	<p>Episode 3</p> <p>D2.2-044 - Detailed Operational Description - Runway Management - E1</p>	<p><i>Version : 3.00</i></p>
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Episode 3

Single European Sky Implementation support through Validation




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Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

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	Episode 3 D2.2-044 - Detailed Operational Description - Runway Management - E1	<i>Version : 3.00</i>
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DOCUMENT CONTROL

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	7
1 INTRODUCTION	8
1.1 PURPOSE OF THE DOCUMENT.....	8
1.2 INTENDED AUDIENCE.....	9
1.3 DOCUMENT STRUCTURE.....	9
1.4 BACKGROUND.....	10
1.5 GLOSSARY OF TERMS.....	11
2 OPERATING CONCEPT-CONTEXT AND SCOPE	12
2.1 SESAR CONCEPT FOR AIRPORT RUNWAY MANAGEMENT.....	12
2.1.1 <i>Increasing Runway Throughput</i>	13
2.1.2 <i>Increasing Runway Utilisation</i>	13
2.1.3 <i>Eliminating Runway Incursions</i>	14
2.2 ATM PROCESSES DESCRIBED IN THE DOCUMENT.....	14
2.3 RELATED SESAR OPERATIONAL IMPROVEMENTS (OIs).....	18
2.4 RELATED SESAR PERFORMANCE REQUIREMENTS.....	18
3 CURRENT OPERATING METHOD AND MAIN CHANGES	21
3.1 ASPECTS OF TODAY'S OPERATIONS THAT WILL REMAIN.....	21
3.2 ASPECTS OF TODAY'S OPERATIONS THAT WILL CHANGE.....	21
3.3 ASPECTS OF TODAY'S OPERATIONS THAT WILL DISAPPEAR.....	22
4 PROPOSED OPERATING PRINCIPLES	23
4.1 RUNWAY MANAGEMENT SUPPORT TO BALANCE ACTUAL DEMAND AND CAPACITY (A3.1).....	23
4.1.1 <i>Scope and Objectives</i>	23
4.1.2 <i>Assumptions</i>	23
4.1.3 <i>Expected Benefits, Issues and Constraints</i>	24
4.1.4 <i>Overview of Operating Method</i>	24
4.1.4.1 Assess Runway Capacity Load (A3.1.1.1.1).....	25
4.1.4.2 Switch Runway Operational Rules (A3.1.2.1.1).....	26
4.1.4.3 Coordinate Temporary Runway Closure (A3.1.2.2.1).....	27
4.1.5 <i>Enablers</i>	28
4.1.6 <i>Transition issues</i>	28
4.2 RUNWAY MANAGEMENT SUPPORT TO MANAGE TRAFFIC QUEUES (A3.2).....	28
4.2.1 <i>Scope and Objectives</i>	28
4.2.2 <i>Assumptions</i>	29
4.2.3 <i>Expected Benefits, Issues and Constraints</i>	29
4.2.4 <i>Overview of Operating Method</i>	30
4.2.4.1 Implement Departure Queue (A3.2.1.2).....	31
4.2.4.2 Implement Arrival Sequence at the Airport (A3.2.3.2.2).....	32
4.2.5 <i>Enablers</i>	35
4.2.6 <i>Transition issues</i>	35
4.3 RUNWAY MANAGEMENT SUPPORT TO DE-CONFLICT AND SEPARATE TRAFFIC (A3.3).....	36
4.3.1 <i>Scope and Objectives</i>	36
4.3.2 <i>Assumptions</i>	36
4.3.3 <i>Expected Benefits, Issues and Constraints</i>	36
4.3.4 <i>Overview of Operating Method</i>	37
4.3.4.1 Decide on Applicable Separation Minima at the Airport (A3.3.1.1).....	38
4.3.4.2 Detect & Solve Conflict Inside the Runway Protected Area (A3.3.1.2.1) ..	38
4.3.4.3 Implement Separation Inside the Runway Protected Area (A3.3.1.3.1).....	39
4.3.5 <i>Enablers</i>	40
4.3.6 <i>Transition issues</i>	41
4.4 RUNWAY MANAGEMENT SUPPORT TO APPLY SAFETY NETS (A3.4).....	41



4.4.1	<i>Scope and Objectives</i>	41
4.4.2	<i>Assumptions</i>	42
4.4.3	<i>Expected Benefits, Issues and Constraints</i>	42
4.4.4	<i>Overview of Operating Method</i>	42
4.4.4.1	Apply Safety Nets at the Airport (A3.4.3).....	42
4.4.5	<i>Enablers</i>	43
4.4.6	<i>Transition issues</i>	43
5	ENVIRONMENT DEFINITION	44
5.1	AIRSPACE CHARACTERISTICS.....	44
5.2	TRAFFIC CHARACTERISTICS	44
6	ROLES AND RESPONSIBILITIES	45
6.1	MAIN ROLES AND RESPONSIBILITIES.....	45
6.2	ACTORS RESPONSIBILITIES IN THE ATM PROCESS MODEL	47
7	REFERENCES AND APPLICABLE DOCUMENTS	50
7.1	REFERENCES	50
7.2	APPLICABLE DOCUMENTS.....	51
8	ANNEX A: OPERATIONAL SCENARIOS	52
9	ANNEX B: DETAILED USE CASE	59
10	ANNEX C: OI STEPS TRACEABILITY TABLE	60
11	ANNEX D: HOT TOPICS	71



LIST OF FIGURES

Figure 1: Scope of the document within SESAR Vision (SESAR ConOps)	9
Figure 2: ATM Model diagrams and high level processes addressed	16

LIST OF TABLES

Table 1: ATM Model low level processes addressed	18
Table 2: Key Performance Areas addressed	20
Table 3: Use Case for Assess Runway Capacity Load	26
Table 4: Use Case for Switch Runway Operational Rules	27
Table 5: Use Case for Coordinate Temporary Runway Closure	28
Table 6: Use Cases for Implement Departure Queue	32
Table 7: Use Case for Implement Arrival Sequence at the Airport	35
Table 8: Use Case for Decide on Applicable Separation Minima at the Airport	38
Table 9: Use Case for Detect & Solve Conflict Inside Runway Protected Area	39
Table 10: Use Cases for Implement Separation Inside Runway Protected Area	40
Table 11: Use Case for Apply Safety Nets at the Airport	43
Table 12: Airport actors involved in Runway management	48
Table 13: Other actors involved in Runway management	49
Table 14: Operational Scenarios identified for Runway management	58
Table 15: Use Case summary	59
Table 16: Operational Improvements addressed	70



Episode 3

D2.2-044 - Detailed Operational Description - Runway Management - E1

Version : 3.00

EXECUTIVE SUMMARY

The business or mission trajectory of an airspace user of any kind represents his/her intention to operate in a desired way. In the SESAR concept, air traffic and other services will facilitate the execution of these trajectories and will ensure that these are delivered in a safe and cost effective way within the infrastructural and environmental constraints.

The operations at airports form the ground segment of the business trajectory. The airport throughput is one of the main processes that determine the on-time performance of the Reference Business Trajectory (RBT). It is not only the beginning and the end of the trajectory; it is also the connecting process between two consecutive flights. The efficiency of this "turnaround" process determines whether delays increase or can be recovered.

The daily operation at an airport involves the real-time management separation and spacing of aircraft moving on the airport surface. Short notice changes and/or refinements are handled using a mixture of collaborative processes and tactical interventions. The latter are handled according to a previously agreed set of rules or the operational insight of the Controllers.

The SESAR concept addresses the following objectives regarding runway management during the execution phase:

- Increase runway throughput: Reducing dependency on wake turbulence separation, minimising Runway Occupancy Time (ROT), using time based Final Approach Spacing in head wind conditions and implementing Reduced Departure Spacing;
- Increase runway utilisation: Implementing arrival and departure management tools, optimising runway configuration/mode of operation, implementing new procedures during Low Visibility Conditions (LVC), optimising the use of existing and future airport (runway) infrastructure and available capacity and strategically de-conflicting and separating traffic on the airport surface;
- Eliminate runway incursions: Providing better situational awareness for the controller, aircrew and vehicle drivers, advanced surveillance systems and advanced, automated systems may be considered such as "auto-brake" to make it impossible for an aircraft or vehicle to cross selected stop bars.

Increasing runway throughput and runway utilisation has to be achieved within the SESAR safety goals. The most important issue is that new procedures and tools, and implementation of best practices are harmonised in such a way that no differences in operation appear for users (Pilots) throughout Europe and preferably worldwide.

The objective of the document is to describe the SESAR concept related to runway management during the execution phase in sufficient detail to permit the definition of validation exercises within Episode 3.



1 INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This document provides a refined description of the SESAR concept of operations regarding runway management processes taking place at airports during the execution phase. Referred as “Runway Management – E1”, this document is part of a set of Detailed Operational Description (DOD) documents which refine and clarify the high level SESAR ConOps concept description in order to support the Episode 3 exercises, which have the objective of developing a better understanding of the SESAR Concept. This set of DODs can be considered as step 0.2 of E-OCVM [1] - i.e. the description of the ATM Operational Concept(s). The DOD document structure and content is derived from the one of the OSED (Operational Service and Environment Definition) described by the ED-78A guidelines [2]. According to the ED-78A: “*the OSED identifies the Air Traffic Services supported by data communications and their intended operational environment and includes the operational performances expectations, functions and selected technologies of the related CNS/ATM system*”. The structure of the DOD has been defined considering the level of details that can be provided at this stage – i.e. the nature and maturity of the concept areas being developed

The complete detailed description of the mode of operations is composed of 10 documents according to the main phases defined by SESAR – i.e. Long Term Planning phase, Medium/Short Term Planning and Execution Phase (the complete set of documents is available from the Episode 3 portal home page [3]):

- The General DOD (G DOD) [4];
- The Long Term Network Planning DOD (L DOD) [5];
- The Collaborative Airport Planning DOD (M1 DOD) [6];
- The Medium & Short Term Network Planning DOD (M2 DOD) [7];
- The Runway Management DOD (E1 DOD), this document;
- The Apron & Taxiways Management DOD (E2/3 DOD) [9];
- The Network Management in the Execution Phase DOD (E4 DOD) [10];
- The Conflict Management in Arrival & Departure High & Medium/Low Density Operations DOD (E5 DOD) [11];
- The Conflict Management in En-Route High & Medium/Low Density operations DOD (E6 DOD) [12];
- The Episode 3 Lexicon (Glossary of Terms and Definitions) [13].



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

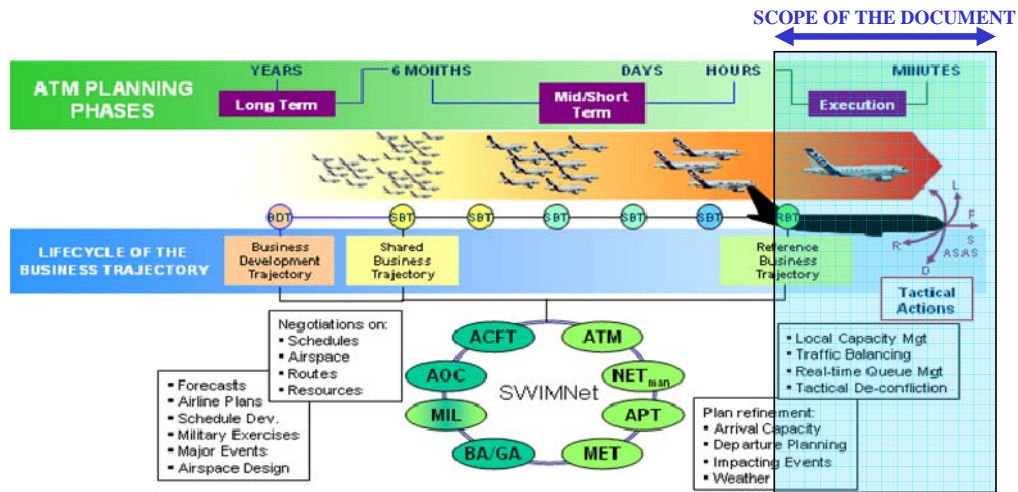


Figure 1: Scope of the document within SESAR Vision (SESAR ConOps)

The target horizon addressed in this document is 2020 timeframe, not taking into account transition elements. Thus, this document considers a restricted list of OI steps for which the Initial Operating Capability (IOC) time frame is until 2020. This is thus mainly related to ATM Service/Capability Levels 3 and 4. Services linked to level 5 are considered out of the scope.

1.2 INTENDED AUDIENCE

The intended audience includes:

- Episode 3 partners;
- The SESAR community.

1.3 DOCUMENT STRUCTURE

The structure of the document is as follows:

- §2 of this document provides an overview of the functions addressed in this document;
- §3 provides a description of how today's operation will be changed with the implementation of the concept area under analysis;
- §4 gives a description of the future operating principles. It details the benefits, the constraints, the human factors aspects, the enablers, the actors and the operating methods;
- §5 gives environment constraints of interest to the DOD (a general document provides this information at the global level);
- §6 lists roles and responsibilities applicable to this concept area;
- Annex A provides the list of the various scenarios relevant to this document;
- Annex B provides the summary of the Use Cases defined in this document;
- Annex C contains the traceability table of the SESAR Operational Improvement (OI) steps addressed by this document.



1.4 BACKGROUND

The Episode 3 project, also called "Single European Sky Implementation Support Through Validation", was signed on 18th April 2007 between the European Community and EUROCONTROL under the contract N° TREN/07/FP6AE/S07.70057/037106. The European Community has agreed to grant a financial contribution to this project equivalent to about 50% of the cost of the project.

The project is carried out by a consortium composed of EUROCONTROL, Entidad Publica Empresarial Aeropuertos Españoles y Navegacion Aérea (AENA); AIRBUS France SAS (Airbus); DFS Deutsche Flugsicherung GmbH (DFS); NATS (EN Route) Public Limited Company (NERL); Deutsches Zentrum für Luft und Raumfahrt e.V.(DLR); Stichting Nationaal Lucht en Ruimtevaartlaboratorium (NLR); The Ministère des Transports, de l'Équipement, du Tourisme et de la Mer de la République Française represented by the Direction des Services de la Navigation Aérienne (DSNA); ENAV S.p.A. (ENAV); Ingenieria y Economia del Transporte S.A (INECO) ISA Software Ltd(ISA); Ingenieria de Sistemas para la Defensa de Espana S.A (Isdefe); Luftfartsverket (LFV); Sistemi Innovativi per il Controllo del Traffico Aereo (SICTA); THALES Avionics SA (THAV); THALES AIR SYSTEMS S.A (TR6); Queen's University of Belfast (QUB); The Air Traffic Management Bureau of the General Administration of Civil Aviation of China (ATMB); The Center of Aviation Safety Technology of General Administration of Civil Aviation of China (CAST); Austro Control (ACG); Luchtverkeersleiding Nederland (LVNL). This consortium works under the co-ordination of EUROCONTROL.

With a view to supporting SESAR Development Phase activities whilst ensuring preparation for partners SESAR JU activities, Episode 3 focuses on:

- Detailing key concept elements in SESAR;
- Initial operability through focussed prototyping exercises and performance assessment of those key concepts;
- Initial supporting technical needs impact assessment;
- Analysis of the available tools and gaps for SESAR concept validation; and
- Reporting on the validation methodology used in assessing the concept.

The main SESAR inputs to this work are:

- The SESAR Concept of Operations (ConOps): T222 [28];
- The description of scenarios developed: T223 [29] & [30];
- The list of Operational Improvements allowing to transition to the final concept: T224 [33];
- The definition of the implementation packages: T333 [32] & [33];
- The list of performance assessments exercises to be carried out to validate that the concept delivers the required level of performance: T232 [34];
- The ATM performance framework, the list of Key Performance Indicators, and an initial set of performance targets: T212 [31].

The objective of detailing the operational concept [35] is achieved through the development of the DODs. These documents are available for the SESAR development phase and are produced through the System Consistency work package of Episode 3. The life cycle of the DOD documents is defined through three main steps:

- Initial DODs provided as the first inputs to the Episode 3 project;



Episode 3

D2.2-044 - Detailed Operational Description - Runway Management - E1

Version : 3.00

- Interim DODs containing first refinement and consolidation from Episode 3 partners aligned to the prototyping/evaluation work, provided by mid-project duration;
- Final DODs updated by the findings and reports produced by the prototyping/evaluation activities, provided at the end of the project.

1.5 GLOSSARY OF TERMS

The Episode 3 Lexicon contains lists of agreed acronyms and definitions [13].



2 OPERATING CONCEPT-CONTEXT AND SCOPE

2.1 SESAR CONCEPT FOR AIRPORT RUNWAY MANAGEMENT

Air Transport is a continuous sequence of arrival, turnaround, departure and flight cruise (en-route) events. The operations at airports form the ground segment of the Business Trajectory. The airport throughput is one of the main processes that determine the on-time performance of the Reference Business Trajectory (RBT). It is not only the beginning and the end of the trajectory; it is also the connecting process between two consecutive flights. The efficiency of this “turnaround” process determines whether delays increase or can be recovered. The airport process is involved in all phases of the trajectory, from business development through resource planning and allocation, towards the daily execution of operations.

The daily operation at an airport involves the safety of all aircraft both parked and moving on the airport surface. It is assumed that a number of systems - e.g. Runway Incursion Alert systems and surveillance systems for safety and control, SURFACE MANAGEMENT and DMAN for optimal runway capacity, stand allocation systems for efficient apron management, and processes – e.g. CDM for optimal system performance, are available to make the operation safe and efficient.

The Airport Operations Centre (APOC) forms the heart of the A-CDM process and is the location where all information is collected and processed. Distribution to the relevant process owners and actors takes place through a System Wide Information Management (SWIM) network.

The APOC is more than just a network of data systems. It is an organisation that manages the data collection, processing and distribution and will ensure common process awareness for all stakeholders.

The information stream from the APOC is filtered to prevent a data overload for the receiver. However additional unfiltered information is immediately available on receiver's request.

Divergence from the planned process is automatically detected and potential actions are reviewed. In collaboration with the process owners and relevant stakeholders adjustments to the process are taken to reduce the negative effects.

In the event of severe operational disruptions (for example due to adverse weather conditions) a significant reduction of airport/runway capacity takes place. The Network Management Function, in co-operation with the APOC, performs an initial allocation of delay proportional to the original demand. This allocation is the starting point for the User Driven Prioritisation Process (UDPP) and the default result in the event that the process fails to produce a timely response.

This document presents the proposed airport process for the future ATM system, focusing on runway management during the execution phase.

The execution of the Airport Resource and Capacity Plan involves the real-time management, separation and spacing of aircraft moving on the airport surface. Short notice changes and/or refinements are handled using a mixture of collaborative processes and tactical interventions. The latter are handled according to a previously agreed set of rules or the operational insight of the Controller.

Increasing runway throughput and runway utilisation has to be achieved within the SESAR safety goals. The most important issue is that new procedures and implementation of best practices is harmonised in such a way that no differences in operation appear for users (pilots) throughout Europe and preferably worldwide.



2.1.1 Increasing Runway Throughput

The following issues can be seen as general enablers to develop and implement techniques and procedures with respect to **increasing runway throughput**:

- Reducing applicable wake turbulence separation: The existing minimum wake turbulence separation is based on a very broad set of aircraft weight categories. It provides the opportunity for a complete re-classification of aircraft into a wider range of weight categories more accurately based on the true wake turbulence (related to the aircraft weight, speed, wingspan loading etc) and its transport and decay depending on meteorological conditions. Wake turbulence procedures in SESAR will be implemented in two steps, firstly by fixed separation based on wake turbulence prediction and secondly applying dynamic adjustment of separation applying real time detection of wake turbulence;
- Minimising Runway Occupancy Times (ROT): Runway occupancy is one of the constraining factors to runway throughput. Less than the best achievable Runway Occupancy Time can result in increased separation being applied, which in turn leads to a less than optimum runway throughput;
- Final Approach Spacing: The application of time based spacing instead of distance spacing between consecutive aircraft on final approach mitigates the negative effect of strong headwind on the runway throughput rate. Physical separation minima to be applied when using time based spacing is not defined and should be considered as a safety issue;
- Reduced Departure Spacing: It should be feasible to reduce the time interval between two successive take-off movements where wake turbulence is an issue. Wake turbulence detection technology will make it possible to reduce the intervals without increasing the risk of wake turbulence encounters.¹

2.1.2 Increasing Runway Utilisation

The following proposals can be seen as general enablers to develop and implement techniques and procedures with respect to **increasing runway utilisation**:

- Implement arrival and departure management tools: Where increased final approach separation and departure intervals due to wake turbulence are unavoidable, increased runway utilisation can be achieved by implementing planning tools to optimise the sequence;
- Optimise runway configuration/mode of operation: Dependencies between multiple runways determine the practical runway capacity which in most cases is lower than the combined single runway capacities. Capacity gains can be achieved by increased utilisation of the combined runways (runway system). Reducing dependencies between runways by implementing more accurate surveillance techniques and controller tools as well as advanced procedures - i.e. wake turbulence detection and RNP, will enlarge the capabilities of existing runway configurations, like closely spaced parallel runways;
- Increase runway utilisation during Low Visibility Conditions (LVC): The runway capacity of an airport reduces significantly with low visibility conditions. Not only is increased separation on final approach needed due to the requirement for an undisturbed ILS signal, ground movement traffic is limited due to the reduced ability of the ground controller to manage surface traffic by visual means, and due to

¹ Detail on improvement and effect based on wake turbulence can be found in CREDOS and RECAT projects.



reduced ability of pilots and vehicle drivers to 'see and avoid' surrounding traffic or obstacles. The introduction of Advanced Surface Movement Guidance and Control System (A-SMGCS) greatly enhances the possibility to improve the control of surface traffic in reduced visibility conditions;

- Optimise the use of existing and future airport (runway) infrastructure and available capacity: Capacity of existing infrastructure is often limited by the layout of the airport. On airports with multiple runways, runway crossings cannot always be avoided. To reduce the negative capacity impact, relocation of runway crossing points could be considered;
- Strategically de-conflict and separate traffic on the airport surface: The physical layout may constrain the options for conflict management. Implementation of good taxiway design at both new and existing airports will reduce interactions between taxi flows, while tools such as SURFACE MANAGEMENT will provide taxi routing solutions that also minimise interactions.

2.1.3 Eliminating Runway Incursions

The following proposals can be seen as enablers to **eliminate runway incursions**:

- Provide better situational awareness for the controller, flight crew and vehicle drivers through the (re)design of the taxiway lay-out, provision of visual aids (signs and markings) and on-board electronic display of traffic (CDTI) technology;
- Advanced surveillance systems (e.g. surface movement radar in combination with Mode-S multilateration technology) will constantly monitor the position, movement and intention of all aircraft and vehicles, operating in the manoeuvring area. It will provide enhanced information to controllers whilst CDTI technology will provide aircrew and vehicle drivers with map, guidance and traffic awareness information. By these means, possible conflicts and runway incursions can be detected at an early stage and alarms issued to the Ground and/or Runway Controller, and also directly transmitted to the cockpit display and alarm systems of the relevant aircraft and /or vehicles;
- Advanced, automated systems may be considered such as "auto-brake" to make it impossible for an aircraft or vehicle to cross selected stop bars.

2.2 ATM PROCESSES DESCRIBED IN THE DOCUMENT

The high-level ATM processes described below are those which are relevant to the management of the runway by the appropriate airport actors during the execution phase (refer to ATM process model [14]):

- **A3.1 Balance Actual Demand and Capacity;**
- **A3.2 Manage Traffic Queues;**
- **A3.3 De-conflict and Separate Traffic;**
- **A3.4 Apply Safety Nets.**

Note that process A3.5 Adjust Traffic and Airspace Requirements Dynamically is fully covered by Network Management in the Execution Phase (E4 DOD [10]) and is not part of the scope of E1 DOD.

The services provided by these processes fit in the SESAR concept areas as indicated below:

- **A3.1 Balance Actual Demand and Capacity**

Missions: The SESAR Concept of Operations empowers the dynamic balancing of demand and capacity to contribute to a smooth flow of traffic. For that purpose,



Episode 3

D2.2-044 - Detailed Operational Description - Runway Management - E1

Version : 3.00

during the Execution Phase, dynamic adjustments can occur to balance the traffic in real-time.

This process is based on instantaneous load and complexity, as well as resources constraints. It aims at assessing traffic load compared to available capacity, possibly detecting an imbalance that will trigger subsequent Demand and Capacity Balancing (DCB) processes. Resources are adjusted when possible, and a DCB solution involving traffic demand changes will only be proposed if resource adjustments can't match the traffic demand.

- **A3.2 Manage Traffic Queues**

Missions: This process describes all the activities related to the management of different traffic queues (in Airports or Terminal Area) for their integration into a smooth flow. This encompasses development of queues and the actions to implement those, resulting in trajectory changes as needed. This process may either result in a solution to abandon the queue, or in a new sequencing activity. Resource Configuration, used as an input, may be changed through Adjust Resources Dynamically A3.5 process, which includes complexity management.

- **A3.3 De-conflict and Separate Traffic**

Missions: This process aims at providing de-confliction and separation between traffic on the Airport Surface, in Terminal Areas and in en-route airspace.

Traffic Separation involves RBT clearances according to the separation mode - e.g. 2D PTC (Precision Trajectory Clearances), 3D PTC. In accordance with the SESAR concept of operations, as result of de-conflicting and separating traffic the RBTs will be successively cleared and updated, together with the uplink of the Trajectory Management Requirements (TMR) parameters.

- **A3.4 Apply Safety Nets**

Missions: This process will provide the Executive Controller and/or Planning Controller in en-route and Terminal airspace, and the Tower Runway Controller and/or Tower Ground Controller at the airport, with information from an activated safety net to be able to monitor a given situation and carry to out the appropriate actions as necessary - i.e. an open-loop tactical instruction given to the Flight Crew.



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

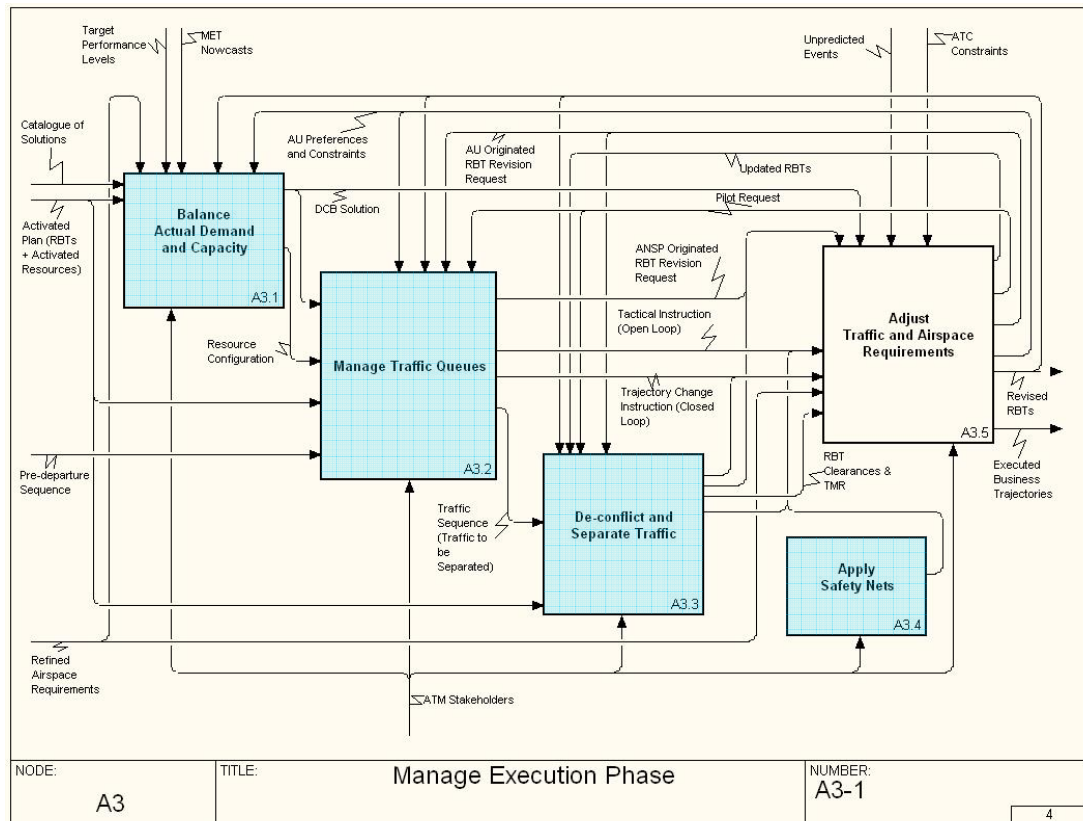
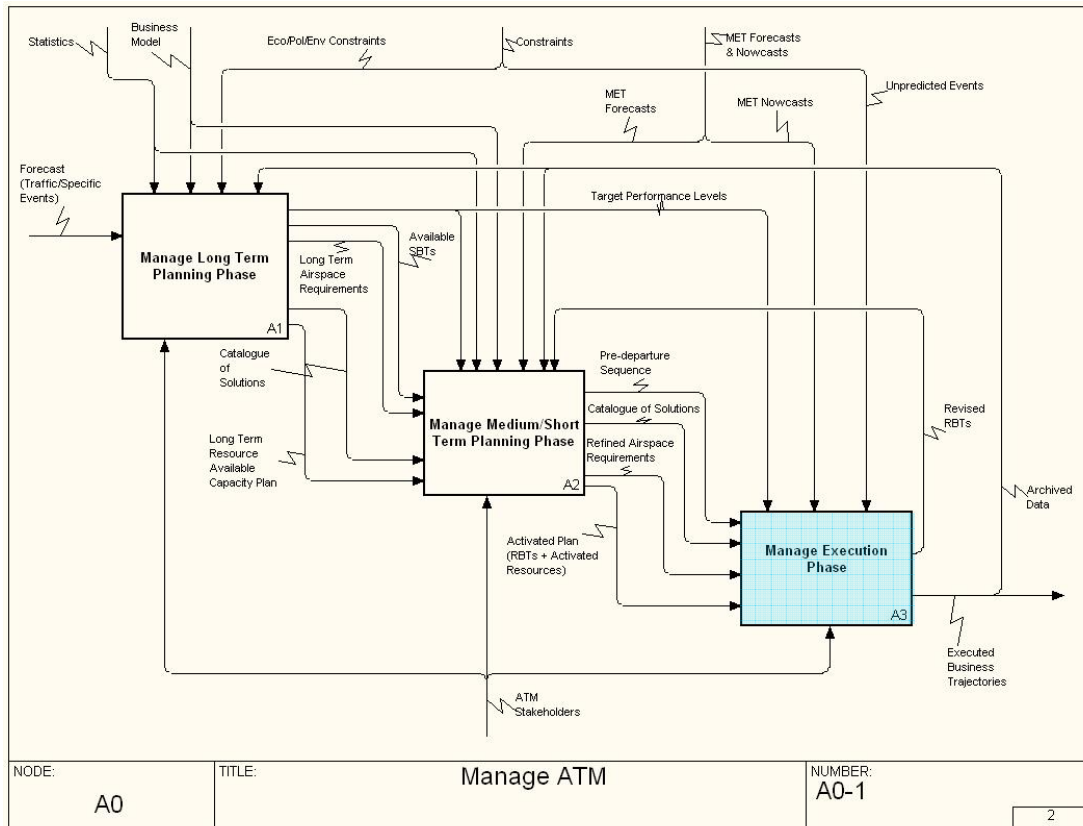


Figure 2: ATM Model diagrams and high level processes addressed



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

Each high-level process is broken down into low-level processes which are covered either by Runway Management (E1 – this DOD), Apron & Taxiways Management (E2/3 DOD [9]), Network Management in the Execution Phase (E4 DOD [10]), Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD [11]), Conflict Management in En-Route High & Medium/Low Density Operations (E6 DOD [12]) or by Collaborative Airport Planning (M1 DOD [6]).

Mid-level processes, when present, usually encapsulate low-level processes supported jointly by the airport/airspace/ network execution activities.

A summary and a brief description of these lowest level ATM processes covered by the present DOD are presented in the following table:

Code ²	ATM Process	Description	SESAR ConOps References
A3.1.1.1.1.1	Assess Runway Capacity Load	This process will allow assessing the current traffic load against the declared runway capacity.	F.2.6.4, F.2.6.5, F.2.6.5.2, F.3, F.5.1.1, F.5.1.2; F.5.1.4; F.5.2
A3.1.2.1.1.1	Switch Runway Operational Rules	This process is run when a change of real-time operation rules is necessary. As an example, it covers the case of a change in the runway configuration (e.g. from 27 to 09 because of a significant change in the wind direction).	F.2.6.4, F.5, F.5.1.3, F.5.1.4, F.5.1.4.1, F.5.1.4.3, F.5.1.4.4, F.5.1.4.5, F.5.1.4.7, F.5.2, F.6.1
A3.1.2.2.1.1	Coordinate Temporary Runway Closure	This process is run when maintenance works are actually performed on airport runways. Variations that occur during this process have an impact on the sequence and dynamic management performed during the mid/short term planning phase.	F.2.6.3, F.2.6.4, F.3, F.5.1.3, F.5.1.4, F.5.1.4.7, F.5.2
A3.2.1.2	Implement Departure Queue	This process aims to include all the activities needed to execute the departure sequence by the Tower Runway Controller and the actions to communicate the flight crew the proper instructions for the take-off.	F.2.7, F.3.1, F.4.2.1, F.4.2.2, F.4.2.3, F.4.2.4.1, F.4.2.4.4, F.5.1.4, F.5.1.4.1, F.5.1.4.3, F.5.1.4.4, F.5.1.4.5, F.5.1.4.7, F.5.2, F.6.1
A3.2.3.2.2	Implement Arrival Sequence at the Airport	This process aims to include all the activities of the Tower Runway Controller to execute the arrival sequence, including giving the appropriate instructions to the flight crew. The last activity covered by this process is the handover from the Tower Runway Controller to the Tower Ground Controller (after the aircraft has vacated the runway).	F.2.6.4, F.2.7, F.3.1, F.3.3, F.4.2.1, F.4.2.2, F.4.2.3, F.4.2.4, F.4.2.4.2, F.4.2.4.3, F.5.1.4, F.5.1.4.1, F.5.1.4.3, F.5.1.4.4, F.5.1.4.5, F.5.1.4.7, F.5.2, F.6.1, F.6.2, F.6.2.1, F.6.2.2
A3.3.1.1	Decide on Applicable Separation Minima at the Airport	This process deals with all the information needed to reach a decision about the separation minima necessary for the flights inside the Runway Protected Area.	F.2.4, F.2.4.1, F.4, F.5, F.5.1.4.7, F.5.2, F.6, F.6.1

² This refers to the code associated to the process in the ATM Process Model SADT diagrams.



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

Code ²	ATM Process	Description	SESAR ConOps References
A3.3.1.2.1	Detect & Solve Conflict Inside the Runway Protected Area	This process aims to control the flights inside the Runway Protected Area in order to detect and solve possible conflicts. The conflict solution will be executed based on the proper separation minima.	F.2.4, F.2.4.1, F.4, F.5, F.5.1.4.7, F.5.2, F.6, F.6.1
A3.3.1.3.1	Implement Separation Inside the Runway Protected Area	This process aims to include the activities needed to provide separation for the flights inside the Runway Protected Area according to the separation minima applicable to the flight, and the detected conflict and advisories if applicable.	F.2.4, F.2.4.1, F.4, F.5, F.5.1.4.7, F.5.2, F.6, F.6.1
A3.4.2	Apply Safety Nets at the Airport	This process will allow the Tower Runway Controller to be informed with the actions of the embarked safety nets system, to be able to monitor and carry out with the appropriate actions inside the Runway Protected Area - i.e. an open-loop tactical instruction given to the Flight Crew.	F.2.4, F.2.4.1, F.4, F.5, F.5.1.4.7, F.5.2, F.6, F.6.1

Table 1: ATM Model low level processes addressed

2.3 RELATED SESAR OPERATIONAL IMPROVEMENTS (OIS)

A table listing the SESAR Operational Improvements steps that are relevant to this DOD, and the associated processes, is provided in Annex C (refer to §10).

2.4 RELATED SESAR PERFORMANCE REQUIREMENTS

SESAR has defined several Key Performance Areas (KPAs) and Performance Requirements (objectives, indicators and targets) which are defining system wide effectiveness and thus, for most of them, affect the various components of the future 2020 ATM target system. The KPAs and performance requirements are shown here with the description of how the scope of Runway Management will address them (refer to [31]):

Key Performance Area (KPA)	Description ³
Safety	<p>The number of ATM induced accidents and serious or risk bearing incidents should not increase and, where possible, should decrease, as a result of the introduction of SESAR concepts. In order to maintain a constant accident rate the overall safety level would have to increase an improvement factor of x3 in order to meet the safety objective of traffic levels in 2020.</p> <p>The overall safety level should reach an improvement factor 3 in order to meet the safety objective SAF1.OBJ1.IND1.</p>

³ SESAR Performance Requirements (as defined by SESAR D2 [31]) are presented in this column; Performance objectives in black, performance targets in blue, along with the corresponding performance indicator ID in brackets.



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

Key Performance Area (KPA)	Description ³
Security	Security is not directly addressed by Runway Management operations; however improvements made will not degrade the current situation.
Environmental Sustainability	<p>Increase the degree in which local environmental rules affecting ATM are respected (E.g. aircraft type restrictions, night movement bans, noise routes and noise quotas, etc.). The percentage of cases in which local environmental rules affecting ATM are respected has to increase.</p> <p>Local environmental rules affecting ATM are to be 100% respected ENV3.OBJ1.IND1.</p>
Cost Effectiveness	<p>Better planned, user driven trajectories and use of aircraft capabilities should provide cost-effectiveness. The cost of equipping resulting better adherence to plans and preferred business trajectories.</p> <p>Halve the direct European gate-to-gate ATM costs through progressive reduction CEF1.OBJ1.IND1.</p>
Capacity	<p>Meet or exceed the growth of the busy-hour demand of individual airports. In line with physical airport capacity increases, the overall growth of IFR demand, and the traffic pattern changes in time and space.</p> <p>Hourly number of IFR movements (departures plus arrivals), as possible during low visibility (IMC) conditions CAP2.OBJ1.IND1.</p> <p>Daily number of IFR movements (departures plus arrivals), as possible during a 15-hour day (between 0700 and 2200 hrs local time) during low visibility (IMC) conditions CAP2.OBJ1.IND2.</p>
Efficiency	<p>Continually reduce the departure delay due to ATM.</p> <p>Occurrence (Punctuality): At least 98% of flights departing on-time EFF1.OBJ1.IND1.</p> <p>Severity (Delays): The average departure delay of delayed flights will not exceed 10 minutes EFF1.OBJ1.IND2.</p> <p>Conform to the Shared Business Trajectory Timing to the greatest extent.</p> <p>Occurrence: At the regional level, more than 95% of flights with a normal flight duration EFF1.OBJ2.IND1.</p> <p>Severity: At the regional level, the average flight duration extension of flights with an extended flight duration will not exceed 10 minutes EFF1.OBJ2.IND2.</p>
Flexibility	<p>Flexibility to modify operator preferences as well as more flexible approach to operational decision making are characteristics of the NOP. Utilising, for example, dynamic processes, capacity headroom.</p> <p>At least 98% (European-wide annual average) of the non-scheduled flight departures will be accommodated with a delay penalty less than 3 minutes FLX2.OBJ1.IND1.</p> <p>At least 98% (European-wide annual average) of the non-scheduled flight departures will be accommodated with a delay penalty less than 3 minutes FLX2.OBJ1.IND2.</p>



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

Key Performance Area (KPA)	Description ³
Predictability	<p>This Focus Area covers the variability of the flight operation: departure and arrival punctuality, and the variability of flight phase durations (turnaround time, taxi time, airborne time). Improve the arrival punctuality to the greatest extent.</p> <p>Occurrence: Less than 5% (European-wide annual average) of flights suffering arrival delay of more than 3 minutes PRD1.OBJ1.IND1.</p> <p>Severity: The average delay (European-wide annual average) of delayed flights (with a delay penalty of more than 3 minutes) will be less than 10 minutes PRD1.OBJ1.IND2.</p> <p>Taxonomy of service disruption is necessary to refine the focus area: adverse weather (airport closure), system failure, industrial action. Prevent and mitigate service disruption to the greatest extent.</p> <p>Number of cancelled flights per type of disruption: At regional level, reduce cancellation rates by 50% by 2020 compared to 2010 baseline PRD2.OBJ1.IND1.</p> <p>Number of diverted flights per type of disruption: At regional level, reduce diversion rates by 50% by 2020 compared to 2010 baseline PRD2.OBJ1.IND2.</p> <p>Total delay due to disruption per type of disruption: At regional level, reduce total disruption delay by 50% by 2020 compared to 2010 baseline PRD2.OBJ1.IND3.</p>
Access and Equity	<p>Access to specific Airport resources for airspace users should be provided in an equitable, transparent and more efficient manner. This should be irrespective of variations in equipage above the minimum level required and enabled by the SESAR CDM/UDPP processes in the NOP.</p>
Participation	<p>Fundamental to the concept is the participation of the user community on the decision making process through collaborative planning. The new concept includes trajectories pre-defined and owned by the airspace users. At airport level the controllers perform separation functions in cognisance of the user preferences.</p>
Interoperability	<p>Application of standards and uniform principles.</p> <p>Level of compliance of ATM operations with ICAO CNS/ATM plans and global interoperability requirements: All European ATM operations are compliant with ICAO CNS/ATM plans and global interoperability requirements IOP3.OBJ1.IND1.</p> <p>Level of seamlessness of ATM service to the user: Provide a seamless service to the user at all times, throughout Europe IOP3.OBJ2.IND1.</p> <p>Level of uniformity of ATM service: Operate on the basis of uniformity throughout Europe IOP3.OBJ3.IND1.</p> <p>Technical and operational interoperability of aircraft and ATM systems.</p> <p>Timeliness of delivery of standards, specifications and procedures for ATM, CNS and associated avionics requirements: All standards, specifications and procedures for ATM, CNS and associated avionics requirements available as required in the ATM Master Plan IOP4.OBJ1.IND1.</p>

Table 2: Key Performance Areas addressed



3 CURRENT OPERATING METHOD AND MAIN CHANGES

3.1 ASPECTS OF TODAY'S OPERATIONS THAT WILL REMAIN

The notion of a runway as a protected surface for aircraft to land and take-off safely will remain unchanged.

The Tower Runway Controller will remain the authority for assuring safe operations on the runway.

3.2 ASPECTS OF TODAY'S OPERATIONS THAT WILL CHANGE

In the SESAR timeframe, airports will be fully integrated into the ATM system. The runway will be a node in that system which will process flight trajectories from en-route to en-route.

The runway will not be considered as the start or end of a flight, but as part of a continuum.

The runway will be required to process the forecasted traffic increases at airports, in a safe manner, eliminating or recovering system delay, while providing levels of safety equal to or above today's standards and respecting the agreed flight schedules.

A range of technical and procedural solutions, both ground and airborne, will support the safe and efficient management of the runway in all weather conditions, achieving throughput rates, equal to or close to the best throughput rates achievable in good weather conditions and with a homogeneous aircraft traffic sequence:

- A-SMGCS will allow accurate surveillance and precise control of traffic on the surface. System features will include traffic advisories and alarms (safety nets) to reduce the risk of runway incursions and ground collisions, while providing guidance and situational awareness to pilots and vehicle drivers. Associated HMI will improve controller situational awareness, allowing enhanced control of traffic in Low Visibility Conditions (head down);
- Time-based spacing of landing aircraft in adverse wind conditions will maintain runway throughput rates equal to the best achievable for a given runway;
- Aircraft Brake-to-Vacate systems will achieve more consistent Runway Occupancy Times (ROT), and will downlink accurate ground trajectories to the ATM system, from runway to parking stand, which will in turn increase the level of predictability of aircraft performance to the Tower Runway Controller and Tower Ground Controllers;
- Wind monitoring and wake turbulence position estimation will allow reduced separation between arriving and departing aircraft where wake turbulence is an issue, leading to increased runway throughput;
- Collaborative Airport Planning will ensure timely delivery of departing aircraft to the runway (Tower Runway Controller);
- Integrated planning tools for airport actors and increased situational awareness will increase the decision making support offered to air traffic controllers and flight crews;
- Implementing linked arrival and departure management tools will increase the runway utilisation;
- Implementing more accurate surveillance techniques and controller tools as well as advanced procedures will optimise the runway configuration / mode of operation;



Episode 3

D2.2-044 - Detailed Operational Description - Runway Management - E1

Version : 3.00

- Strategically de-conflicting and separating traffic on the airport surface will improve safety and efficiency of surface operations.

3.3 ASPECTS OF TODAY'S OPERATIONS THAT WILL DISAPPEAR

At airports operating close to, or at capacity, and which adapt the necessary technical and procedural solutions which will enable them to evolve in the SESAR context, reliance on visual identification and tracking of traffic (aircraft and vehicles) will be removed. As SESAR Concept of Operations states, responsibility will not only rely on visual identification, it will be additionally supported by other technologies, such as A-SMGCS and data link.

Collaborative Airport Planning will remove some of the uncertainty, and subsequent requirement for the Tower Runway and Tower Ground Controller to adjust traffic sequences (except in exceptional circumstances).



4 PROPOSED OPERATING PRINCIPLES

4.1 RUNWAY MANAGEMENT SUPPORT TO BALANCE ACTUAL DEMAND AND CAPACITY (A3.1)

4.1.1 Scope and Objectives

The SESAR Concept of Operations empowers the dynamic balancing of demand and capacity to contribute to a smooth flow of traffic. For that purpose, during the Execution phase, dynamic adjustments can occur to balance the traffic in real-time, as a final refinement of the Activated Plan (RBTs + Activated Resources) coming from the Medium/Short Term Planning phase.

This process is based on instantaneous load and complexity, as well as resources constraints. It aims at assessing traffic load compared to available capacity, possibly detecting an imbalance that will trigger subsequent DCB processes: Resources are adjusted when possible, and a DCB solution involving traffic demand changes will only be proposed if resource adjustments can't match the traffic demand.

This readjustment between resources and traffic demand is facilitated by new data becoming available at the execution phase:

- Target performance levels;
- Meteorological data (Nowcasts);
- RBTs;
- Airspace users' preferences and constraints;
- Resources constraints and unpredicted events.

As mentioned in section 2, the scope of E1 (this DOD) is related to runway management in airport operations during the execution phase, thus the following sections will only focus on the adjustment of resources and traffic demand at the runway level. Traffic demand adjustments to airport resources outside the runway protected area are covered by Apron & Taxiways Management (E2/3 DOD), focusing on surface movement management at the apron and taxiways levels. Additionally, adjustment of resources and traffic demand at the airspace level is covered by Network Management in the Execution Phase (E4 DOD).

This process will, as far as is practicable, adjust resources and traffic demand at runway level through addressing the following tasks:

- Runway capacity load assessment;
- Switching operational rules at runway level - i.e. change runway configurations;
- Coordination of temporary runway closure, due to unpredicted events, works or surface cleaning operations on the runway;
- Coordination with arrival and departure management activities.

4.1.2 Assumptions

In nominal situations, it is assumed that the airport, APOC Staff and Runway Controller, will be the primary actors involved in adjusting resources and traffic demand at runway level. Airlines (AOC Staff) and Network management units will collaborate as support actors in order to confirm and validate the dynamic update of the demand and capacity balance.



4.1.3 Expected Benefits, Issues and Constraints

The expected benefits are mostly linked to optimising capacity and efficiency. Dynamic balancing of demand and capacity will provide:

- Possible remaining bottlenecks will be identified, enabling operators to implement mitigation actions or adjust the demand to the available capacity;
- Closer analysis of likely what-if scenarios can be conducted and mitigation strategies prepared, reducing the operational cost in case if e.g. bad weather with reduced capacity;
- Improvement of efficiency, both in the air and on the ground, through the collaborative mechanism of the sharing of 4D trajectories all along the indented en-route to en-route operation;
- Improvement of the overall stability of the en-route to en-route operations.

However, some issues have to be mentioned:

- More delegation to flight crew will also induce potential increase of the flight crew's task-load;
- Mixed equipage may limit efficiency and the Tower Runway Controller has to be aware of airborne capabilities in order to decide about relevant procedures to be applied.

4.1.4 Overview of Operating Method

Process A3.1 Balance Actual Demand and Capacity, is mainly fed by the Activated Plan (i.e. RBTs and Activated Resources) and the Catalogue of Solutions, both developed during the medium/short planning phase.

Constraints applying to the process are either linked to the performance objectives (i.e. Target Performance Levels), or the weather conditions or ATC Constraints leading to adjustment of the traffic and/or the airspace, by means of revised trajectories - i.e. Revised RBTs, AU preferences and constraints.

As a result of this process the airport will adjust capacity configurations for the various airport resources:

- Arrival, departure and surface throughputs;
- Stand, pushback, de-icing and holding bay capacity;
- Ground resources such as passenger buses, baggage handling, refuelling, catering, cleaning, etc.

Process A3.1 Balance Actual Demand and Capacity (high-level) is broken down into three mid-level processes:

- A3.1.1 Identify Demand Capacity Imbalance;
- A3.1.2 Adjust Resources Dynamically;
- A3.1.3 Propose a Dynamic DCB Solution.

A3.1.1 Identify Demand Capacity Imbalance and A3.1.2 Adjust Resources Dynamically are the only processes partially covered by Runway Management (E1 – this DOD). The operating method for these processes, at runway level, is developed below. Process A3.1.3 Propose a Dynamic DCB Solution, is covered by Network Management in the Execution Phase (E4 DOD [10]) and Collaborative Airport Planning (M1 DOD [6]).



4.1.4.1 Assess Runway Capacity Load (A3.1.1.1.1.1)

Process A3.1.1 Identify Demand and Capacity Imbalance aims at assessing traffic load compared to available capacity, possibly detecting an imbalance triggering event for subsequent DCB processes.

Identify Demand Capacity Imbalance is broken down into two sub-processes:

- A3.1.1.1 Assess Capacity Load;
- A3.1.1.2 Assess Traffic Complexity.

Process A3.1.1.2 Assess Traffic Complexity is out of the scope of Runway Management (E1 – this DOD) and is covered by Network Management in the Execution Phase (E4 DOD [10]).

Process A3.1.1.1 Assess Capacity Load allows assessing the current traffic load against the declared resource capacity. This capacity load assessment may be done at airport or airspace level according to a granularity depending on the look-ahead time horizon (from instantaneous load to complexity through density). Therefore, this process is broken down into two sub-processes:

- A3.1.1.1.1 Assess Airport Capacity Load;
- A3.1.1.1.2 Assess Airspace Capacity Load.

Process A3.1.1.1.2 Assess Airspace Capacity Load is out of the scope of Runway Management (E1 – this DOD) and is covered by Network Management in the Execution Phase (E4 DOD).

Process A3.1.1.1.1 Assess Airport Capacity Load describes how the capacity load of every planned airport resource is assessed in order to put in place a DCB solution if needed. This capacity load assessment may be done inside and outside the runway protected area. Therefore, this process is broken down into two low-level processes:

- A3.1.1.1.1.1 Assess Runway Capacity Load;
- A3.1.1.1.1.2 Assess Surface Capacity Load.

Process A3.1.1.1.1.2 Assess Surface Capacity Load is out of the scope of Runway Management (E1 – this DOD) and is covered by Apron & Taxiways Management (E2/3 DOD [9]).

Process A3.1.1.1.1.1 Assess Runway Capacity Load describes how the runway capacity load is assessed in order to put in place a DCB solution if needed, applying, as needed, Optimised Departure Management in the Queue Management Process (TS-0306), Departure Management from Multiple Airports (TS-0302), Integrated Arrival / Departure Management in the Context of Airports with Interferences (other local/regional operations) (TS-0304).

Assess Runway Capacity Load presents the following main drivers:

- Inputs:
 - None.
- Control constraints:
 - Activated Plan (RBTs + Activated Resources);
 - Possible Runway Configurations.
- Human actors⁴:
 - Sub-regional Network Manager;

⁴ Actors, roles and responsibilities are described in detail in Section 6.



- APOC Staff.
- Outputs:
 - Capacity Over/Under Load (Runway).

The following Use Case has been identified for Assess Runway Capacity Load process:

Use Case	Description
Asses Runway Capacity Load	This Use Case describes how the capacity load of the airport runways system is assessed in order to put in place a DCB solution if needed.

Table 3: Use Case for Assess Runway Capacity Load

4.1.4.2 Switch Runway Operational Rules (A3.1.2.1.1)

Process A3.1.2 Adjust Resources Dynamically allows Resources to be adjusted with respect to an identified Demand Capacity Imbalance. This process also covers changes due to weather constraints or any other Constraints (Unpredicted Events) as well as resources maintenance works.

Adjust Resources Dynamically is broken down into three sub-processes:

- A3.1.2.1 Switch Airport Operational Rules;
- A3.1.2.2 Coordinate Temporary Airport Resource Closure;
- A3.1.2.3 Adjust Airspace Resources Dynamically.

Both processes A3.1.2.1 Switch Operational Rules and A3.1.2.2 Coordinate Temporary Resource Closure are partially covered by Runway Management (E1 – this DOD).

Process A3.1.2.2 Coordinate Temporary Resource Closure is developed in next section (4.1.4.3). Process A3.1.2.3 Adjust Airspace Resources Dynamically is described in the Network Management in the Execution Phase DOD (E4 DOD [10]).

Process A3.1.2.1 Switch Airport Operational Rules is run when a change of real-time operation rules is necessary at the airport. It covers, for example the case of a change in the runway configuration (e.g. from 27 to 09 because of a significant change in the wind direction). The switching of rules may be done separately at runway, surface and gate levels. Therefore, this process is broken down into three low-level processes:

- A3.1.2.1.1 Switch Runway Operational Rules;
- A3.1.2.1.2 Switch Surface Operational Rules;
- A3.1.2.1.3 Switch Gate Operational Rules.

Processes A3.1.2.1.1 Switch Runway Operational Rules, switching runway direction could have much wider impact than today if more fuel-efficient routes are in place, because these would mean that the trajectories of arriving traffic would probably deviate before the Initial Approach Fix.

Processes A3.1.2.1.2 Switch Surface Operational Rules and A3.1.2.1.3 Switch Gate Operational Rules are out of the scope of Runway Management (E1 – this DOD) and are covered respectively by Apron & Taxiways Management (E2/3 DOD [9]) and Collaborative Airport Planning (M1 DOD [6]).

Process A3.1.2.1.1 Switch Runway Operational Rules, run when a change of real-time operation rules is necessary, presents the following main drivers:

- Inputs:
 - Possible Airport Configurations;
 - Activated Resources.



- Control constraints:
 - Activated Plan (RBTs + Activated Resources);
 - Detected Imbalance;
 - MET (Nowcasts);
 - Constraints (Unpredicted Events);
 - DCB Solution;
 - Constraints (on Resources).
- Human actors:
 - APOC Staff;
 - Sub-Regional Network Manager;
 - AOC Staff.
- Outputs:
 - Runway Configuration.

The following Use Case has been identified for Switch Runway Operational Rules process:

Use Case	Description
Change of Runway Configuration	This Use Case describes the collaborative process initiated by the APOC Staff to change the runway configuration. The APOC Staff contacts other actors involved to negotiate conditions of the transition.

Table 4: Use Case for Switch Runway Operational Rules

4.1.4.3 Coordinate Temporary Runway Closure (A3.1.2.2.1)

Process A3.1.2.2 Coordinate Airport Temporary Resource Closure is run when maintenance works are actually performed on ATM resources, either at the airport. Variations that occur during this process have an impact on the sequence and dynamic management performed during the medium/short term planning phase. This action could be addressed at runway, surface and gate levels. Therefore, this process is broken down into three low-level processes:

- A3.1.2.2.1 Coordinate Temporary Runway Closure;
- A3.1.2.2.2 Coordinate Temporary Airport Surface Resources Closure;
- A3.1.2.2.3 Coordinate Temporary Gate Closure.

Processes A3.1.2.2.2 Coordinate Temporary Airport Surface Resources Closure and A3.1.2.2.3 Coordinate Temporary Gate Closure are out of the scope of Runway Management (E1 – this DOD) and are covered respectively by Apron & Taxiways Management (E2/3 DOD [9]) and Collaborative Airport Planning (M1 DOD [6]).

Process A3.1.2.2.1 Coordinate Temporary Runway Closure, is run when maintenance works are actually performed on airport runways. Variations that occur during this process have an impact on the sequence and dynamic management performed during the medium/short term planning phase. This sub-process presents the following main drivers:

- Inputs:
 - Possible Airport Configurations;
 - Activated Resources;
 - Airport Resource Configuration.



- Control constraints:
 - Constraints (Unpredicted Events);
 - Activated Plan (RBTs + Activated Resources).
- Human actors:
 - APOC Staff;
 - Tower Runway Controller;
 - Sub-regional Network Manager.
- Outputs:
 - Resource Configuration (Resource Unavailability) (Runway).

The following Use Case has been identified for Coordinate Temporary Runway Closure process:

Use Case	Description
Coordinate Temporary Runway Closure	This Use Case describes how the APOC Staff coordinates with the Tower Runway Controller surface cleaning operations on the runway. In order to be able to guarantee air traffic without or a minimum of delay, runways must be maintained in operational conditions at all times (e.g. kept clear of ice, snow and debris).

Table 5: Use Case for Coordinate Temporary Runway Closure

4.1.5 Enablers

Main enablers to support Balance Actual Demand and Capacity within the SESAR concept are:

- Collaborative infrastructure supported by SWIM allowing data sharing between aircraft operators, APOC Staff and the Tower Runway Controller;
- Network Operations Plan information dissemination;
- Automated meteorological data reporting supported by data-link.

4.1.6 Transition issues

IP1 OI steps related to Balance Actual Demand and Capacity are considered as already implemented.

4.2 RUNWAY MANAGEMENT SUPPORT TO MANAGE TRAFFIC QUEUES (A3.2)

4.2.1 Scope and Objectives

This process describes all the activities related to the management of different traffic queues (in Airports or Terminal Area) for their integration in a smooth flow. This encompasses elaboration of queues and the actions to implement those, resulting in trajectory changes as needed. This process may either result in a solution to get rid of the queue, or in a sequencing activity. Resource Configuration, used as an input, may be changed through "adjust resources dynamically" sub process, which includes complexity management.

The management of traffic queues is allowed by the following inputs:

- Resource Configuration;
- Activated Plan (RBTs + Activated Resources);



- DCB Solution;
- Pre-departure Sequence.

Traffic queues are managed separately at Airport and TMA levels. The airport System is responsible for the optimisation and implementation of the departure queues and for the implementation of the arrival queues. TMA is responsible for optimising arrival queues and for optimising and implementing TMA queues.

As mentioned in section 2, the scope of E1 (this DOD) is related to runway management in airport operations during the execution phase, thus following sections will only focus on the management of traffic queues at the runway level, which covers the implementation of departure and arrival queues. Optimisation of departure queues is covered by Apron & Taxiways Management (E2/3 DOD [9]), focusing on surface movement management at the apron and taxiways levels. Additionally, managing of TMA queues and optimising arrival queues are covered by Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD [11]).

Thus, manage traffic queues at runway level will address the following main actions:

- Implementation of departure queues;
- Implementation of arrival queues.

Runways mostly act as 'single servers' processing one aircraft at a time. A degree of departure and arrival queuing is a consequence of airports operating close to their capacities. The effects of weather conditions on queuing (e.g. wet runways, strong winds, low visibility) are today well known and contribute to the variability of instantaneous runway capacity.

There is a trade-off between planned airport utilisation levels (i.e. setting of hourly schedule rates vs. capacity) and arrival/departure queuing. Different airports adopt different strategies for this trade-off depending on business decisions, environmental constraints and local needs and priorities.

Arrival and departure queue management will not by itself significantly reduce delays, nor increase capacity: but it does achieve better management of the delay process, ensuring that delay is managed in the most fuel-efficient and environmentally acceptable manner.

4.2.2 Assumptions

In nominal situations, it is assumed that the Tower Runway Controller, will be the primary actor involved in departure and arrival queuing. The Tower Runway Controller has to clear and monitor the Reference Business Trajectory (RBT) ground segment and the first/last air segment. The Tower Runway Controller will comply with RBT tolerances and will only modify the RBT for safety or operational reasons. Any change in RBT will be automatically disseminated by the system. During departure and arrival queuing, the main interactions of Tower Runway Controllers are with Pilots (Flight Crew), Tower Ground controllers and TMA or Approach Executive Controllers.

4.2.3 Expected Benefits, Issues and Constraints

The expected benefits from departure and arrival queuing at runway level are the following:

- Improved runway throughput due to optimised wake turbulence separation minima and minimising Runway Occupancy Times (ROT)⁵;

⁵ The separation minima needs further development as conclusions from CREDOS Project related to wake vortex separation are not yet available.



- Increased runway utilisation optimising runway configuration/mode of operation (interlaced take-off and landing⁶, traffic segregation by aircraft size) and during Low Visibility Conditions (LVC);
- Optimised use of runway capacity in line with aircraft operator priorities;
- In arrival queuing, more accurate estimate of incoming flights will lead to improved management of all resources in the airport (stands/gates, staff, vehicles). Additionally, this will enable a more accurate prediction of the duration of the turnaround process;
- Earlier prediction of bottlenecks on airport surface will allow for implementation of mitigation strategies, avoiding aircraft to be blocked on the surface or when arriving to the parking area.

However, some issues have to be mentioned:

- More delegation to flight crew on traffic separation responsibility will also induce potential increase of the flight crew's task-load;
- Mixed equipage may limit efficiency and the Tower Runway Controller has to be aware of airborne capabilities in order to decide about relevant procedures to be applied.

4.2.4 Overview of Operating Method

Process A3.2 Manage Traffic Queues is mainly fed in by the Activated Plan (i.e. RBTs and Activated Resources), the Pre-departure Sequence; all of them outputs from the medium/short planning phase; and by the DCB Solution and the Resource Configuration; coming from process A3.1 Balance Actual Demand and Capacity.

Constraints applying to the process are either linked to the performance objectives (i.e. Target Performance Levels), constraints leading to adjust the traffic by means of revised trajectories (i.e. Revised RBTs) or user preferences and requests - i.e. AU Originated RBT Changes and Pilot Request.

As a result of this process the airport will adjust capacity configurations for the various airport resources:

- Arrival, departure and surface throughputs;
- Stand, pushback, de-icing and holding bay capacity;
- Ground resources such as passenger buses, baggage handling, refuelling, catering, cleaning, etc.

Process A3.2 Manage Traffic Queues (high-level) is broken down into three mid-level processes:

- A3.2.1 Manage Airport Departure Queue;
- A3.2.2 Manage Terminal Area Exit Queue;
- A3.2.3 Manage Arrival Queue.

A3.2.1 Manage Airport Departure Queue and A3.2.3 Manage Arrival Queue are the only processes partially covered by Runway Management (E1 – this DOD). The operating method for these processes, at runway level, is developed below. Process A3.2.2 Manage Terminal

⁶ AMAN, DMAN and his interface needs further development as at many single and multi runway airfields managing and optimising the balance between arrivals and departures to (a) mixed mode runway(s) will be the main source of increased capacity.



Area Exit Queue is covered by Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD [11]).

4.2.4.1 Implement Departure Queue (A3.2.1.2)

Process A3.2.1 Manage Airport Departure Queue deals with all the activities related to the creation and execution of a final optimised Departure queue - i.e. sequencing of surface movements, elaboration of surface plans and departure queues - e.g. multiple runways. The main constraint here is the runway resource, but also complexity management constraints for departure metering from single or multiple airports (Departure metering constraints). This process is broken down into two sub-processes:

- A3.2.1.1 Optimise Departure Queue;
- A3.2.1.2 Implement Departure Queue.

Process A3.2.1.1 Optimise Departure Queue is out of the scope of Runway Management (E1 – this DOD) and is covered by Apron & Taxiways Management (E2/3 DOD [9]). Anyway, coordination between both processes is necessary since the main input for implementing departure queues is the optimised departure sequence that is provided as an output of the previous 'optimise departure queue' process.

Process A3.2.1.2 Implement Departure Queue aims to include all the activities needed to execute the departure sequence by the Tower Runway Controller and the actions to communicate the flight crew the proper instructions for the take-off.

Implement Departure Queue sub-process presents the following main drivers:

- Inputs:
 - Activated Plan (RBTs + Activated Resources);
 - Optimised Departure Sequence (including Advisories).
- Control constraints:
 - Pilot Request.
- Human actors:
 - Tower Runway Controller;
 - Flight Crew;
 - Executive Controller (Departure Controller);
 - Tower Ground Controller.
- Outputs:
 - Traffic Sequence (Traffic to be Separated);
 - Tactical Instruction (Open Loop);
 - Trajectory Change Instruction (Closed Loop).

The main objective of Implementing Departure Queue is to ensure that aircraft take-off according to the departure sequence, by applying Optimised Departure Management in the Queue Management Process ([TS-0306](#)).

Implementing departure queue presents the following pre-conditions:

- The aircraft has completed the taxi out and is at the departure runway holding point;
- The transfer of responsibility between the Tower Ground Controller and the Tower Runway Controller is completed and communication is established (voice and/or D/L) between the Tower Runway Controller and the Flight Crew;



- Optimised Departure Sequence frozen;
- Activated Plan agreed (RBTs + Activated Resources) and departure clearance delivered (DCL);
- The system has informed the pilot via data link on the runway traffic situation and weather at airport (e.g. wind) supported through extended Operational Terminal Information Service Provision using datalink (IS-0402).

The overall description of the aircraft take-off process with the interactions between the involved actors and systems, and the flow of data exchanged is the following:

- Firstly, the Tower Runway Controller checks that the runway is available (no other aircraft or vehicles). This action can be done visually by external reference, or by reference to the surveillance system;
- Secondly, the Tower Runway Controller gives the clearance to the aircraft for take-off via voice;⁷
- The Pilot initiates the take-off roll and lifts off. The system detects the take-off and records the Actual Take-off Time (ATOT). RBTs are updated with the exact departure time ATOT;
- The Tower Runway Controller, by external reference or assisted by the system, verifies that the aircraft has left the runway;
- Finally, the aircraft is transferred to the Executive Controller (Departure Controller).

The controller will be assisted in this by the system through Automatic RBT Update through TMR (IS-0305).

The Tower Runway Controller will still be able to optimise the runway throughput by re-adjusting the departure sequence, swapping departure flights while still respecting the RBT tolerances applied. As the departure sequence is updated, all actors, including the Executive Controller (Departure Controller), will be informed through the system.

Safety management tools will assist in the assurance of runway safety - i.e. Runway Incursion alert system and A-SMGCS.

The following Use Cases have been identified for Implement Departure Queue process:

Use Case	Description
Modify Departure Sequence by Tower Runway Controller	This Use Case describes how the Tower Runway Controller changes the position of a flight in the planned departure queue at an airport.
Handle Aircraft Take- Off	This Use Case describes how the Tower Runway Controller uses the System to control that the aircraft takes off in a safe manner and according to the departure queue.

Table 6: Use Cases for Implement Departure Queue

4.2.4.2 Implement Arrival Sequence at the Airport (A3.2.3.2.2)

Process A3.2.3 Manage Arrival Queue deals with all the activities related to the creation and execution of the final optimised arrival queue (ultimately constrained by runway acceptance rates and Terminal Area – and possibly en-route – delay absorption capabilities). This process is broken down into two sub-processes:

- A3.2.3.1 Optimise Arrival Queue;

⁷ Data link has not been considered as this is a time critical instruction.



- A3.2.3.2 Implement Arrival Queue.

Process A3.2.3.1 Optimise Arrival Queue is out of the scope of Runway Management (E1 – this DOD) and is covered by Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD). Anyway, coordination between both processes is necessary since the main input for implementing arrival queues is the optimised arrival sequence coming as an output of the previous optimise arrival queue process.

Process A3.2.3.2 Implement Arrival Queue aims to include all the activities needed to execute the arrival sequence by the Executive Controller (Arrival Controller) and the Tower Runway Controller including giving the appropriate instructions to the flight crew. This process is broken down into two sub-processes:

- A3.2.3.2.1 Implement Arrival Queue in TMA;
- A3.2.3.2.2 Implement Arrival Sequence at the Airport.

Process A3.2.3.2.1 Implement Arrival Queue in TMA is out of the scope of Runway Management (E1 – this DOD) and is covered by Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD).

Process A3.2.3.2.2 Implement Arrival Sequence at the Airport aims to include all the activities of the Tower Runway Controller to execute the arrival sequence, including giving the appropriate instructions to the flight crew. The last activity covered by this process is the handover from the Tower Runway Controller to the Tower Ground Controller (after the aircraft has vacated the runway). This process will take into account as appropriate, Crosswind Reduced Separations for Departures and Arrivals ([AO-0301](#)), Time Based Separation for Arrivals ([AO-0302](#)), Fixed Reduced Separations based on Wake Vortex Prediction ([AO-0303](#)), Dynamic Adjustment of Separations based on Real-Time Detection of Wake Turbulence ([AO60304](#)), Tailored Arrivals ([AOM-0704](#)), multiple Controlled times of Over-fly (CTOs) ([TS-0106](#)), Interlaced Take-Off and Landing ([AO-0402](#)), Optimised Dependent Parallel Operations ([AO-0403](#)), use of Runway Occupancy Time reduction techniques ([AUO-0701](#)), including Brake to Vacate (BTV) procedures ([AUO-0702](#)) and Automated Brake to Vacate (BTV) using Datalink ([AUO-0703](#)), and enhanced visual separation on Approach (ATSA-VSA) ([AUO-0502](#)).

Implement Arrival Sequence at the Airport sub-process presents the following main drivers:

- Inputs:
 - Traffic Sequence (Traffic to be Separated).
- Control constraints:
 - Pilot Request.
- Human actors:
 - Tower Runway Controller;
 - Flight Crew;
 - Tower Ground Controller.
- Outputs:
 - Traffic Sequence (Traffic to be Separated);
 - Tactical Instruction (Open Loop);
 - Trajectory Change Instruction (Closed Loop).

The Tower Runway Controller controls the landing of an aircraft. It starts when the intermediary approach phase is completed and the aircraft is ready for final approach and ends when the Tower Runway Controller is ensured that the aircraft has vacated the runway.



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

The Tower Runway Controller is responsible for the final approach, landing and roll-out phase of flight. This responsibility begins when the aircraft is transferred by the Approach Controller to the Tower Runway Controller. It ends when the Tower Runway Controller transfers the aircraft to the Tower Ground Controller.


Implementing Arrival Queue by the Tower Runway Controller presents the following pre-conditions:

- The flight is cleared for final approach by the Executive Controller (TMA/APP Arrival Controller) in charge of establishing the aircraft on final approach;
- The transfer of responsibility between the Executive Controller (TMA/APP Arrival Controller) and the Tower Runway Controller is completed;
- The communication contact (voice and/or D/L) between the Tower Runway Controller and the Pilot is established;
- The system has informed the pilot via data-link on the runway traffic situation and weather at airport (e.g. wind).

The overall description of the handle aircraft landing process with the interactions between the involved actors and systems, and the flow of data exchanged is the following:

- The system notifies the Tower Runway Controller of the planned runway exit and proposes to the Pilot the runway exit and associated taxi-in plan using data-link;
- The Pilot confirms the proposed runway exit and associated taxi-in plan using data-link;
- Alternatively, the airborne system notifies the ground system of the planned, pilot-preferred runway exit and associated taxi-in plan;
- The ground system confirms the proposed runway exit, and a contract is made between the ground and airborne systems;
- The Tower Runway Controller, by visual reference or by using the surveillance system, verifies that the runway is available for the landing of the aircraft. The required input data relates to the availability of the runway, mainly weather conditions, the runway traffic situation and the lack of physical obstacles in the runway;
- The Tower Runway Controller issues the landing clearance using voice;
- The Pilot lands the aircraft. The system detects the landing and records the Actual Landing Time (ALDT);
- The Tower Runway Controller, by visual reference or by using the surveillance system, verifies that the aircraft has vacated the runway;
- The system detects that the aircraft has vacated the runway via the planned exit. Communications are transferred to the Tower Ground Controller. If needed, Estimated In-Blocks Time (EIBT) is updated case aircraft landing has resulted in a deviation from schedule (output data);
- The process ends when the system records that the aircraft has safely vacated the runway (output data) and has been transferred to the Tower Ground Controller.

The following Use Case has been identified for Implement Arrival Sequence at the Airport process:

	Episode 3 D2.2-044 - Detailed Operational Description - Runway Management - E1	<i>Version : 3.00</i>
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Use Case	Description
Handle Aircraft Landing	This Use Case describes how the Tower Runway Controller uses the System to control the landing of an aircraft. It starts when the intermediate approach phase is completed and the aircraft is ready for final approach and ends when the Tower Runway Controller is ensured that the aircraft has vacated the runway.

Table 7: Use Case for Implement Arrival Sequence at the Airport

4.2.5 Enablers

The main enablers to support Manage Traffic Queues within the SESAR concept are:

- Collaborative infrastructure supported by SWIM allowing data sharing between the Flight Crew, the Tower Runway Controller, the Tower Ground Controller and Executive Controllers (TMA Arrival & Departure Controllers);
- Complied Automatic Terminal Information Service (ATIS) information specifically relevant to the departure, approach and landing phases of flight (such as runway in use, current weather, and airport and facility conditions) is transmitted to the aircrew by data-link;
- Automated meteorological data reporting supported by data-link;
- Runway throughput and capacity improvements due to new procedures, technologies and where possible infrastructure, including interlaced take-offs and landing;
- Use of Runway Occupancy Time (ROT) reduction techniques. The main flight operations elements that affect the Runway Occupancy Time (ROT) include not only braking distance or runway/taxiway design but also pilot's awareness of ROT requirements, pilot's reaction times to line-up/departure clearances, pre-departure actions, etc;
- Brake to Vacate (BTV) procedure at a pre-selected runway exit coordinated with the Tower Runway Controller by voice or data-link, and based on BTV avionic that controls the deceleration of the aircraft to a fixed speed at the selected exit;
- Additional rapid exit taxiways (RET) and entries;
- Improved operations in low visibility conditions through enhanced ATC procedures;
- Improved low visibility runway operations using alternative landing systems;
- Optimised dependent parallel operations: Capacity gains can be achieved by increased utilisation of the combined runways. Reducing dependencies between runways by implementing more accurate surveillance techniques and controller tools as well as advanced ATM and Flight procedures, will enlarge the capabilities of existing runway configurations;
- Enhanced guidance assistance to aircraft on the airport surface combined with routing;
- Automated alerting of runway incursions to the Pilot and the Tower Runway Controller.

4.2.6 Transition issues

IP1 OI steps related to Manage Traffic Queues are considered as already implemented.



4.3 RUNWAY MANAGEMENT SUPPORT TO DE-CONFLICT AND SEPARATE TRAFFIC (A3.3)

4.3.1 Scope and Objectives

This process aims at providing de-confliction and separation between traffic at the Airport, in Terminal Areas and in en-route airspace. Traffic Separation involves RBT clearances according to the separation mode (e.g. 2D PTC, 3D PTC etc). In accordance with the SESAR concept of operations, the RBT will be successively cleared that way, together with the uplink of Trajectory Management Requirements (TMR) parameters.

Actions to solve near-term conflicts are generally safety critical in the tactical timeframe and thus generally result in a closed loop trajectory change from the original RBT to avoid the conflict or a tactical open loop instruction. In all cases, the direct consequence will be a revised RBT.

De-conflict and separate traffic process is allowed by the following inputs:

- Activated Plan (RBTs + Activated Resources);
- Optimised Traffic Queue.

De-conflict and separate traffic process is managed separately at Airport, TMA and en-route levels.

As mentioned in section 2, the scope of E1 (this DOD) is related to runway management in airport operations during the execution phase, thus following sections will only focus on de-conflict and separate traffic at the runway level, inside the runway protected area. De-conflict and separate traffic outside the runway protected area at the airport level is covered by Apron & Taxiways Management (E2/3 DOD), focusing on surface movement management at the apron and taxiways levels. Additionally, de-conflict and separate traffic in terminal area is covered by Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD) and de-conflict and separate traffic in en-route airspace is covered by Conflict Management in En-Route High & Medium/Low Density Operations (E6 DOD).

De-conflict and separate traffic at runway level will address the following main actions:

- Decide separation minima inside runway protected area;
- Detect and solve conflict inside runway protected area;
- Implement separation inside runway protected area.

On the airport, the physical layout constrains the options for conflict management. The provision of separation between aircraft and hazards on the airport will continue to be achieved through visual means, complemented by on-board capabilities such as moving maps, traffic displays and synthetic vision systems which will also increase safety and improve throughput in low-visibility conditions. In low visibility conditions ground controllers experience a very high workload to assist pilots in preventing collisions on the ground. Eventually, these new on-board capabilities should alleviate much of the workload.

4.3.2 Assumptions

None identified.

4.3.3 Expected Benefits, Issues and Constraints

The expected benefits from de-conflict and separate traffic at runway level are grouped in the following main groups:

- Increased runway throughput:



- Reducing dependency on wake turbulence separations minimum;
- Optimising Final Approach Spacing;
- Reducing Departure Spacing.
- Increased runway utilization:
 - Using integrated arrival and departure management tools (AMAN & DMAN);
 - Optimising runway configuration / mode of operation;
 - Optimum use of existing and future airport (runway) infrastructure and available capacity.
- Runway incursions eliminated;
- Improved safety of operations on the airport surface (inside the runway protected area).

However, it has to be mentioned that mixed equipage may limit efficiency and the Tower Runway Controller has to be aware of airborne capabilities in order to decide about relevant procedures to be applied.

4.3.4 Overview of Operating Method

Process A3.3 De-conflict and Separate Traffic is mainly fed in by the Activated Plan (i.e. RBTs and Activated Resources), output from the medium/short planning phase; and by the Traffic Sequence; coming from process A3.2 Manage Traffic Queues.

Constraints applying to the process are either linked to constraints leading to adjust the traffic by means of revised trajectories - i.e. Revised RBTs and Updated RBTs, or user requests - i.e. Pilot Request.

As a result of this process the airport will de-conflict and separate the traffic providing:

- RBT Revision Request;
- RBT Clearances & TMR;
- Tactical Instruction (open loop);
- Trajectory Change Instruction (closed loop).

Process A3.3 De-conflict and Separate Traffic (high-level) is broken down into three mid-level processes:

- A3.3.1 De-conflict and Separate Traffic at the Airport;
- A3.3.2 De-conflict and Separate Traffic in Terminal Area;
- A3.3.3 De-conflict and Separate Traffic in En-Route Airspace.

Process A3.3.1 De-conflict and Separate Traffic at the Airport is covered by Runway Management (E1 – this DOD) and Apron & Taxiways Management (E2/3 DOD). The operating method for this process, at runway level, is developed below. Process A3.3.2 De-conflict and Separate Traffic in Terminal Area is covered by Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD) and process A3.3.3 De-conflict and Separate Traffic in En-Route Airspace is covered by Conflict Management in En-Route High & Medium/Low Density Operations (E6 DOD).

Process A3.3.1 De-conflict and Separate Traffic at the Airport aims at providing de-confliction and separation between traffic at the Airport. This process is broken down into three sub-processes:

- A3.3.1.1 Decide on Applicable Separation Minima at the Airport;



- A3.3.1.2 Detect and Solve Conflict at the Airport;
- A3.3.1.3 Maintain Separation at the Airport.

Process A3.3.1.1 Decide on Applicable Separation Minima at the Airport is only covered by Runway Management (E1 – this DOD).

Processes A3.3.1.2 Detect and Solve Conflict at the Airport and A3.3.1.3 Maintain Separation at the Airport are covered by Runway Management (E1 – this DOD) and Apron & Taxiways Management (E2/3 DOD). Thus, each of them is broken down in two sub-processes addressing respectively the actions done, at the airport level, inside and outside the runway protected area.

4.3.4.1 *Decide on Applicable Separation Minima at the Airport (A3.3.1.1)*

This process deals with all the information needed to reach a decision about the separation minima necessary for the flights inside the Runway Protected Area. Information provided through Additional Rapid Exit Taxiways and Entries (AO-0305), Crosswind Reduced Separations for Departures and Arrivals (AO-0301), Time Based Separation for Arrivals (AO-0302), Fixed Reduced Separations based on Wake Vortex Prediction (AO-0303), Dynamic Adjustment of Separations based on Real-Time Detection of Wake Turbulence (AO-0304), improved operations in low visibility conditions through enhanced ATC procedures (AO-0502), and using GNSS / GBAS (AO-0505) will drive this decision as appropriate.

Decide on Applicable Separation Minima at the Airport sub-process presents the following main drivers:

- Inputs:
 - Traffic Sequence (Traffic to be Separated).
- Control constraints:
 - None.
- Human actors:
 - Tower Runway Controller.
- Outputs:
 - Applicable Separation Minima (inside Runway Protected Area).

The following Use Case has been identified for Decide on Applicable Separation Minima at the Airport process:

Use Case	Description
Determine Separation Minima Inside Runway Protected Area	This Use Case describes how the Tower Runway Controller uses the system to identify the proper separation minima for an aircraft inside the Runway Protected area, the required separation minima will be based on the meteorological conditions and the capability level of the aircraft and the ground systems.

Table 8: Use Case for Decide on Applicable Separation Minima at the Airport

4.3.4.2 *Detect & Solve Conflict Inside the Runway Protected Area (A3.3.1.2.1)*

This process aims to control the flights inside the Runway Protected Area in order to detect and solve possible conflicts. The conflict solution will be executed based on the proper separation minima. This process will include the advantages from improved procedures and Best Practice on the ground (AO-0101), detection of Foreign Object Debris on the Airport



Surface (AO-0202), enhanced guidance assistance to airport vehicle driver combined with routing (AO-0206) and Air Traffic Situational Awareness on the airport surface (AUO-0401).

Detect & Solve Conflict Inside the Runway Protected Area sub-process presents the following main drivers:

- Inputs:
 - Traffic Sequence (Traffic to be Separated);
 - Activated Plan (RBTs + Activated Resources).
- Control constraints:
 - Updated RBTs;
 - Revised RBTs;
 - Applicable Separation Minima.
- Human actors:
 - Tower Runway Controller.
- Outputs:
 - Detected Conflict + Advisories for Tower Runway controller to solve the conflict.

The following Use Case has been identified for Detect & Solve Conflict Inside Runway Protected Area process:

Use Case	Description
Detect & Solve Conflict Inside Runway Protected Area	This Use Case describes how the Tower Runway Controller uses the system to detect a conflict inside the Runway Protected Area and issues the necessary instructions to Pilots.

Table 9: Use Case for Detect & Solve Conflict Inside Runway Protected Area

4.3.4.3 Implement Separation Inside the Runway Protected Area (A3.3.1.3.1)

This process aims to include the activities needed to provide separation for the flights inside the Runway Protected Area by detecting conflict, then acting on advisories or by controller intervention to resolve conflicts. This process is supported by Airport Safety Nets including Taxiway and Apron (AO-0104), improved procedures and Best Practice on the ground (AO-0101), use of Runway Occupancy Time reduction techniques (AUO-0701), including Brake to Vacate procedures (AUO-0702), and automated Brake to Vacate using Datalink (AUO-0703) within the context of aircraft noise management and mitigation at and around airports (AO-0703).

Implement Separation inside the Runway Protected Area sub-process presents the following main drivers:

- Inputs:
 - Detected Conflict + Advisories;
 - Activated Plan (RBTs + Activated Resources);
 - Traffic Sequence (Traffic to be Separated).
- Control constraints:
 - Revised RBTs;



- Updated RBTs;
- Applicable Separation Minima.
- Human actors:
 - Tower Runway Controller;
 - Flight Crew;
 - Vehicle Drivers;
 - Tower Ground Controller.
- Outputs:
 - RBT Clearances & TMR;
 - Tactical Instruction (open loop).

The following Use Cases have been identified for Implement Separation Inside Runway Protected Area process:

Use Case	Description
Apply Separation Inside Runway Protected Area	This Use Case describes how the Tower Runway Controller uses the system to provide the pilot of the aircraft (or the vehicle driver) with separation inside the Runway Protected Area.
Monitor and Issue Clearances Inside Runway Protected Area	Monitor and delivery of the runway clearances in compliance with the arrival and departure sequences.

Table 10: Use Cases for Implement Separation Inside Runway Protected Area

4.3.5 Enablers

The main enablers to support De-conflict and Separate Traffic within the SESAR concept are:

- Collaborative infrastructure supported by SWIM allowing data sharing between the Flight Crew, the Tower Runway Controller, the Tower Ground Controller and Executive Controllers (TMA Arrival & Departure Controllers);
- Runway throughput and capacity improvements due to new procedures, technologies and where possible infrastructure, including interlaced take-offs and landing;
- Use of Runway Occupancy Time (ROT) reduction techniques. The main flight operations elements that affect the Runway Occupancy Time (ROT) include not only braking distance or runway/taxiway design but also pilot's awareness of ROT requirements, pilot's reaction times to line-up/departure clearances, pre-departure actions, etc;
- Improvements in lay-out of taxiway system as well as location of runways with respect to the terminal/apron, incl. Better placed runway crossings, use of additional perimeter taxiways, avoiding alignment of the main taxiways with entries or exits, use of perpendicular intersections. Include also enhanced signage and markings and use of Red Stop Bars;
- Enhanced ground controller situational awareness in all weather conditions: The system provides the controller with the position and automatic identity of all relevant aircraft and all relevant vehicles on the movement area - i.e. manoeuvring area plus apron;
- Guidance assistance to aircraft on airport surface combined with routing: The system displays dynamic traffic context information including status of runways and



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

taxiways, obstacles, route to runway or stand. Ground signs (stop bars, centreline lights, etc.) are triggered automatically according to the route issued by ATC;

- Brake to Vacate (BTV) procedure at a pre-selected runway exit coordinated with the Tower Runway Controller by voice or data-link, and based on BTV avionic that controls the deceleration of the aircraft to a fixed speed at the selected exit;
- Additional rapid exit taxiways (RET) and entries;
- Improved operations in low visibility conditions through enhanced ATC procedures;
- Improved low visibility runway operations using alternative landing systems;
- Reduced ILS sensitive critical areas: Smaller ILS sensitive and critical areas in CAT II/III are created through changes in the ILS antenna and ILS interception procedures (due to smaller angle of localizer beam);
- Automated alerting of runway incursions to the Pilot and the Tower Runway Controller.

4.3.6 Transition issues

IP1 OI steps related to De-conflict and Separate Traffic are considered as already implemented.

4.4 RUNWAY MANAGEMENT SUPPORT TO APPLY SAFETY NETS (A3.4)

4.4.1 Scope and Objectives

This process will allow the Executive Controller (as such in en-route and Terminal airspace or as Tower Runway Controller and Tower Ground Controller at the airport) to be informed with the actions of the available safety nets, to be able to monitor and carry out with the appropriate actions - i.e. an open-loop tactical instruction given to the Flight Crew.

Apply Safety Nets process is managed separately at Airport, TMA and en-route levels.

As mentioned in section 2, the scope of E1 (this DOD) is related to runway management in airport operations during the execution phase, thus following sections will only focus on applying safety nets at the runway level, inside the runway protected area. Apply safety nets outside the runway protected area at the airport level is covered by Apron & Taxiways Management (E2/3 DOD [9]), focusing on surface movement management at the apron and taxiways levels. Additionally, apply safety nets in the terminal area is covered by Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD [11]) and apply safety nets in en-route airspace is covered by Conflict Management in En-Route High & Medium/Low Density Operations (E6 DOD [12]).

One of the elementary requirements for a safety net is that it must work independently from other parts of the system, on the ground or in the air. The reason for this is to ensure that reduced system availability or common mode failure (where a single data error may invalidate several safety layers) does not prevent the safety net from achieving its Safety objectives.

On the airport surface (manoeuvring area) collisions can take place between aircraft and between aircraft and vehicles, where those on runways being the most critical ones.

To reduce the risk of runway incursions better situational awareness for the controller, aircrew and vehicle drivers will be provided not only through (re)design of the taxiway lay-out and provision of visual aids (signs and markings) but also through CDTI technology.

Advanced surveillance systems (e.g. ground radar in combination with multi-lateration technology) will constantly monitor the position, movement and intention of all aircraft and vehicles, operating in the manoeuvring area. It will provide enhanced information to



controllers whilst CDTI technology will provide aircrew and vehicle drivers with map, guidance and traffic awareness information.

By these means, possible conflicts and runway incursions can be detected at an early stage and alarms issued to the ground controller and also directly transmitted to the cockpit display and alarm systems of the relevant aircraft and /or vehicles.

Advanced, automated, systems may be considered such as “auto-brake” to make it impossible for an aircraft or vehicle to cross selected “stop bars”.

4.4.2 Assumptions

None identified.

4.4.3 Expected Benefits, Issues and Constraints

The expected benefit for apply safety nets at runway level is to improve safety of operations on the airport surface (inside the runway protected area).

4.4.4 Overview of Operating Method

Process A3.4 Apply Safety Nets is broken down into three mid-level processes:

- A3.4.1 Apply Safety Nets in the En-Route Airspace;
- A3.4.2 Apply Safety Nets in the TMA Airspace;
- A3.4.3 Apply Safety Nets at the Airport.

Process A3.4.3 Apply Safety Nets at the Airport is covered by Runway Management (E1 – this DOD). The operating method for this process, at runway level, is developed below. Process A3.4.1 Apply Safety Nets in the En-Route Airspace is covered Conflict Management in En-Route High & Medium/Low Density Operations (E6 DOD [12]) and Process A3.4.2 Apply Safety Nets in the TMA Airspace by Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD [11]).

4.4.4.1 Apply Safety Nets at the Airport (A3.4.3)

This process will allow the Tower Runway Controller to be informed with the actions of the available safety nets, through Airport Safety Nets including Taxiway and Apron (AO-0104), to be able to monitor and carry out with the appropriate actions inside the Runway Protected Area - i.e. an open-loop tactical instruction given to the Flight Crew.

Apply Safety Nets at the Airport sub-process presents the following main drivers:

- Inputs:
 - None.
- Control constraints:
 - None.
- Human actors:
 - Tower Runway Controller;
 - Flight Crew;
 - Vehicle Drivers;
 - Tower Ground Controller.

- Outputs:
 - Tactical Instruction (open loop).

The following Use Case has been identified for Apply Safety Nets at the Airport process:

Use Case	Description
Apply Safety Nets inside Runway protected Area	This Use Case describes how the Tower Runway Controller is informed with the actions of the available safety nets inside the Runway Protected Area. The Tower Runway Controller monitors the system and carries out with the actions needed to stabilize the system.

Table 11: Use Case for Apply Safety Nets at the Airport

4.4.5 Enablers

The main enablers to support Apply Safety Nets within the SESAR concept are:

- A-SMGCS;
- Automated alerting of runway incursions to the Pilot and the Tower Runway Controller.

4.4.6 Transition issues

IP1 OI steps related to Avoid Collision are considered as already implemented.



Episode 3

D2.2-044 - Detailed Operational Description - Runway Management - E1

Version : 3.00

5 ENVIRONMENT DEFINITION

5.1 AIRSPACE CHARACTERISTICS

This section is covered by the General DOD [4].

5.2 TRAFFIC CHARACTERISTICS

This section is covered by the General DOD [4].



6 ROLES AND RESPONSIBILITIES

The section addresses the roles and responsibilities of organisations and human actors in the context of runway management activities during the execution phase.

6.1 MAIN ROLES AND RESPONSIBILITIES

Runway management activities during the execution phase involve one primary actor making decisions under their area of responsibility:

- Tower Runway Controller, responsible for traffic on final approach under his/her control, landing and roll-out phase of flight.

He/she interacts with and is supported by several secondary actors:

- Other Air Traffic Control Units, transferring the responsibility of the flight from/to the Tower Runway Controller:
 - Tower Ground Controller;
 - Executive Controllers (Arrival and Departure Controllers).
- Airport Operations Centre (APOC) Staff, balancing actual demand and capacity during the execution phase;
- Airspace Users, acting in cooperation with Tower Runway Controllers and APOC Staff:
 - Flight Crew, conducting flights according to the RBT and applicable rules and assuring separation if separator;
 - Airline Operational Control (AOC) Staff, giving support to balance actual demand and capacity during the execution phase.
- Vehicle drivers, adhering to given clearances to avoid collisions;
- Sub-regional Network Manager, giving support to balance actual demand and capacity during the execution phase.

The **Tower Runway Controller** is responsible for assuring safe access to the runway for landing and departing aircraft, for aircraft and vehicles requiring crossing a runway, and for vehicles to operate on or within a runway protected area, according to the appropriate rules.

In the SESAR context the Tower Runway Controller will be supported in managing RBTs by advanced tools which will include (i) enhanced surveillance, guidance and control in all weather conditions, (ii) safety nets to reduce the risk of runway incursions and ground collisions, (iii) meteorological information to support decision making regarding wake turbulence reduced separations, (iv) digital as well as voice communications systems.

The main interactions of Tower Runway Controllers are with the Tower Ground Controllers, Arrival/Departure Executive Controllers and Flight Crew, Vehicle Drivers, and with the Airport Operations Centre (APOC) Staff as appropriate.

The **Tower Ground Controller** is responsible for assuring the safe movement of aircraft and vehicles on the manoeuvring area, excluding the runway protected area unless delegated by the Tower Runway Controller, according to the appropriate rules.



Episode 3

D2.2-044 - Detailed Operational Description - Runway Management - E1

Version : 3.00

The principal tasks of **Executive Controllers** (Arrival Controller and Departure Controller) are to separate and to sequence known flights operating within his/her area of responsibility, and to issue instructions to pilots for conflict resolution. He/she is also responsible for the transfer of flights to/from Tower Runway Controllers and to the next appropriate Executive Controller and for co-ordination with the appropriate **Planning Controller**. The principal tasks of the Planning Controller are to check the planned trajectory of aircraft intending to enter the TMA arrival/departure sector for potential separation risk, and to co-ordinate entry/exit conditions leading to conflict free trajectories.

The **Airport Operations Centre (APOC)** is the central organisational unit responsible for airport operations. It provides the roles of Resource Management, Flight Operations Management and Environment Management and is responsible for CDM with all relevant stakeholders

Airport Resources are planned and allocated iteratively and fed into the Network Operational Plan (NOP). The data has also to be collected into the airport information sharing database, which will be the entry-point for SWIM applications. On the day of operation the plan is consolidated through the balanced mapping of Business Trajectories demand on the various airport resources. If demand exceeds capacity the Resources Manager has to revise the plan through a collaborative process. He/she will be supported by the Flight Operations Manager who is aware of all the dependencies within the daily operations plan – e.g. Aircraft turnaround, transfer data.

The APOC hosts the function of the Airport CDM Cell. This unit is responsible for ensuring and improving communication between all stakeholders, including data-management of CDM relevant data. This includes the dissemination of airport information like landing time, constraints, turn-round time, "Departure Planning Information" and received "Flight Update Messages", etc.

Environmental issues play an important role in the vicinity of an airport. In order to guarantee environmental sustainability an Environment Manager needs to oversee airport operations in view of environmental impact. He/she has to develop and implement an airport wide environmental management policy and has to collaborate and communicate with all affected air transport stakeholders on measures to be taken and with local and national communities.

At smaller airports the tasks of the Airport Operations Centre may also include the tasks of Apron Control and/or Turnaround Manager.

Main interactions of Airport Operations Centre (APOC) Staff are with Apron Control within the domain of Airport Operations and with Airspace User Operations.

The **Flight Crew** remains ultimately responsible for the safe and orderly operation of the flight in compliance with the ICAO Rules of the Air, other relevant ICAO and CAA/JAA provisions, and within airline standard operating procedures. It ensures that the aircraft operates in accordance with ATC clearances and the agreed Reference Business Trajectory (RBT).

Main interactions of the Flight Crew are with the Airline Operations Centre (AOC) Staff within the domain of Airspace Users Operations and with Air Traffic Control (Tower Runway Controller, Tower Ground Controller, and Executive Controllers).

The **Airline Operational Control (AOC)** is an organisational unit of an airline and is run by a variety of professionals from different areas. It hosts the roles of Flight Dispatch, Slot Management and Strategic & CDM Management thereby managing the operations of the Airline and implementing the flight programme.

The AOC Staff is responsible for improving airline network performance (integrity) and optimisation of the Shared Business Trajectory SBT (prior to departure) and Reference



Business Trajectory RBT (execution phase) to ensure the users' business objectives for a flight are met. It devises solutions for constraints arising from the NOP.

During the execution of a flight the AOC Staff is responsible for negotiating 4D business trajectory and informing the crews of resulting impacts on the flight (this does not include transfer of clearance).

The **Sub-regional Network Manager** assures the stability and efficiency of the ATM Network on the sub-regional level. In the execution phase the Sub-regional Network Manager has the following tasks:

- Monitor the load and the developing traffic situation and – if necessary – implement appropriate Demand and Capacity Balancing (DCB) measures in co-ordination with Airspace Users and local Flow Managers;
- Monitor the balance between demand and capacities for and on airports and request the provision of adequate resources.

Main interactions of the Sub-regional Network Manager are with the Central Network Manager and with local Flow Managers in the DCB domain and with Airspace Users (AOC) and Airport Operations (APOC) for matters of CDM.

6.2 ACTORS RESPONSIBILITIES IN THE ATM PROCESS MODEL

The following table summarizes the main actors and roles involved in Collaborative Airport Planning relating to the ATM processes:

Airport area actors:

Organisation/Unit	Individual Actor	Related Process(es)	Main Role(s) & Responsibilities
Air Navigation Service Provider / TWR (Civ., Mil.)	Tower Runway Controller	A3.1.2.2.1 Coordinate Temporary Runway Closure A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.1 Decide on Applicable Separation Minima at the Airport A3.3.1.2.1 Detect & Solve Conflict Inside Runway Protected Area A3.3.1.3.1 Implement Separation Inside Runway Protected Area A3.4.2 Apply Safety Nets at the Airport	Assure Separation Avoid Collisions Optimise Queueing



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

Organisation/Unit	Individual Actor	Related Process(es)	Main Role(s) & Responsibilities
Air Navigation Service Provider / TWR (Civ., Mil.)	Tower Ground Controller	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.3.1 Implement Separation Inside Runway Protected Area A3.4.2 Apply Safety Nets at the Airport	Assure Separation Avoid Collisions Optimise Queueing
Airport Operations Centre (APOC, Civ. Aerodrome) WingOps (Mil. Aerodrome)	APOC Staff	A3.1.1.1.1.1 Assess Runway Capacity Load A3.1.1.2.1.1.1 Switch Runway Operational Rules A3.1.2.2.1.1 Coordinate Temporary Runway Closure	Set up Departure Queue Manage Airport Resources Manage Environmental issues Manage Flight Data
Airport Ground Handling Unit Third Party	Vehicle Driver	A3.3.1.3.1 Implement Separation Inside Runway Protected Area A3.4.2 Apply Safety Nets at the Airport	Avoid Collisions

Table 12: Airport actors involved in Runway management

Other areas actors:

Organisation/Unit	Individual Actor	Related Process(es)	Main Role(s)
Air Navigation Service Provider / ACC, APP (Civ., Mil.)	Executive Controller (Arrival Controller and Departure Controller)	A3.2.1.2 Implement Departure Queue A3.2.3.2.1 Implement Arrival Queue in TMA A3.2.3.1 Optimise Arrival Queue	Facilitate Flight according to RBT and applicable rules Assure Separation (if Separator) Avoid Collisions Optimise Queueing
Airlines, BA, GA, Military	Flight Crew Pilot	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.3.1 Implement Separation Inside Runway Protected Area A3.4.2 Apply Safety Nets at the Airport	Conduct Flight according to RBT and applicable rules Assure Separation (if Separator) Avoid Collisions Optimise Queueing



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

Organisation/Unit	Individual Actor	Related Process(es)	Main Role(s)
Airline Operational Control AOC WingOps	AOC Staff	A3.1.1.2.1.1.1 Switch Runway Operational Rules	Dispatch Flights Prioritise Flights Develop and Plan Trajectories Manage Flight Data Manage Environmental issues
Sub-regional Network Management Unit	Sub-regional Network Manager	A3.1.1.1.1.1 Assess Runway Capacity Load A3.1.1.2.1.1.1 Switch Runway Operational Rules A3.1.2.2.1.1 Coordinate Temporary Runway Closure	Optimise traffic flows in execution phase

Table 13: Other actors involved in Runway management



7 REFERENCES AND APPLICABLE DOCUMENTS

7.1 REFERENCES

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- [2] Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications, EUROCAE ED-78A, December 2000
- [3] **Episode 3** Single European Sky Implementation support through Validation portal, www.episode3.aero
- [4] **Episode 3** SESAR DOD G, General Detailed Operational Description, D2.2-040
- [5] **Episode 3** SESAR DOD L, Long-term Network Planning Detailed Operational Description, D2.2-041
- [6] **Episode 3** SESAR DOD M1, Collaborative Airport Planning Detailed Operational Description, D2.2-042
- [7] **Episode 3** SESAR DOD M2, Medium/Short-term Network Planning Detailed Operational Description, D2.2-043
- [8] **Episode 3** SESAR DOD E1, Runway Management Detailed Operational Description, D2.2-044
- [9] **Episode 3** SESAR DOD E2/3, Apron and Taxiways Management Detailed Operational Description, D2.2-045
- [10] **Episode 3** SESAR DOD E4, Network Management in the Execution Phase Detailed Operational Description, D2.2-046
- [11] **Episode 3** SESAR DOD E5, Conflict Management in Arrival and Departure High & Medium/Low Density Operations Detailed Operational Description, D2.2-047
- [12] **Episode 3** SESAR DOD E6, Conflict Management in En-Route High & Medium/Low Density Operations Detailed Operational Description, D2.2-048
- [13] **Episode 3** SESAR DOD Lexicon, Glossary of Terms and Definitions, D2.2-049
- [14] **Episode 3** SESAR/Episode 3 Information Navigator
- [15] **Episode 3** OS-12, Landing & Taxi to Stand, part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050
- [16] **Episode 3** OS-13, Taxi-out and Take-off, part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050
- [17] **Episode 3** OS-17, Solve Hazardous Situations during Taxiing, part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050
- [18] **Episode 3** OS-19, Severe (UDPP) Capacity Shortfalls impacting Departures in the Short-Term, part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050
- [19] **Episode 3** OS-21, Departure from non Standard Runway, part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050
- [20] **Episode 3** OS-26, Non-Severe (No UDPP) Capacity Shortfalls impacting Departures in the Short-Term, part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

- [21] **Episode 3** OS-30, Handle Planned Closure of an Airport Airside Resource, part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050
- [22] **Episode 3** OS-31, Handle Unexpected Closure of an Airport Airside Resource, part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050
- [23] **Episode 3** OS-32, Management of Vehicles on Manoeuvring Area, part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050
- [24] Use-Case UC-05, Handle Aircraft Landing.doc, V0.2, December 2008
- [25] Use-Case UC-17, Modify Departure Sequence by Tower Runway Controller.doc, V0.3, December 2008
- [26] Use-Case UC-23, Change of Runway Configuration.doc, V0.2, July 2008
- [27] Use-Case UC-38, Handle Aircraft Take-Off.doc, V0.2, June 2008

7.2 APPLICABLE DOCUMENTS

- [28] **SESAR** Concept of Operations, WP2.2.2 D3, DLT-0612-222-02-00 v2.0 (validated), October 2007
- [29] **SESAR** Operational Scenarios and Explanations – Network Airline Scheduled Operation, v0.6, November 2007
- [30] **SESAR** WP2.2.3/D3, DLT-0707-008-01-00 v1.0, July 2007
- [31] **SESAR** The Performance Target (D2), DLM-0607-001-02-00a (approved), December 2006
- [32] **SESAR** The ATM Deployment Sequence (D4), DLM-0706-001-02-00 (approved), January 2008
- [33] **SESAR** The ATM Master Plan (D5), DLM-0710-001-02-00 (approved), April 2008
- [34] **SESAR** Investigate Needs for New Appropriate Modelling and Validation Tools and Methodologies, DLT-0710-232-00-01 v0.01, May 2008
- [35] **Episode 3** Description Of Work (DOW), v3.1, July 2009



8 ANNEX A: OPERATIONAL SCENARIOS

The detailed description of those scenarios will be provided through individual files - i.e. one per identified scenario.

The following table summarises the dedicated scenarios for Runway Management. This list could be refined according to the specific needs of Runway Management exercises.

Scenario	Summary	Status
Landing and Taxi to Stand	<p>The Operational Scenario describes the processes and interactions among actors during landing and taxiing to stand operations at the airport level, within the context of SESAR 2020 concept of operations.</p> <p>The Scenario focuses on how the Tower Runway Controller and the Tower Ground Controller interact between them and with the Flight Crew to control the landing and the taxi-in of an aircraft. In addition, all interactions between human actors and the System are described.</p> <p>The Scenario covers all nominal and non-nominal procedures and is applicable for both CAVOK and Low Visibility Conditions (LVC). Description of procedures for solving hazardous situations during taxiing is out of the scope of the present Scenario and will be covered by the specific Scenario "Solve Hazardous Situations during Taxiing".</p> <p>The Scenario starts when the intermediate approach phase is completed and the aircraft is ready for final approach, covers landing and taxiing in and ends when the aircraft is in-block.</p>	Produced (OS-12)



Episode 3
**D2.2-044 - Detailed Operational Description -
 Runway Management - E1**

Version : 3.00

Scenario	Summary	Status
Taxi-out and Take-off	<p>The Operational Scenario describes the processes and interactions among actors during taxi-out and take-off operations at the airport level, within the context of SESAR 2020 concept of operations.</p> <p>The Scenario focuses on how the Tower Ground Controller and the Tower Runway Controller interact between them and with the Flight Crew to control the taxi-out and take-off of an aircraft. In addition, all interactions between human actors and the System are described.</p> <p>The Scenario covers all nominal and non-nominal procedures and is applicable for both CAVOK and Low Visibility Conditions (LVC). Description of procedures for solving hazardous situations during taxiing is out of the scope of the present Scenario and will be covered by the specific Scenario "Solve Hazardous Situations during Taxiing". In addition, the present Scenario does not cover the activities of modifying the taxi route for a specific aircraft or group of aircraft resulting in the modification of the departure sequence, which will be covered by the Specific Scenario "Departure Queue Management".</p> <p>The Scenario starts when the turn-round process is completed, the aircraft doors are closed and the Flight Crew (Pilot) is ready to leave aircraft stand, covers taxiing out and take-off and ends when the aircraft has taken-off and communications have been transferred from the Tower Runway Controller to the Executive Controller (Departure TMA).</p>	Produced (OS-13)
Departure from non Standard Runway	<p>The Operational Scenario describes the processes and interactions among actors for the non-nominal case of departing from a non-standard runway, within the context of SESAR 2020 concept of operations.</p> <p>The Scenario focuses on how controllers – the Tower Ground Controller, the Tower Runway Controller and the Approach Planning Controller – interact between each other and with the Flight Crew and the APOC Staff to respond to the non-standard departure request and allocate the departing flight within the arrival and departure sequences.</p> <p>The Scenario description takes place at an airport with independent parallel runways; one of them dedicated for departures and the other one for arrivals, and covers the operation of one departing flight that requests permission to depart on the current arrival runway (longer than the current departing runway) in order to operate on a balanced field length adequate to the aircraft weight and the existing penalising wind conditions.</p> <p>The Scenario starts when the aircraft's Flight Crew requests to change the departure runway, after receiving the initial allocated TSAT, 10 minutes before the TOBT; covers the procedure of accommodating the departing flight within the arrival, pre-departure and departure sequences; and finishes with the execution of the taxi-out and take-off operations.</p>	Produced (OS-21)



Episode 3

D2.2-044 - Detailed Operational Description - Runway Management - E1

Version : 3.00

Scenario	Summary	Status
Aborted Take-off	<p>The Operational Scenario describes the processes and interactions among actors for the handling of an aborted take-off within the context of SESAR 2020 concept of operations.</p> <p>The scenario focuses on how the Tower Runway Controller, the Tower Ground Controller and the Flight Crew interact between each other to handle an aborted take-off. In addition, all interactions between human actors and the System are described.</p> <p>The Scenario is applicable for both CAVOK and Low Visibility Conditions (LVC).</p> <p>The Scenario starts when the aircraft, cleared for take-off, aborts its take-off roll.</p> <p>The Scenario ends when either, the aircraft takes-off after a second attempt or returns back at a parking stand.</p>	Produced (OS-39)
Solve Hazardous Situations during Taxiing	<p>The Operational Scenario describes the processes and interactions among actors during the control of aircraft on the airport surface in order to detect and solve potential hazardous situations, within the context of SESAR 2020 concept of operations.</p> <p>The Scenario covers the taxiing phase for departing and arriving aircraft and describes the procedures for solving hazardous situations while aircraft are manoeuvring on airport taxiways. The Scenario focuses on how the Tower Ground Controller interacts with the Flight Crew to detect and solve these potential hazardous situations. In addition, all interactions between human actors and the System are described.</p> <p>The Scenario covers all nominal and non-nominal procedures and is applicable for both CAVOK and Low Visibility Conditions (LVC). Description of procedures for solving hazardous situations while aircraft are manoeuvring on airport runways is out of the scope of the present Scenario. In addition, the present Scenario does not cover the activities of modifying the taxi route for a specific aircraft or group of aircraft resulting in the modification of the departure sequence, which will be covered by the specific Scenario "Departure Queue Management".</p>	Produced (OS-17)



Episode 3
**D2.2-044 - Detailed Operational Description -
 Runway Management - E1**

Version : 3.00

Scenario	Summary	Status
Management of Vehicles on Manoeuvring Area	<p>The Operational Scenario describes the processes and interactions among actors for the management of vehicles on the manoeuvring area within the context of SESAR 2020 concept of operations.</p> <p>The scenario focuses on how the Tower Ground Controller and the Tower Runway Controller interact between each other and with the Vehicle Driver to control the movement of vehicles on the manoeuvring area (this includes as well the tow movements of aircraft). In addition, all interactions between human actors and the System are described.</p> <p>The Scenario covers all nominal and non-nominal procedures and is applicable for both CAVOK and Low Visibility Conditions (LVC).</p> <p>The Scenario starts when the Vehicle Driver contacts the Tower Ground Controller in order to receive approval to enter the manoeuvring area and ends when the vehicle has safely evacuated the manoeuvring area.</p>	Produced (OS-32)
Handle Planned Closure of an Airport Airside Resource	<p>The Operational Scenario describes the processes and interactions among actors during the execution phase to handle a planned closure of an airport airside resource, within the context of SESAR 2020 concept of operations.</p> <p>The Scenario focuses on how the APOC Staff, the Tower Ground Controller, The Tower Runway Controller and the Apron Controller interact with the airlines (Flight Crew, Airline Station Manager, Ground Handling Agent) and the Sub-Regional Network Manager to respond to a closure of one runway of the airport due to planned works.</p> <p>The Scenario description takes place at an airport with parallel runways, where works for the maintenance of one of the runways are being executed during 3 days. During the execution of the maintenance works, airport capacity is reduced to 55%.</p> <p>The Scenario takes place at the short term planning and execution phases and describes the final planning adjustments and the coordination actions between the different airports resources (runway, taxiway, apron, remote de-icing pad...) required when maintenance works are actually performed on one of the airport runways.</p>	Produced (OS-30)



Episode 3

D2.2-044 - Detailed Operational Description - Runway Management - E1

Version : 3.00

Scenario	Summary	Status
Handle Unexpected Closure of an Airport Airside Resource	<p>The Operational Scenario describes the processes and interactions among actors during the execution phase to handle an unexpected closure of an airport airside resource, within the context of SESAR 2020 concept of operations.</p> <p>The Scenario focuses on how the Tower Runway Controller, the Tower Ground Controller, the Apron Controller and the APOC Staff interact with the airlines (Flight Crew, AOC Staff, Airline Station Manager, and Ground Handling Agent) and the Sub-Regional Network Manager to respond to an unexpected closure of one runway of the airport.</p> <p>The Scenario description takes place at an airport with parallel runways, where one of the runways is suddenly blocked and consequently closed for a temporary period of time. During the unexpected closure of the runway, airport capacity is reduced to 55%.</p> <p>The Scenario starts at the execution phase describing the coordination actions between the different airports resources (runway, taxiway, apron, remote de-icing pad...) required to cover the unexpected closure of the airport runway, and continues describing the impact of the sudden airport capacity shortfall on the short term planning phase.</p>	Produced (OS-31)



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

Scenario	Summary	Status
<p>Severe (UDPP) Capacity Shortfalls impacting Departures in the Short-Term</p>	<p>Prioritisation for departure in the event of reduced capacity is the result of a collaborative process involving all partners. Airspace users among themselves can recommend a priority order for flights affected by delays caused by an unexpected reduction of capacity.</p> <p>This process will be needed in case of disruptions at congested airports. This process leaves room for airspace users to trade slots if they individually agree to do so, based on agreements and rules that are transparent to the other actors but that respect sets of rules agreed by all parties. The process is permanently monitored by the Regional Network Manager in order to make sure that an acceptable solution is available in due time and that all concerned parties are aware of any adverse network wide effects that may develop.</p> <p>This specific scenario is related to the departures during the reduced capacity period and during the recovery time after the capacity shortfall. During those periods there is more departure demand than departure capacity at the airport level without en-route constrictions. Two typical situations can be identified:</p> <ul style="list-style-type: none"> • during reduced departure capacity which is less than schedule (demand) due to weather conditions or runway restrictions; • or during recovering from a period of capacity shortfall when several aircrafts exceeding the normal capacity are waiting at the apron for the departure clearance. <p>In both situations, more than one aircraft is requesting the same departing time and new SBTs/RBTs have to be allocated to each flight without the presence of any relevant en-route restriction.</p> <p>Due to the imbalance between the departure demand and capacity, a new AOP has to be built taking into account the possibilities from the network and the needs or preferences from the users following the previously agreed procedures and according to the airport agreed performance targets.</p> <p>The AOP evolution is continuously monitored and the performance indicators are updated accordingly and are forecasted for the next hours. The UDPP process starts as soon as the capacity restriction affects the real time or forecasted performance targets producing an unacceptable result.</p>	<p>Produced (OS-19)</p>



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

Scenario	Summary	Status
<p>Non-Severe (No UDPP) Capacity Shortfalls impacting Departures in the Short-Term</p>	<p>The Operational Scenario describes the processes and interactions among actors for the nominal case of solving a non-severe capacity shortfall impacting departures on the day of operations (short term planning phase and execution phase), within the context of SESAR 2020 concept of operations.</p> <p>The Scenario focuses on how the APOC Staff, the Tower Ground Controller and the ATS Tower Supervisor, in coordination with the Sub-Regional Network Manager, interact with the AOC Staff, the Airline Station Manager and the Ground handling Agents to solve an airport capacity shortfall impacting departures by the activation of a departure queue management process.</p> <p>The Scenario description takes place at one European airport (Riviera Airport), which is strongly connected to a close airport (Sunshine Airport). Actions described by the present scenario at Riviera Airport are triggered by a previous capacity shortfall impacting arrivals at Sunshine Airport resulting from sudden adverse weather conditions (See Scenario “Non-Severe (No UDPP) Capacity Shortfalls impacting Multiple Nodes of the Network in the Short-Term” for further detailed description). The application of a Demand and Capacity Balancing (DCB) queue for arrivals at Sunshine creates an imbalance at Riviera Airport impacting departures.</p> <p>The Scenario starts when the capacity shortfall is triggered at Riviera airport caused by the remote imbalance at Sunshine airport; it covers the processes taken into account at Riviera airport to apply a DCB queue solution for departures, which implies a revision of the departure and pre-departure sequences; continues with the publication of the updated AOP and NOP into the SWIM; and finishes with the implementation of the new pre-departure and departure sequences.</p>	<p>Produced (OS-26)</p>

Table 14: Operational Scenarios identified for Runway management



9 ANNEX B: DETAILED USE CASE

The detailed description of those Use Cases will be provided through individual files - i.e. one per identified Use Case.

Use Case	Status
Assess Runway Capacity Load	Not Planned within Episode 3
Change of Runway Configuration	Produced (UC-23)
Coordinate Temporary Runway Closure	Not Planned within Episode 3
Handle Aircraft Take-Off	Produced (UC-38)
Handle Aircraft Landing	Produced (UC-05)
Modify Departure Sequence by Tower Runway Controller	Produced (UC-17)
Detect & Solve Hazardous Situations Inside Runway Protected Area by Tower Runway Controller	Not Planned within Episode 3
Apply Separation Inside Runway Protected Area	Not Planned within Episode 3
Monitor Traffic and Issue Clearances Inside Runway Protected Area	Not Planned within Episode 3
Apply Safety Nets inside Runway protected Area	Not Planned within Episode 3
Detect & Solve Conflict inside the runway Protected Area	Not Planned within Episode 3
Determine Separation Minima Inside Runway Protected Area	Not Planned within Episode 3

Table 15: Use Case summary



10 ANNEX C: OI STEPS TRACEABILITY TABLE

The following table captures the SESAR Operational Improvements (OIs/OI Steps) addressed by the Runway Management during Execution Phase. Although most of the OI Steps should be IP2, some of them might be IP1 (if their implementation is still part of the target system context) or IP3 (if their implementation starts in 2020).

OI Step	Description	Rationale	Related ATM Model Processes
Improving Aeronautical and Weather Information Provision [L01-02]			
Extended Operational Terminal Information Service Provision Using Datalink [IS-0402]	Current meteorological and operational flight information derived from ATIS, METAR and NOTAMS/SNOWTAMs, specifically relevant to the departure, approach and landing flight phases is transmitted to pilots by datalink. The flight crew has real-time access to the relevant airport operational parameters applicable to the most critical phases of flight (ATIS, METAR and OFIS).	The main objective is to provide pilots with easy access to the widest possible range of information to support the decision making process whilst reducing cockpit workload and enhancing safety.	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport
Airspace User Data to Improve Ground Tools Performance [L01-05]			
Automatic RBT Update through TMR [IS-0305]	The event-based Trajectory Management Requirements (TMR) logic is specified by the ground systems on the basis of required time interval and delta of current PT versus previously downlinked PT. TMR parameters can be static/globally defined or dynamic/flight-specific. This process is transparent to ATCOs and pilots (deviation alerts that are relevant for the ATCO should be associated with larger tolerance than ground-managed TMR).	The objective is to improve ground trajectory prediction by use of airborne data while optimising the communication bandwidth. The improvement may be in several steps starting with fixed/pre-defined periodic downlink (possibly varying according to airspace and/or phase of flight), then event-based ground-managed TMR, then static airborne-managed TMR parameters (the detection of deviation being performed by airborne systems), then dynamic airborne-managed TMR parameters (defined on the ground and uplinked as appropriate).	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

OI Step	Description	Rationale	Related ATM Model Processes
Optimising Climb/Descent [L02-08]			
Tailored Arrival [AOM-0704]	Tailored arrival procedures are defined from Top of descent to Initial Approach Fix (IAF) or to runway taking in account the other traffic and constraints, to optimize the descent. The concept is based on the downlink to the ANSP of actual aircraft information (like weight, speed, weather etc.) and the uplink of cleared route (STAR) calculated by the ANSP.	This procedure is a kind of Continuous Descent Approach (CDA) in which descent is made mostly on idle power. The objective is to minimise fuel consumption (operating cost) as well as noise production. In an operating environment with low traffic volume these optimized approaches can easily be made (as already done at several airports worldwide, especially during night time) but in case of high traffic volume the concept has still to be proven.	A3.2.3.2.2 Implement Arrival Sequence at the Airport
Arrival Traffic Synchronisation [L07-01]			
Multiple Controlled times of Over-fly (CTOs) through use of data link [TS-0106]	The CTOs (Controlled Times of Over-fly) are ATM imposed time constraints set on successive defined merging points for queue management purposes. The CTOs are computed by the ground actors on the basis of the estimated times provided by the airspace user (airline operation center or flight crew). They have to be met by the aircraft with the required performance.	The CTOs allow to perform precise sequencing not only on arrival (CTA) but also on other intermediate merging points e.g. in en-route.	A3.2.3.2.2 Implement Arrival Sequence at the Airport



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

OI Step	Description	Rationale	Related ATM Model Processes
Departure Traffic Synchronisation [L07-02]			
Optimised Departure Management in the Queue Management Process [TS-0306]	With knowledge of the TTA (if applicable), the elapsed time derived from the trajectory, the departure and arrival demand for the runway(s) and the dependent departure route demand from adjacent airports, the system (DMAN) calculates the optimum take-off time and the SMAN will determine the associated start-up and push-back times and taxi route.	There will be no need to finalise a departure sequence earlier than necessary, flexibility being the key to maximum use of capacity. The take-off sequence is built as predicted take-off times achieve a required level of accuracy. The precise point at which take-off times are known with sufficient accuracy will depend on the accuracy and reliability of the data available on the status of the turn-round process. Initially the required level of accuracy may not be achieved until the aircraft has requested push-back. It is however expected that during the SESAR time-frame the improving view on the status of the turn-round process will enable valid departure sequences to be built earlier. This earlier sequencing will enhance departure and arrival queue management collaboration.	A3.1.1.1.1.1 Assess Runway Capacity Load A3.2.1.2 Implement Departure Queue
Managing Interactions between Departure and Arrival Traffic [L07-03]			
Departure Management from Multiple Airports [TS-0302]	The system provides support to departure metering and coordination of traffic flows from multiple airports to enable a constant delivery into the en-route phase of flight.	While basic departure management considers only the distribution of initial departure routes, there is a need for the consideration of the departure traffic flows into the en-route environment and interactions with other traffic flows.	A3.1.1.1.1.1 Assess Runway Capacity Load A3.2.1.2 Implement Departure Queue



Episode 3

D2.2-044 - Detailed Operational Description - Runway Management - E1

Version : 3.00

OI Step	Description	Rationale	Related ATM Model Processes
Integrated Arrival / Departure Management in the Context of Airports with Interferences (other local/regional operations) [TS-0304]	Integration of AMAN and DMAN with the CDM processes between airports with interferences.	The effectiveness of AMAN-DMAN will improve by including the operations of close airports with interferences.	A3.1.1.1.1 Assess Runway Capacity Load A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport
Airborne Situational Awareness [L08-03]			
Air Traffic Situational Awareness (ATSAW) on the Airport Surface [AUO-0401]	Information regarding the surrounding traffic (incl. both aircraft and airport vehicles) during taxi and runway operations is displayed in the cockpit. The electronic flight bag is extended with a moving map and other traffic (aircraft+vehicles) information.	The objectives are to improve safety (e.g. at taxiways crossings, before entering an active runway, before take-off, etc) and to reduce taxi time in particular during low visibility conditions and by night.	A3.3.1.2.1 Detect & Solve Conflict Inside Runway Protected Area A3.3.1.3.1 Implement Separation Inside Runway Protected Area A3.4.2 Apply Safety Nets at the Airport
Improving Safety of Operations on the Airport Surface [L10-01]			
Reduced Risk of Runway Incursions through Improved Procedures and Best Practices on the Ground [AO-0101]	ECAC airports and aircraft operators develop procedures and apply recommendations contained in the European Action Plan for the prevention of runway incursions (e.g. compliance of infrastructure with ICAO provisions, best practices on flight deck procedures for runway crossing, while taxiing; assessment for pilots regarding aerodrome signage, markings and lighting.).	Cf. European Action Plan for the Prevention of Runway Incursions.	A3.3.1.2.1 Detect & Solve Conflict Inside Runway Protected Area A3.3.1.3.1 Implement Separation Inside Runway Protected Area A3.4.2 Apply Safety Nets at the Airport



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

OI Step	Description	Rationale	Related ATM Model Processes
Airport Safety Nets including Taxiway and Apron [AO-0104]	The systems detect potential conflicts/incursions involving mobiles (and stationary traffic) on runways, taxiways and in the apron/stand/gate area. The alarms are provided to controllers, pilots, and vehicle drivers together with potential resolution advisories (depending on the complexity of resolution possibilities). The systems also alert the controller in case of unauthorized / unidentified traffic.	Current automated alerting system is limited to the runway and is based upon a set of rules that assist controllers in detecting the most serious conflicts. This system has no knowledge of aircraft intent and in some cases the time window to determine and communicate a solution may be very limited.	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.1 Decide on Applicable Separation Minima at the Airport A3.3.1.2.1 Detect & Solve Conflicts Inside Runway Protected Area A3.3.1.3.1 Implement Separation Inside Runway Protected Area A3.4.2 Apply Safety Nets at the Airport
Improved Runway-Taxiway Lay-out, Signage and Markings to Prevent Runway Incursions [AO-0103]	Improvements in lay-out of taxiway system as well as location of runways with respect to the terminal/apron, incl. Better placed runway crossings, use of additional perimeter taxiways, avoiding alignment of the main taxiways with entries or exits, use of perpendicular intersections. Include also enhanced signage and markings and use of Red Stop Bars.	Reduce the risk of runway incursions.	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.2.1 Detect & Solve Conflicts Inside Runway Protected Area
Detection of FOD (Foreign Object Debris) on the Airport Surface [AO-0202]	The system provides the controller with information on FOD detected on the movement area.	Safety (to avoid accidents like the concorde crash in Paris). Micro-wave systems can detect small objects on the movement area.	A3.3.1.2.1 Detect & Solve Conflicts Inside Runway Protected Area A3.4.2 Apply Safety Nets at the Airport



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

OI Step	Description	Rationale	Related ATM Model Processes
Improving Traffic Management on the Airport Surface [L10-02]			
Enhanced Guidance Assistance to Airport Vehicle Driver Combined with Routing [AO-0206]	The system displays dynamic traffic context information including status of runways and taxiways, obstacles, and an airport moving map.		A3.3.1.2.1 Detect & Solve Conflict Inside Runway Protected Area A3.3.1.3.1 Implement Separation Inside Runway Protected Area A3.4.2 Apply Safety Nets at the Airport
Surface Management Integrated With Departure and Arrival Management [AO-0207]	The taxiing process is considered as an integral part of the process chain from arrival to departure and AMAN / DMAN is integrated with CDM processes between airport operator, aircraft operators and air traffic service provider at the same airport.	To improve the aerodrome throughput, Arrival and Departure Management need to be considered as a combined entity, itself closely linked to surface movement especially at airports with runways used for both arriving and departing flights.	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.3.1 Implement Separation Inside Runway Protected Area
Enhanced Trajectory Management through Flight Deck Automation Systems [AUO-0604]	Use of advanced aircraft automated systems such as e.g. auto-brake (making it impossible for an aircraft to cross a lit stop bar) and auto-taxi (optimising speed adjustment).	Flight crew supported by advanced tool for ground operations.	A3.3.1.3.1 Implement Separation Inside Runway Protected Area
Using Runways Configuration to Full Potential [L10-04]			
Interlaced Take-Off and Landing [AO-0402]	Mixed mode of operations.	In order to provide mitigation for the inherent delays/queuing associated with capacity constrained airports and to gain a significant capacity enhancement without impacting the overall queue management concepts, interlaced take-off and landing procedures instead of segregates use of multiple runways can be envisaged.	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

OI Step	Description	Rationale	Related ATM Model Processes
Optimised Dependent Parallel Operations [AO-0403]	Capacity gains can be achieved by increased utilisation of the combined runways. Reducing dependencies between runways by implementing more accurate surveillance techniques and controller tools as well as advanced procedures, will enlarge the capabilities of existing runway configurations (like closely spaced parallel runways).	Dependencies between multiple runways determine the practical runway capacity which in most cases is lower than the combined single runway capacities.	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport
Use of Runway Occupancy Time (ROT) Reduction Techniques [AUO-0701]	The main flight operations elements that affect the Runway Occupancy Time (ROT) include not only braking distance or runway/taxiway design but also pilot's awareness of ROT requirements, pilot's reaction times to line-up/departure clearances, pre-departure actions, etc. This improvement addresses enhancements to operating practices of airlines and pilots in that respect.	Evidence suggests that there is a measurable difference in the efficiency of both pilots and airlines in the use of runways. Saving just one second on every movement could result in one slot gain every two hours, so it is in the interests of all parties to ensure that vital seconds are not lost.	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.3.1 Implement Separation Inside Runway Protected Area
Brake to Vacate (BTV) Procedure [AUO-0702]	Brake to vacate at a pre-selected runway exit coordinated with ground ATC by voice.		A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.3.1 Implement Separation Inside Runway Protected Area
Automated Brake to Vacate (BTV) using Datalink [AUO-0703]	Automated braking to vacate at a pre-selected runway exit coordinated with ground ATC through datalink, and based on BTV avionics that controls the deceleration of the aircraft to a fixed speed at the selected exit.	Landing aircraft can make optimal use of existing exits (RETS or other) by adapting their braking techniques. During blue sky situations the pilot can adapt its braking as he can see the exit from quite a distance. During low visibility conditions this will become more difficult and longer ROTs will occur. Assisting the pilot in optimal braking techniques will result in lower ROTs and thus increasing capacity.	A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.3.1 Implement Separation Inside Runway Protected Area



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

OI Step	Description	Rationale	Related ATM Model Processes
Maximising Runway Throughput [L10-05]			
Crosswind Reduced Separations for Departures and Arrivals [AO-0301]	Under certain crosswind conditions it may not be necessary to apply wake turbulence minima.	The objective is to reduce dependency on wake vortex operations which under suitable weather conditions, will lead to reduced arrival / departure intervals, with a positive effect on delays and runway throughput.	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.1 Decide on Applicable Separation Minima at the Airport A3.3.1.3.1 Implement Separation Inside Runway Protected Area
Time Based Separation for Arrivals [AO-0302]	Constant time separations (LIV & STIV) independent of crosswind conditions and wake turbulence existence are introduced. Time based separation is an option to replace the distance criteria currently used to separate trailing aircraft on the approach beyond the wake turbulence of the leading aircraft.	The intent is to mitigate the effect of wind on final approach sequencing so as to achieve accurate and more consistent final approach spacing, and recover most of the capacity lost under strong headwind.	A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.1 Decide on Applicable Separation Minima at the Airport A3.3.1.3.1 Implement Separation Inside Runway Protected Area
Fixed Reduced Separations based on Wake Vortex Prediction [AO-0303]	In the applicable situations, the controller uses reduced aircraft separations derived from forecasted wake vortex behaviour.	Separation standards are too conservative for a variety of meteorological situations. Use of a statistical model giving wake-vortex behaviour with fixed aircraft separations - e.g. from collection of all relevant combinations of wake vortex behaviours in meteorological situations - could be an intermediate step towards individual wake-vortex forecasting.	Implement Arrival Queue in TMA Implement Separation in Terminal Area Optimise Arrival Queue



Episode 3
**D2.2-044 - Detailed Operational Description -
 Runway Management - E1**

Version : 3.00

OI Step	Description	Rationale	Related ATM Model Processes
Dynamic Adjustment of Separations based on Real-Time Detection of Wake Turbulence [AO-0304]	The controller optimises aircraft separations taking account of the actual wake-vortices strength.		A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.1 Decide on Applicable Separation Minima at the Airport A3.3.1.3.1 Implement Separation Inside Runway Protected Area
Additional Rapid Exit Taxiways (RET) and Entries [AO-0305]	<p>Appropriate runway exits are provided for the aircraft mix using the runway. The Runway Occupancy Time (ROT) as well as the predictability is based on the number of exits, the design/shape of the exit, the location with respect to the landing threshold as well as pilot/airline behaviour policy. Finding a well accepted balance between number, shape and location is necessary.</p> <p>Multiple runway entries and a wide holding area can help to optimize the sequencing process for departing aircraft and can generate significant operational benefits during periods of traffic congestion.</p>	In some cases, where for example backtracking after landing is required or new aircraft types at an airport cannot use existing high-speed exits, infrastructure improvements may be needed.	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.3.1 Implement Separation Inside Runway Protected Area



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

OI Step	Description	Rationale	Related ATM Model Processes
Improving Operations under Adverse Conditions incl. Low Visibility [L10-06]			
Improved Operations in Low Visibility Conditions through Enhanced ATC Procedures [AO-0502]	LVP (Low Visibility Procedures) are collaboratively developed and are implemented at applicable airports involving in particular an harmonised application across airports and the use of optimised separation criteria.	Operations in poor weather are responsible for considerable delays within Europe. There is considerable variance in the ways LVP are applied, and in the procedures used. There is the potential for considerable short term benefits from the collaborative development and implementation of procedures (e.g. best practices).	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.1 Decide on Applicable Separation Minima at the Airport A3.3.1.3.1 Implement Separation Inside Runway Protected Area
Reduced ILS Sensitive and Critical Areas [AO-0503]	Smaller ILS sensitive and critical areas in CAT II/III are created through changes in the ILS antenna and ILS interception procedures (due to smaller angle of localizer beam).	ILS tuning will increase runway capacity during already limiting visibility conditions (landing aircraft will free the runway earlier). This seems even more important with the introduction of New Large Aircraft (NLA) and their effect on the ILS when taxiing near/parallel to the landing runway.	Implement Arrival Queue in TMA
Improved Low Visibility Runway Operations Using GNSS / GBAS [AO-0505]	Use of GNSS / GBAS for precision approaches.	The main benefit is the increased runway capacity in poor weather conditions as the glide path and azimuth signals will face hardly any interference from previous landing aircraft or other obstacles.	A3.2.1.2 Implement Departure Queue A3.2.3.2.2 Implement Arrival Sequence at the Airport A3.3.1.1 Decide on Applicable Separation Minima at the Airport A3.3.1.3.1 Implement Separation Inside Runway Protected Area



Episode 3
**D2.2-044 - Detailed Operational Description -
 Runway Management - E1**

Version : 3.00

OI Step	Description	Rationale	Related ATM Model Processes
Visual Conducted Approaches [L10-07]			
Enhanced Visual Separation on Approach (ATSA-VSA) [AUO-0502]	The application (ATSA-VSA) helps crew to achieve the visual acquisition of the preceding aircraft and then to maintain visual separation from this aircraft.	The objective is to facilitate successive approaches for aircraft cleared to maintain visual separation from another aircraft on the approach. However, applicability within core European airspace appears to be very limited and for airports that do not currently use visual separation on approach, there is unlikely to be a case to introduce Enhanced Visual Separation.	A3.2.3.2 Implement Arrival Sequence at the Airport
Implementing Sustainable Operations at Airport [L10-08]			
Aircraft Noise Management and Mitigation at and around Airports [AO-0703]	Time management techniques and aircraft movement technologies are developed which reduce both fuel consumption and noise by taxiing aircraft (e.g. taxiing with not all engines operating) or towing the aircraft to/from the runway with all engines off. The use of electric (instead of hydro-carbon powered) auxiliary power units and ground handling vehicles further reduces the noise and particulate pollution around parked aircraft.	Even if the share of aviation in the total air quality in the surrounding of the airport is small today, its part of air pollutions may be more dominant in the future with the evolution of landside transport (new car technology, use of public transports).	A3.3.1.3.1 Implement Separation Inside Runway Protected Area

Table 16: Operational Improvements addressed



Episode 3

D2.2-044 - Detailed Operational Description - Runway Management - E1

Version : 3.00

11 ANNEX D: HOT TOPICS

There are some areas which need further development, but there was no area identified in the ConOps definition where either, a consensus amongst partners is not reached or, where the concerned topic needs elevating to the S-JU for resolution by WPB and/or the operational/technical threads.

It should also be noted that none of the Episode 3 exercise results have made it necessary to change the content of this DOD.



Episode 3
D2.2-044 - Detailed Operational Description -
Runway Management - E1

Version : 3.00

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