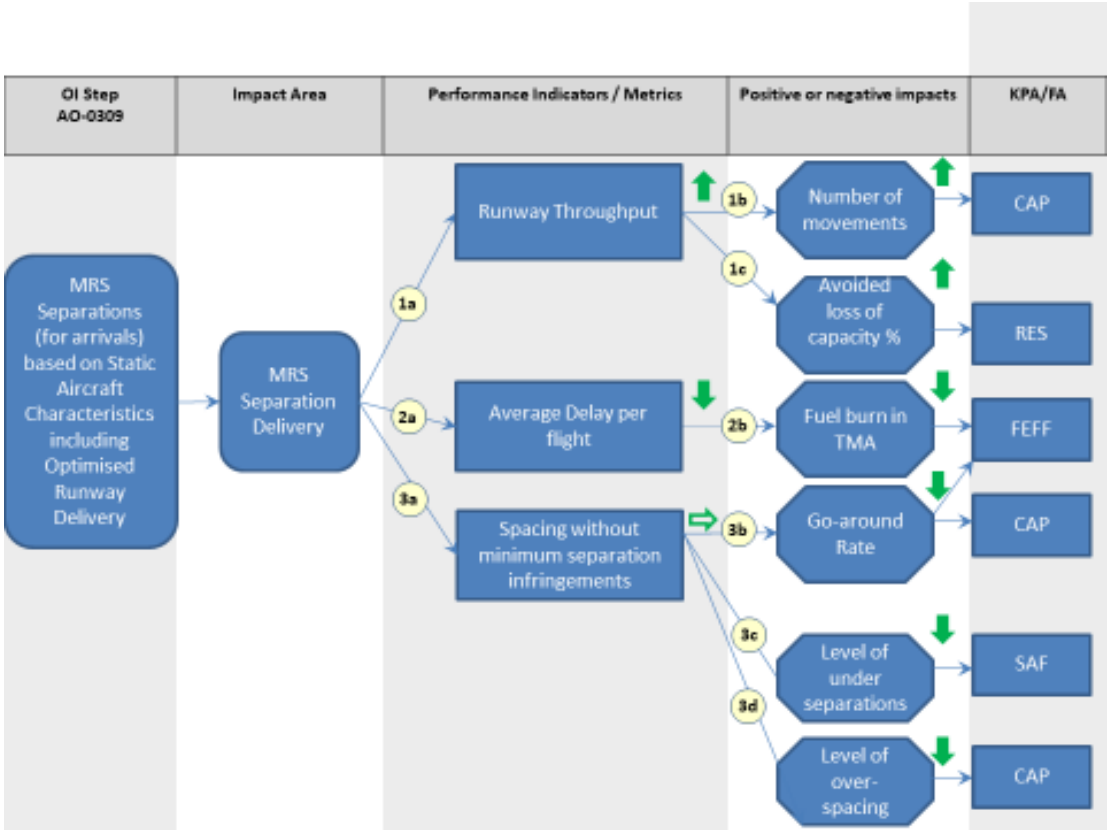
		Capacity: Runway throughput will be improved. Resilience: Additional resilience in terms of runway throughput in case of perturbation e.g. due to weather / wind conditions
Airlines /airspace Users	Airspace Users / Airlines will have to implement any necessary changes to aircraft operating procedures operating methods and ensure their flight crew comply with new wake concepts.	Airlines will need to understand a concept which reduces separations and will need to provide sufficient training to flight crew. Airspace Users / airline expectations in terms of KPA/TA: Cost efficiency: The implementation and deployment will be cost effective. Flight efficiency: Fight efficiency will be maintained or improved as average delay per flight is expected to decrease with the reduction on the in-trail Minimum Radar Separation from 2.5 NM to 2 NM as the majority of aircraft separations are expected to decrease. Environment: A reduction in delay will reduce fuel burn in the TMA, this links to Environment and Fuel Efficiency (as well as flight efficiency). The reduced fuel burn has a direct link to CO2 emissions which link to Environment. Safety: Safety will be maintained or improved.
Airport Operators	Airport operators will have to implement any necessary changes and will benefit from increased runway throughput.	Airport Operators expectations in terms of KPA/TA: Safety: Safety will be maintained or improved. Cost efficiency: The implementation and deployment will be cost effective. Capacity: Runway throughput will be improved. Resilience: Additional resilience in terms of runway throughput in case of perturbation e.g. due to weather / wind conditions

Regulatory Authorities	Regulatory authorities will have to approve the new wake concepts from a regulatory and safety perspective	Regulatory authorities expectations in terms of KPA/TA: Safety: Harmonisation of regulations according to the European Standard. Ensuring the SESAR 2020 Solutions meeting needed requirements in safety. Safety: Evidence to show that the reduction on the in-trail Minimum Radar Separation from 2.5 NM to 2 NM is as safe as current operations

Table 11: Stakeholder's expectations

A.2 Benefits mechanisms

The Benefit and Impact Mechanisms developed to cover AO-0309 with the use of the ORD tool is detailed below:



(1a) The use of the in-trail 2NM MRS reduces current minimum separation so it increases the runway throughput

(1b) A reduced spacing between aircraft has positive impact on the runway throughput. The higher the throughput, the higher the number of movements, leading to a positive impact on Capacity.

(1c) Reduction of separations will result in higher Resilience and avoid loss of capacity.

(2a) Reduction of separations will reduce the average delay per flight.

(2b) As airborne delay uses more fuel (e.g. in case of holding), a reduction in this delay will result in reduced fuel burn in the TMA. This has a positive impact on Fuel Efficiency.

(3a) With the use of the ORD tool, the accuracy of the spacing between aircraft is improved compared to what is achieved today (e.g. distance between pair of aircraft closer to separation minima) and will reduce the margins delivered.

(3b) Validations show that the rate of Go-around decreased using the ORD tool

(4a) With the use of the target indicators, the accuracy of the spacing between aircraft is improved compared to what is achieved today (e.g. distance between pair of aircraft closer to separation minima) and will allow controllers to deliver aircraft with greater accuracy than today.

(4b) Improving spacing accuracy will reduce the number of aircraft that are under-separated which links to Safety.

(4c) Improving spacing accuracy will enable more aircraft to be sequenced with reduced spacing which links to Capacity.

A.3 Costs mechanisms

For airports where the approach controllers already use a surveillance service that has the RSP, the costs associated with:

- Formally carrying out the local RSP assessment of the surveillance service.
- Carrying out the local CRM assessment for the approach speed procedures employed on final approach.
- The development and validation of the local method of operations covering all local nominal, non-nominal and failure scenarios for employing an in-trail spacing minimum below 2.5 NM down to 2 NM.
- Developing the local safety case and obtaining local safety regulatory approval
- The adaptation of STCA or a Separation Monitor Function for the employment of the in-trail spacing minimum below 2.5 NM down to 2 NM on final approach
- The adaptation of AMAN to support the employment of the in-trail spacing minimum below 2.5 NM down to 2 NM on final approach
- The development and provision of the Optimised Runway Delivery (ORD) tool support where this is the chosen option.

For airports where the approach controllers do not use a surveillance service that has the RSP there will also be the additional costs associated with providing for a surveillance service that a has the RSP.

With respect to the provision of the ORD tool support the following are the ORD tool support cost drivers:

- The development and validation of the local method of operations covering all local nominal, non-nominal and failure scenarios.
- The training of the ATCOs and Supervisors and the development and provision of the supporting real-time simulation training facilities and briefing materials.

- The briefing of the Airline Operators and Airspace Users and the development and provision of the supporting briefing materials.
- The data mining and analysis of the local aircraft behaviour on final approach required to characterise the required performance of the aircraft type behaviour modelling in the ATC tool support.
- The data mining and analysis of the local final approach wind conditions aloft behaviour and runway surface wind conditions behaviour required to characterise the required performance of the final approach wind profile modelling in the ATC tool support.
- The data mining and analysis of the local aircraft behaviour on each arrival runway with respect to expeditious exit taxiway vacation and associated runway occupancy time profiles required to characterise the required performance of the aircraft type behaviour modelling in the ATC tool support to provide for ROT Spacing support for clearance to land.
- The development and provision of the required local ATC tool support, the associated integration with the local ATC systems and services with respect to the provision of the required information and events, and the associated integration with the controller and supervisor workstation position facilities with respect to the provision of the required display and HMI interaction facilities support.
- The development and provision of the required local final approach wind conditions aloft service.
- The provision of the required local runway surface wind conditions service.
- The preparing of the local case with the associated evidence, and the activities for obtaining the local regulatory approval.
- The development of the system support for local post operational monitoring and the provision of the associated local resources for carrying out, reporting and acting on the monitoring findings and associated recommendations.
- The local ATC tool support maintenance costs with respect to accommodating new aircraft types and with respect to actioning required refinements to the characterisation of the aircraft type behaviour modelling and actioning required refinements to the final approach wind profile modelling.

The integration with local ATC systems includes consideration of:

- Surveillance tracking of the arrival aircraft on the intermediate and final approach path legs until entering the airport surface radar blanking area approaching the runway landing threshold.
- Provision of a high integrity final approach arrival sequence order out to the horizon that separation/spacing support is required to be provide to the approach controllers. This may be through provision of the electronic flight progress strip order of the final approach controller, or through the population and controller amendment of the AMAN sequence order, or through the provision of an auto-sequence function or an automatic checking and correction function in the ATC tool support.
- Provision of the flight data for the arrival aircraft on intermediate and final approach. This may be from the AMAN System or from the Flight Data Processing (FDP) System.
- Provision of the other Separation and Spacing Minima that are required to be applied; both non-changing pre-configured criteria such as the MRS associated with the Surveillance Service being employed by the approach controllers and also the prevailing operating conditions dependent criteria such as the Spacing Minima required to be applied for the runway surface conditions and the visual conditions in order to ensure provision of the required spacing for

the clearance to land procedures. The required Spacing Minima may be provided through the AMAN System.

- Provision of scenario specific spacing requirements such as gaps for accommodating crossing movements, gaps for accommodating departure aircraft in mixed mode operations, and gaps for other reasons such as for accommodating a runway inspection for foreign objects and debris.
- Provision of runway surface wind conditions from the local runway anemometer service.
- Provision of the final approach wind conditions aloft profile through a suitable MET Service which may include local derivation from the downlinked Enhanced Mode S airborne parameters in the secondary surveillance data of the local final approach surveillance service.

-END OF DOCUMENT-