Episode 3

Single European Sky Implementation support through Validation

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Rosalind Eveleigh	EUROCONTROL
Contributing partners	

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DOCUMENT CONTROL

Approval

Role	Organisation	Name
Document owner	EUROCONTROL	Rosalind Eveleigh
Technical approver	EUROCONTROL	Giuseppe Murgese
Quality approver	EUROCONTROL	Frédérique Sénéchal
Project coordinator	EUROCONTROL	Philippe Leplae

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3.00	15/04/2010	Approved	Ros Eveleigh	Cross DOD alignment. Approved by the Episode 3 Consortium

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

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

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. 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 “turn-round” process determines whether delays increase or can be recovered.

The daily operation at an airport involves the real-time, safe and efficient management of aircraft and vehicles movements on the airport surface. Short notice changes and/or refinements to the planning of surface movements 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 Air Traffic Controllers and Apron Managers.

The SESAR concept addresses the following objectives regarding the management of apron and taxiway movement during the execution phase:

- Enhanced scheduling of airport surface movements in normal and congestion situations and in coordination with runway operations and turn-round operations will provide increased operational efficiency;
- Visual enhancement technology will provide increased situational awareness for flight crew and vehicle drivers during night and reduced visibility conditions;
- Onboard features will allow the anticipation of safety hazardous situations through the provision of warnings directly to flight crew and drivers as well as to ATC controllers;
- Advanced, automated, systems may be considered such as “auto-brake” to make it impossible for an aircraft or vehicle to cross active red “stop bars”;
- Planning of surface routes may consider constraints imposed by the need to minimise the environmental impact especially surface holding or the need to avoid braking or changes in engine thrust levels as the aircraft moves from the runway to the stand or vice versa.

As surface movement efficiency is to be increased without compromising the level of safety, particularly the risk for runway incursions, a range of actions need to be taken. Better situational awareness for the controller, flight crew and vehicle drivers including conflict detection and warning systems will not only enhance airports surface movement safety but will also create "room" for surface movement efficiency and contribute to the required airport capacity increase.

Advanced Surface Movement Guidance and Control System (A-SMGCS) will provide enhanced information to controllers whilst Cockpit Display of Traffic Information (CDTI) technology will provide flight crew and vehicle drivers with guidance and traffic information. On airports where A-SMGCS is not implemented by 2020, non-cooperative surveillance systems NCSS (e.g. SMR) which are in the scope of SMGCS will help to provide visual information to ATCO in low visibility conditions.

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1 INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This document contains a refined description of the SESAR concept of operations regarding apron and taxiway movement management processes taking place at airports during the execution phase[1]. Referred as “Apron & Taxiways Management - E2/3 DOD”, this document is part of a set of Detailed Operational Description (DOD) documents that refine and clarify the high level SESAR ConOps concept description in order to support the Episode 3 validation activities, which have the objective of developing a better understanding of the SESAR Concept. This set of DODs documents 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 that of the Operational Service and Environment Definition (OSED) 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) [8];
- The Apron & Taxiways Management DOD (E2/3 DOD), this document;
- The Network Management in the Execution Phase DOD (E4 DOD) [9];
- The Conflict Management in Arrival & Departure High & Medium/Low Density Operations DOD (E5 DOD) [10];
- The Conflict Management in En-Route High & Medium/Low Density operations DOD (E6 DOD) [11];
- The Episode 3 Lexicon (Glossary of Terms and Definitions) [12].

[1] The turn-round operations are out of the scope of Apron & Taxiway Management (E2/3 – this DOD), those are covered by Collaborative Airport Planning (M1 DOD).

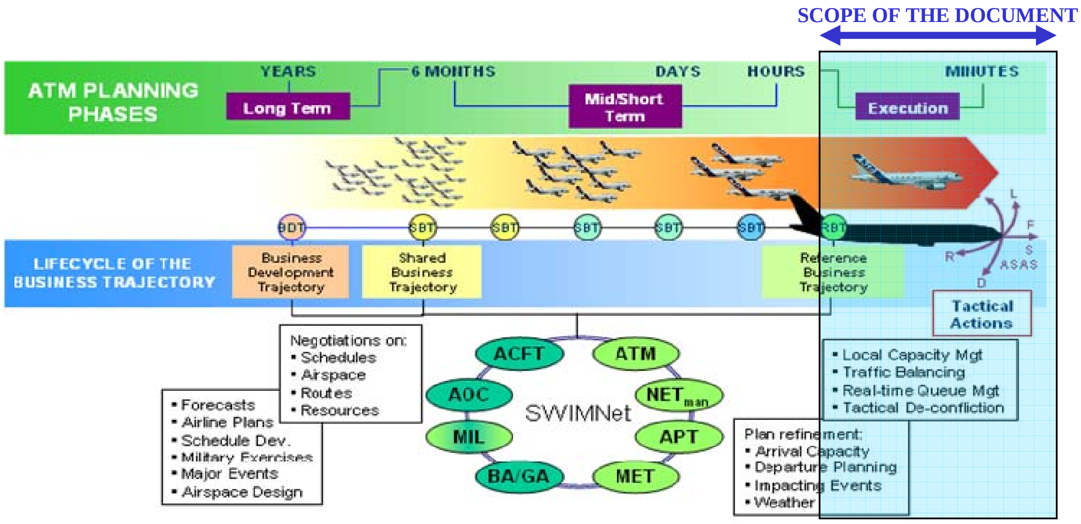

Figure 1: Scope of the document within SESAR Vision (SESAR ConOps)

The target horizon addressed in this document is the 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 Espanõles 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'Equipement, 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); Ingeneria 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 [29];
- The description of scenarios developed: T223 [30] & [31];
- The list of Operational Improvements allowing to transition to the final concept: T224 [32];
- 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 [35].

The objective of detailing the operational concept [37] 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;
- 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 [12].

2 OPERATING CONCEPT-CONTEXT AND SCOPE

2.1 SESAR CONCEPT FOR AIRPORT APRON & TAXIWAYS MANAGEMENT

2.1.1 General introduction

Air Transport is a continuous sequence of arrival, turn-round, departure and flight cruise (en-route) events. The operations at airports, apron and taxiway movements in our case, 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 “turn-round” 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.

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

The execution of the Airport Resource and Capacity Plan (addressing runway, taxiway, stand and de-icing resources) involves the real-time safe and efficient management of aircraft movements on the airport surface. Short notice changes and/or refinements to the planning of surface movements 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 Air Traffic Controller and Apron Managers.

If surface movement capacity is to be increased without increasing the risk of runway incursions a range of actions need to be taken. Better situational awareness both for the controller, flight crew and vehicle drivers including conflict detection and warning systems will not only enhance airports surface safety but will also create "room" for surface movement capacity expansion. Advanced Surface Movement Guidance and Control System (A-SMGCS) will provide enhanced information to controllers whilst Cockpit Display of Traffic Information (CDTI) technology will provide flight crew and vehicle drivers with map, guidance and traffic information.

Enhanced scheduling of airport surface movements in normal and congestion situations and in coordination with runway operations and turn-round operations will provide increased operational efficiency. Planning of surface routes may consider constraints imposed by the need to minimise the environmental impact especially surface holding or the need to avoid braking or changes in engine thrust levels as the aircraft moves from the runway to the stand or vice versa. This Optimum management of surface traffic flows will not only increase efficiency and predictability during the ground movement phase but will also have a positive impact on the environment.

Predicting the taxi times and routing of inbound and outbound traffic, A-SMGCS Routing and Planning functions can provide stable and reliable planning (target) times and is prerequisite for pre-departure sequencing and an optimised usage of the departure runways(s). Integration of the Planning and Routing information with the Arrival and Departure Management tools (AMAN/DMAN) is a necessity to gain the full benefit of these tools.

Achieving the optimal departure sequence in an early stage of the outbound ground movement phase will reduce the necessity of sequence changes near the departure.

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On the airport, the physical layout constrains the options for conflict management. Implementation of good taxiway design at both new and existing[2] airports will reduce interactions between taxi flows, while A-SMGCS Routing function provides taxi routing solutions that also minimise interactions.

The provision of separation between aircraft and obstacle avoidance on the airport will continue to be achieved through visual means and use of A-SMGCS Surveillance data, complemented by on-board capabilities such as Airport Moving Maps (AMM), traffic displays and enhanced or 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 avoiding obstacles and preventing collisions while manoeuvring on airport surface. Eventually, these new on-board capabilities should alleviate much of the extra workload compared to normal visibility conditions.

Further enhancements for conflict detection and management will come in the form of new ATC capabilities such A-SMGCS and cooperative capabilities for all mobiles.

2.1.2 Safety on the airport surface

On the airport surface (manoeuvring area) collisions can take place between aircraft and between aircraft and vehicles. Runways and the vicinity of runways represent the most critical areas for the safety of operations.

To reduce the risk of runway incursions better situational awareness for the controller, flight crew 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 flight crew and vehicle drivers with map, guidance and traffic awareness information.

By these means, possible hazardous situations 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”.

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 such as A-SMGCS Control function (including Runway Incursion Alert systems for safety), stand allocation systems (for efficient apron management), A-SMGCS Routing, Planning, Guidance and Surveillance functions (for optimising aircrafts and vehicles movement and identification) and processes (CDM for optimal system performance) are available to make the operation safe and efficient.

2.1.3 Arrival flight operations

After the aircraft has vacated the runway according to a runway exit previously coordinated between the Flight Crew[3] and the Tower Runway controller (taking into account the automatic braking provided by Brake to Vacate (BTV) to optimise runway occupancy time), the taxi route, taxi clearances, potential stopping points, the aircraft current position and the assigned stand are shown on a map in the cockpit (CDTI). The transfer of control of the aircraft from

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[2] Probably a limited option at existing airports since a complete taxiway re-design may be out of their financial scope.

[3] May also be referred as “Pilot” in rest of the document.

the Tower Runway Controller to the Tower Ground Controller is completed. In normal situations the taxi route and stand assignment will be the same as the one received when entering the AMAN horizon however [4](short notice) changes can happen like runway configuration changes, stand occupation etc. The assigned stand and the taxi route, including related taxi clearances and potential stopping points, will be updated when necessary.

The pilot acknowledges the assigned route and follows it. For each inbound flight, a Estimated In-Block Time (EIBT) is found in the RBT, based on the pre-assigned stand, taxi route/clearance. This time including the current status of the aircraft stand, is later confirmed by the Aircraft Operator and the Ground Handling Agent. The Pilot executes the taxiing process to meet this time. The Ground Handling Agent makes sure that the stand is free of obstacles and other occupants and the handling equipment and staff are present. Being early at the stand is not always desirable as blockage of apron/ taxi lanes could happen if the stand is not vacated/ available.

The ground movement process is continuously monitored by A-SMGCS. The position of all aircraft and vehicles within the manoeuvring area is available for the Tower Ground Controller and the Airport Operations Centre (APOC). The current traffic situation is taken into account for the determination of the achievable taxi time from/to the stand for each aircraft. Based on practical and operationally feasible taxi speeds and the target stand, the routes and the related taxi times of all taxiing aircraft are calculated by the A-SMGCS. It also provides a speed suggestion to the cockpit to control the taxiing phase for each aircraft[5].

If a significant deviation of EIBT occurs, then a new EIBT is calculated by the A-SMGCS and transmitted to the APOC. In the APOC a collaborative decision about mitigating the adverse effects to the network planning of this deviation is taken.

The assigned routes are calculated to be conflict free, optimised in taxi distance/time and minimum power adjustments (braking - accelerating) to reduce fuel burn as much as possible. In case of intermediate taxi clearances within the route, stop points (e.g. Runway crossings) are included and presented on the cockpit display map. In every case, the controller has to issue a clearance to pass the presented stop point. This clearance can be given by a verbal message or by an indication on the onboard display. The pilot must always acknowledge the crossing clearance (reading back).

The taxi route is dynamically adapted to the actual situation. Upcoming conflicts or hazardous situations are detected by A-SMGCS and immediately displayed in the controller display. Where for conflict resolution purposes changes to taxi route and taxi clearances (stop points) are needed, A-SMGCS Routing function provides a new routing suggestion based on optimisation algorithms. The controller follows the new routing suggestion before it is transferred to the cockpit. The previous route and clearance information is automatically overwritten and the pilot confirms the new route and clearance instructions. If the controller and/or the pilot does not react in due time and the conflict candidates infringe their exclusion zones, a stop command is automatically issued to all affected aircraft by the conflict detection and resolution functionality of the A-SMGCS.

2.1.4 Turn-round operations

In a 4D trajectory, deviations from the EIBT are known far before touch-down as aircraft status and flight progress is constantly monitored. Significant deviation (i.e. outside agreed boundaries) between the EIBT in the RBT predicted on departure and the EIBT as updated

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[4] Airport Expert Group 5.3.2 advises that the pilot workload during approach and uncertainty of information might mean that it is not possible to deliver the taxiway routing during the approach phase of flight

[5] Airport Expert Group 5.3.2 view was that the use of speed as part of the taxiway clearance would reduce the flexibility of the tower controller and the many causes of delays in taxiing. The group also noted that speed or timings will be needed for the route to be conflict-free.

during the execution of the flight is analysed by the APOC. The effects on stand allocation, handling crew disposition, rerouting baggage and passengers within the terminal as well as the influence on the next corresponding outbound flight are determined. If possible and desirable, another flight/aircraft can be directed to the not used stand to ensure an optimal utilization of the parking positions and the ground handling resources.

The minimum reaction time for stand allocation changes is around 30 minutes prior to the EIBT, based on the necessity of re-routing passenger and baggage flows within the terminal. For repositioning ground handling crew a minimum reaction time of 15 minutes is applicable. Most taxi-in times are less than 10 minutes[6]. Therefore irregularities during the inbound ground movement phase do not result in stand changes and handling crew dispositions. In cases where the parking position for the aircraft is still occupied at the EIBT, the APOC decides whether to re-plan the stand utilisation or to temporarily hold the inbound aircraft on a remote area, depending on the predicted delay of the outbound aircraft. The inbound aircraft is provided with relevant taxi route changes and clearances (stop position) and a new EIBT.

Turn-round phase starts when the aircraft reaches the stand area when an automated docking system guides the aircraft to the stand. 'In-block' (providing AIBT) is automatically detected and indicated to the APOC. The Target Off-Block Time for the next flight (SBT) is automatically calculated or updated if the process has started prior to AIBT. The responsible ground handler at the aircraft stand is informed through the information network (SWIM) about this Target Off-Block Time (TOBT) as well as the target times for the different phases in the aircraft ground handling process. The execution of the ground handling process is constantly monitored with progress (status) information being reported to the APOC. The turn-round phase is out of the scope of Apron & Taxiway Management (E2/3 – this DOD), it is covered by Collaborative Airport Planning (M1 DOD [6]).

The agreement of the RBT will be shared with the cockpit. The RBT provides the pilot with information about the TOBT. This time is constantly updated, or revised for significant deviations, with respect to all operational influences from the ground handling process to the departure, en-route and destination airport situation. The Airline/Ground Handling Agent informs ATC, Network Manager and all the partners that the aircraft is ready for taxi/push-back. When necessary the Tower Clearance Controller revises the target times (TSAT (Target Start-up/Approval Time) and TTOT) and taxi route to take into account changes in factors such as taxi time, runway, stand allocation and wake vortex considerations. Just before TSAT, the Pilot sends a request for start-up and push back to the Tower Clearance/Ground Controller. After acceptance by the controller, the start-up/pushback clearance with all possible options (e.g. push-back heading/direction) and assigned taxi route are sent to the cockpit and Ground Handling Agent. The Pilot acknowledges the clearance and taxi route. This acknowledgement is shared with the controller and the APOC. The Ground Handling Agent initiates the pushback in coordination with the pilot.

2.1.5 Departing flight operations

The pilot starts the engines and, after receiving the taxiing clearance, starts taxiing to the departure runway according to the assigned taxi route. In normal situations the departure runway and outbound taxi route will be the same as the one received during the pre-departure phase, however (short notice) changes can happen like runway configuration or departure route changes. [7]An update of the departure runway and departure route clearance will be sent to the aircraft when necessary.

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[6] The time is assumed to be for an unimpeded taxi. At some larger airports with remote runways e.g. Schipol, this will be larger.

[7] The Airport Expert 5.3.2 advises that the taxi route itself cannot be provided until the crew indicates that they are ready for start/pushback, (CDM Milestone 13) and this ground element can only be represented by timings (unless there is only one routing possibility). Depending on the event triggering

Each aircraft taxiing to the departure runway must comply with a TTOT. The TTOT is generated with respect to an optimal departure sequence (DMAN) and to the optimum RBT backtracking from the required time of arrival including a prioritisation by the airspace users (in cases where the User Defined Prioritisation Process (UDPP) is required). The execution of the taxi phase is monitored and controlled by the A-SMGCS in such a way that the aircraft reaches the departure hold according to the optimal sequence.

At take-off clearance, the airborne part of the 4D trajectory starts and the aircraft will follow the assigned departure route.

In the above description of the process, it is assumed that all aircraft can cooperate. However it must be admitted that this is most probably not the case. Not all aircraft are equipped with display devices for ground routes and taxi clearances. The ground movement system and process must cater for aircraft which have to be controlled "manually". As the predefined taxi route cannot be transmitted to the cockpit the controller must co-ordinate by verbal description. In most cases the standard taxi route as described in the AIP [8] related elements of the Network Operation Plan (NOP) is used. Progress of the ground movement operation is still detected by the A-SMGCS as well as possible conflicts and/or hazardous situations. Resolution by the A-SMGCS takes place but in case of non-co-operative aircraft only the controller is informed. With respect to runway incursions the alert is not automatically transmitted by the A-SMGCS to the aircraft or vehicle involved. Possible recovery action is therefore delayed. As cooperative and non-cooperative aircraft need different treatment, it is necessary to know in advance if the aircraft is compliant. A "flag" is set with the aircraft's information, like the label on the controller's ground movement display and the flight data in the APOC systems.

2.2 ATM Processes described in the document

Apron & Taxiways Management process covers all tasks where the Airport will be involved during the Execution phase regarding to airport surface operations outside the runway protected area.

Regarding to the ATM process model, Apron & Taxiways Management operations described in the present document address the following high level ATM processes (refer to the Navigator [13] as well as Figure 2 found below):

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

Note that process A3.4 Avoid Collision is covered by Runway Management (E1 DOD [8]), by Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD [10]) and by Conflict Management in En-Route High & Medium/Low Density Operations (E6 DOD [11]).

Additionally, process A3.5 Adjust Traffic and Airspace Requirements Dynamically is fully covered by Network Management in the Execution Phase (E4 DOD [9]) and is not part of the scope of E2/3 DOD.

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

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

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the RBT agreement, this will either be part of the RBT agreement, or result in a change to the SBT or an update to the RBT.

[8] The AIP in 2020 be significantly more comprehensive than is the case today.

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, 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 cannot match the traffic demand.

- **A3.2 Manage Traffic Queues**

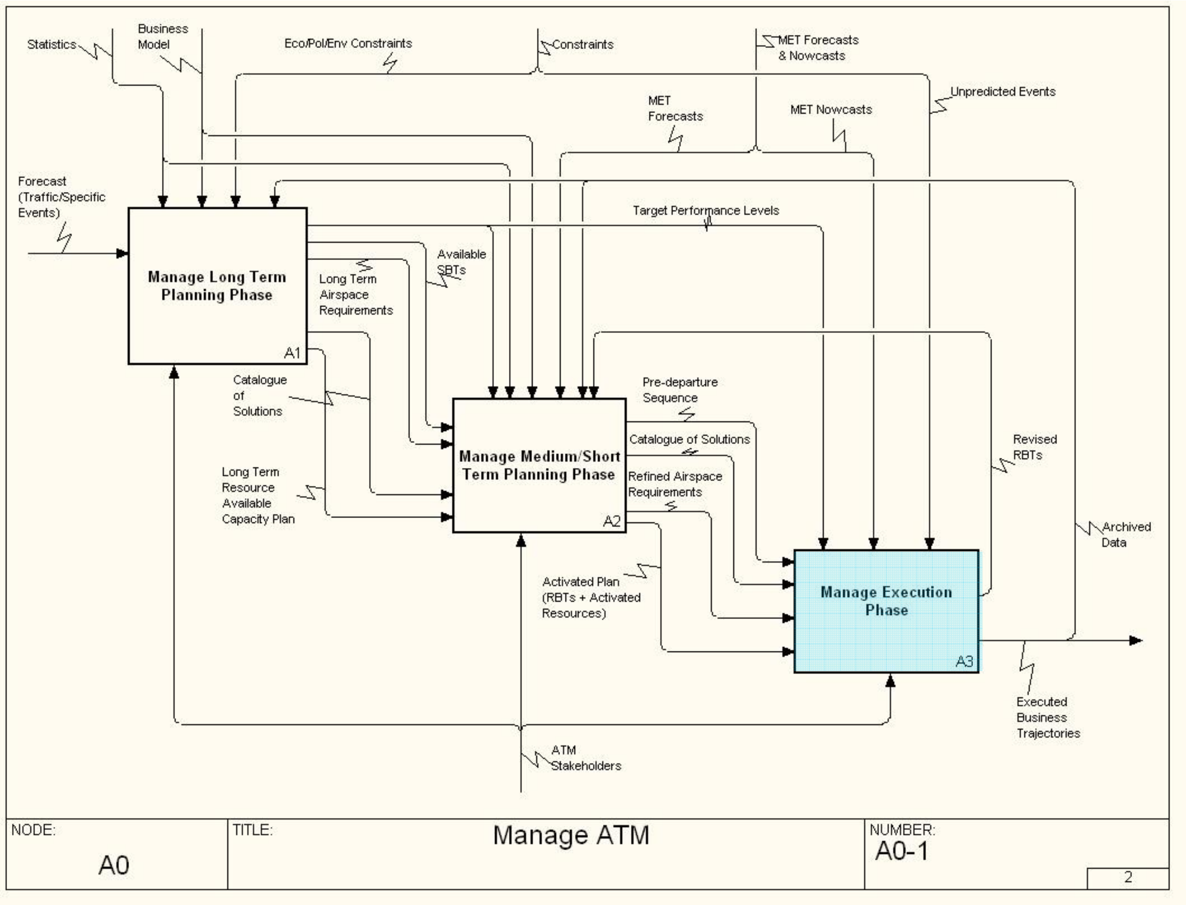
Missions: This process describes all the activities related to the management of traffic queues for their integration in a smooth flow. This encompasses development of queues and the actions to implement those, resulting in trajectory changes as needed. This process may result either in a solution to abandon the queue, or in a new sequencing activity.

The use of Resource Configuration as an input, to the "adjust resources dynamically" sub process, (including complexity management), allows resources to be adjusted to meet demand at this phase of ATM operations.

- **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.


Statistics
Business Model
Eco/Pol/Env Constraints
Constraints
MET Forecasts & Nowcasts
Unpredicted Events
MET Forecasts
MET Nowcasts
Forecast (Traffic/Specific Events)
Target Performance Levels
Manage Long Term Planning Phase
A1
Long Term Airspace Requirements
Available SBTs
Catalogue of Solutions
Long Term Resource Available Capacity Plan
Manage Medium/Short Term Planning Phase
A2
Pre-departure Sequence
Catalogue of Solutions
Refined Airspace Requirements
Revised RBTs
Archived Data
Activated Plan (RBTs + Activated Resources)
Manage Execution Phase
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Executed Business Trajectories
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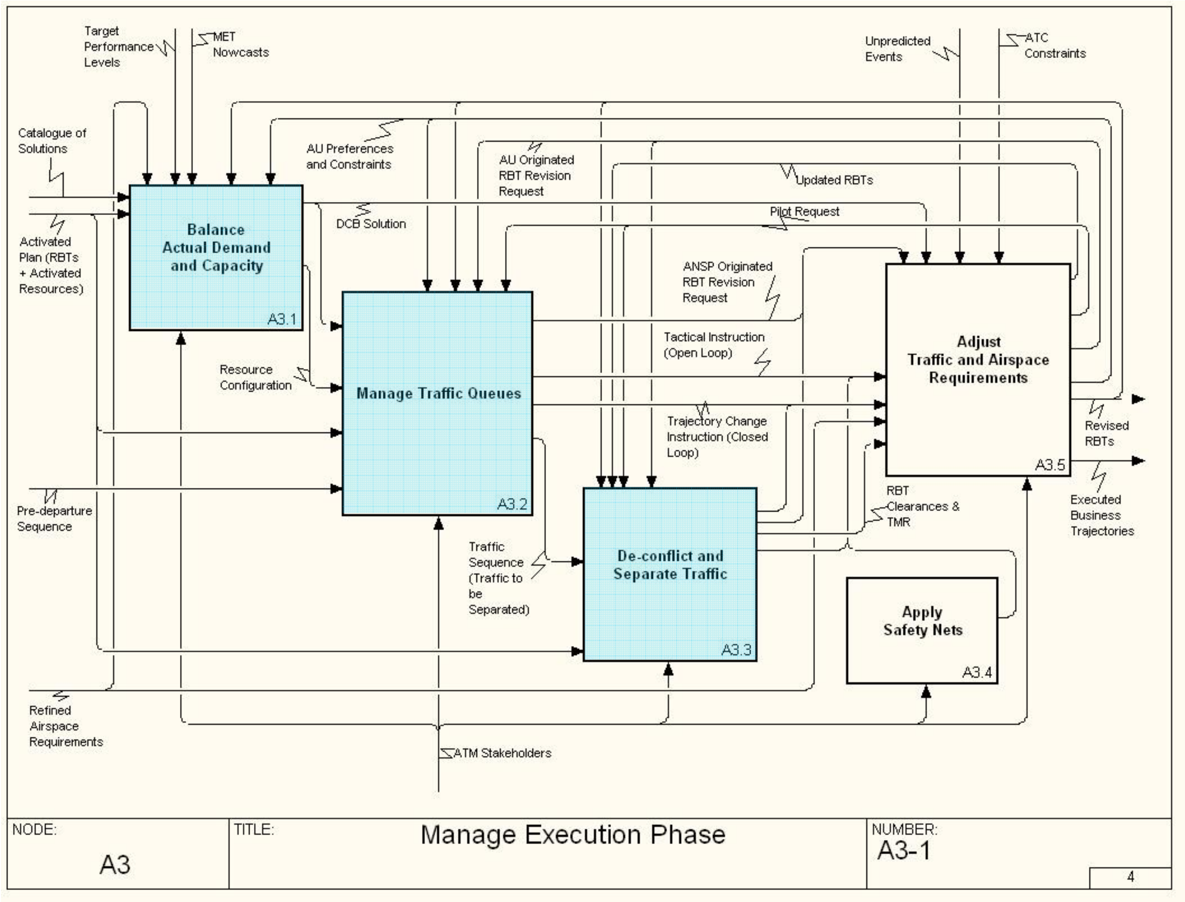

Figure 2: ATM Model diagrams and high level processes addressed

Each high-level process is broken down into low-level processes which are covered either by Apron & Taxiways Management (E2/3 – this DOD), Runway Management (E1 DOD [8]), Network Management in the Execution Phase (E4 DOD [9]), Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD [10]), Conflict Management in En-Route High & Medium/Low Density Operations (E6 DOD [11]) 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[9]	ATM Process	Description	SESAR ConOps References
A3.1.1.1.2	Assess Surface Capacity Load	This process allows assessing the current traffic load against the declared surface capacity (apron stands, taxiways).	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

[9] This refers to the code associated to the process in the ATM Process Model SADT diagrams.

Code[9]	ATM Process	Description	SESAR ConOps References
A3.1.2.1.2	Switch Surface 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 taxiways configuration.	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
A3.1.2.2.2	Coordinate Temporary Airport Surface Resource Closure	This process is run when maintenance works are actually performed on airport surface. Variations that occur during this process have an impact on the sequence and dynamic management performed during the medium/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
A3.2.1.1	Optimise Departure Sequence	This process describes how the Tower Ground Controller optimizes the departure sequence by changing the position of a flight which has already pushed back.	F.2.3, F.2.6.4, F.3.1, F.3.2, 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.5.2, F.6.1
A3.3.1.2.2	Detect & Solve Hazardous Situations Outside Runway Protected Area	This process aims to control the aircraft and vehicles on the airport surface outside the Runway Protected Area (apron and taxiways) in order to detect and solve possible hazardous situations - i.e. aircraft exiting taxiway at unintended or non-approved location.	F.2.4, F.2.4.1, F.4, F.5, F.5.1.4.7, F.5.2, F.6, F.6.1
A3.3.1.3.2	Manage Traffic Movement Outside Runway Protected Area	This process aims to include the activities needed to manage aircraft and vehicles movements on the airport surface outside the Runway Protected Area with respect to safety requirements and planning constraints.	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 (refer to SESAR D2 [35] and SESAR Strategic Objectives Definition [36]).

The KPAs and Performance Requirements are shown here with the description of how the scope of Apron & Taxiways Management addresses them:

Key Performance Area (KPA)	Performance Requirements Description
Safety	This KPA addresses the risk, the prevention and the occurrence and mitigation of air traffic accidents. The number of ATM induced accidents and serious or risk bearing incidents must not increase and, where possible, must 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 by a factor of 3 in order to meet the safety objective for traffic levels in 2020. List of Performance Objective and related KPIs: • Improve safety levels by ensuring that the numbers of ATM induced accidents and serious or risk bearing incidents (includes those with direct and indirect ATM contribution) do not increase and, where possible, decrease [SAF1.OBJ1]. o *The overall safety level should reach an improvement factor 3 in order to meet the safety objective [SAF1.OBJ1.IND1].*
Security	This KPA covers a subset of aviation security. It addresses the risk, the prevention, the occurrence and mitigation of unlawful interference with flight operations of civil aircraft and other critical performance aspects of the ATM system. This includes attempts to use aircraft as weapons and to degrade air transport services. Unlawful interference can occur via direct interference with aircraft, or indirectly through interference with ATM service provision (e.g. via attacks compromising the integrity of ATM data or services). ATM security also includes the prevention of unauthorised access to and disclosure of ATM information. Security is not directly addressed by Apron & Taxiways Management operations. However improvements made will not degrade the current situation.
Environmental Sustainability	This KPA addresses the role of ATM in the management and control of environmental impacts. The aims are to reduce adverse environmental impacts (average per flight); to ensure that air traffic related environmental constraints are respected; and, that as far as possible new environmentally driven non-optimal operations and constraints are avoided or optimised as far as possible. This focus on environment must take place within a wider “sustainability” scope that takes account of socio-economic effects and the synergies and trade-offs between different sustainability impacts. List of Performance Objective and related KPIs: • 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. The percentage of cases in which local environmental rules affecting ATM are respected has to increase. [ENV3.OBJ1]. o *Local environmental rules affecting ATM are to be 100% respected [ENV3.OBJ1.IND1].*

Key Performance Area (KPA)	Performance Requirements Description
Cost Effectiveness	This KPA addresses the cost of gate-to-gate ATM in relation to the volume of air traffic that is managed. In line with the political vision and goal, the working assumption for Cost Effectiveness design target is to halve the total direct European gate-to-gate ATM costs from 800 €/flight to 400 €/flight, in 2020 (2005 Euros). Better planned, user driven trajectories and use of aircraft capabilities should provide cost-effectiveness. The cost of equipping results in better adherence to plans and preferred business trajectories. List of Performance Objective and related KPIs: • Continually reduce the Direct Cost of gate-to-gate ATM [CEF1.OBJ1]. o *Halve the direct European gate-to-gate ATM costs through progressive reduction [CEF1.OBJ1.IND1].*
Capacity	This KPA addresses the ability of the ATM system to cope with air traffic demand (in number and distribution through time and space). List of Performance Objective and related KPIs: • Meet or exceed the growth of the busy-hour demand of individual airports [CAP.2.OBJ1]. In line with physical airport capacity increases, the overall growth of IFR demand, and the traffic pattern changes in time and space. o *Hourly number of IFR movements (departures plus arrivals), as possible during low visibility (IMC) conditions [CAP2.OBJ1.IND1].* o *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].*
Efficiency	This KPA addresses the actually flown 4D trajectories of aircraft in relationship to their initial Shared Business Trajectory. List of Performance Objective and related KPIs: • Continually reduce the departure delay due to ATM [EFF1.OBJ1]. o *Occurrence (Punctuality): At least 98% of flights departing on-time [EFF1.OBJ1.IND1].* o *Severity (Delays): The average departure delay of delayed flights will not exceed 10 minutes [EFF1.OBJ1.IND2].* • Conform to the Shared Business Trajectory Timing to the greatest extent [EFF1.OBJ2]. o *Occurrence: At the regional level, more than 95% of flights with a normal flight duration [EFF1.OBJ2.IND1].* o *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].*

Key Performance Area (KPA)	Performance Requirements Description
Flexibility	This KPA addresses the ability of the ATM system and airports to respond to "sudden" changes in demand and capacity: rapid changes in traffic patterns, last minute notifications or cancellations of flights, changes to the Reference Business Trajectory (pre-departure changes as well as in-flight changes, with or without diversion), late aircraft substitutions, sudden airport capacity changes, late airspace segregation requests, weather, crisis situations, etc 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). List of Performance Objective and related KPIs: • Flexible access-on-demand for non-scheduled flights [FLX2.OBJ1]. o *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].* o *The average delay (European-wide annual average) of such non-scheduled flight departures (with a delay penalty of more than 3 minutes) will be less than 5 minutes [FLX2.OBJ1.IND2].*
Predictability	This KPA addresses the ability of the ATM system to ensure a reliable and consistent level of 4D trajectory performance. In other words: across many flights, the ability to control the variability of the deviation between the actually flown 4D trajectories of aircraft in relationship to the Reference Business Trajectory. List of Performance Objective and related KPIs: • Improve the arrival punctuality to the greatest extent [PRD1.OBJ1]. o *Occurrence: Less than 5% (European-wide annual average) of flights suffering arrival delay of more than 3 minutes [PRD1.OBJ1.IND1].* o *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].* • Prevent and mitigate service disruption to the greatest extent [PRD2.OBJ1]. o *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].* o *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].* o *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].*

Key Performance Area (KPA)	Performance Requirements Description
Access and Equity	This KPA splits the management of airspace usage (and usage of other ATM resources such as airports and ATM services) into two distinct issues: access/segregation and equity/prioritization. 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. "Access and Equity" is not directly addressed by Apron & Taxiways Management operations. However improvements made will not degrade the current situation.
Participation	Fundamental to the concept is the participation of the user community in 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 taking account of the user preferences. There were no KPIs defined by the SESAR Definition Phase for this KPA.

Interoperability	At the level of overall ATM performance, the main purpose of interoperability KPA is to facilitate homogeneous and non-discriminatory global and regional traffic flows.
	Applying standards and uniform principles, and ensuring the technical and operational interoperability of aircraft and ATM systems are to be seen as supporting (enabling) objectives for the above main objective.
	• Improve compliance of ATM operations with ICAO CNS/ATM plans and global interoperability requirements [IOP3.OBJ1].
	  o *Level of compliance of ATM operations with ICAO CNS/ATM plans and global interoperability requirements [IOP3.OBJ1.IND1].*
	• Improve seamlessness of ATM service to the user [IOP3.OBJ2].
	  o *Level of seamlessness of ATM service to the user: Provide a seamless service to the user at all times, throughout Europe [IOP3.OBJ2. IND1].*
	• Improve uniformity of ATM service [IOP3.OBJ3].
	  o *Level of uniformity of ATM service: Operate on the basis of uniformity throughout Europe [IOP3.OBJ3. IND1].*
	• Improve the speed of delivery of standards, specifications and procedures for ATM, CNS and associated avionics requirements [IOP4.OBJ1].
	  o *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].*

Table 2: Key Performance Areas addressed

3 CURRENT OPERATING METHOD AND MAIN CHANGES

3.1 ASPECTS OF TODAY'S OPERATIONS THAT WILL REMAIN

The main aspect of current surface movement operations that will remain is the reliance of ‘see and avoid’ principle as the primary mean to ensure the safety of surface movements.

Controllers will remain responsible for issuing information and instructions to aircraft under control in order to assist pilots to navigate safely and timely on the airport surface.

Voice communication for tactical clearances will also remain.

3.2 ASPECTS OF TODAY'S OPERATIONS THAT WILL CHANGE

The main change to current surface movement operations is the transition from the ‘first to call – first served’ principle to an increase adherence to predefined schedule of surface movement (Reference Business Trajectory) for the planning and execution of departure movements.

More information will be available to the pilots on-board to ensure a safe expeditious and efficient movement on the ground. 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).

The situation awareness of current operational situation amongst airport actors will improve.

3.3 ASPECTS OF TODAY'S OPERATIONS THAT WILL DISAPPEAR

Accommodation of un-scheduled traffic on airports operating near maximum capacity level may become limited to exceptional cases only.

Other aspects of today’s operations that will be limited to exceptional cases only:

- Excessive queuing of aircraft at runway holding point;
- Late stand changes;
- Lost aircraft and vehicles on the manoeuvring area;
- Congested frequencies due to increased datalink communications.

4 PROPOSED OPERATING PRINCIPLES

4.1 APRON & TAXIWAYS 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 resource 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 cannot 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);
- Revised RBTs;
- Airspace users' preferences and constraints;
- Resources constraints and unpredicted events.

As mentioned in section 2, the scope of E2/3 (this DOD) is related to apron and taxiways management in airport operations during the execution phase, thus the following sections will only focus on balancing actual demand and capacity at apron and taxiway levels. Balance actual demand to airport resources capacity inside the runway protected area is covered by Runway Management (E1 DOD [8]). Additionally, balance actual demand and capacity at the airspace level is covered by Network Management in the Execution Phase (E4 DOD [9]).

Balance actual demand and capacity at apron and taxiways level will address the following main actions:

- Surface capacity load assessment;
- Switch operational rules at surface level - i.e. change taxiway configurations;
- Coordinate temporary airport surface resource closure, due to unpredicted events, works or surface cleaning operations on the apron or taxiways;
- Coordination with arrival and departure management activities.

4.1.2 Assumptions

In nominal situations, it is assumed that the airport will be the primary actor involved in balancing actual demand and capacity at apron and taxiways level. Airlines (AOC Staff) 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 capacity through decrease of the Tower Ground and Apron Controllers task-load supported by collaborative tools, which benefit from increase of data accuracy provided by airborne/ground systems and massive data sharing provided by SWIM environment;
- 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 task-load;
- Mixed equipage may limit efficiency and the Tower Ground and Apron Controllers 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[10]), or the weather conditions or ATC Constraints leading to adjustment of the traffic and/or the airspace, by means of updated 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.

[10] Environmental constraints are taken into account in those Target Performance Levels, e.g. operations at the airport may be reduced due to noise quotas.

A3.1.1 Identify Demand Capacity Imbalance and A3.1.2 Adjust Resources Dynamically, are the only processes partially covered by Apron & Taxiways Management (E2/3 – this DOD). The operating method for these processes, at apron and taxiways level, is developed below. Process A3.1.3 Propose a DCB Solution, is covered by Network Management in the Execution Phase (E4 DOD [9]) and Collaborative Airport Planning (M1 DOD [6]).

4.1.4.1 Assess Surface Capacity Load (A3.1.1.1.1.2)

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 Apron & Taxiways Management (E2/3 – this DOD) and is covered by Network Management in the Execution Phase (E4 DOD).

Process A3.1.1.1 Assess Capacity Load allows the assessment of 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 Apron & Taxiways Management (E2/3 – 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 A3.1.1.1.1.1 Assess Runway Capacity Load is out of the scope of Apron & Taxiways Management (E2/3 – this DOD) and is covered by Runway Management (E1 DOD).

Process A3.1.1.1.1.2 Assess Surface Capacity Load allows the assessment of the current traffic load against the declared surface capacity (apron stands, taxiways) in order to put in place a DCB solution if needed. This process will enable operational improvement ***[AO-0501]*** where systematic strategies are agreed and applied by CDM partners in advance to deal with predictable (e.g. forecast bad weather, industrial action, scheduled maintenance) or unpredictable adverse conditions (e.g. unforeseen snow or fog, accident).

Assess Surface Capacity Load presents the following main drivers:

- Inputs:
  - None;
- Control constraints:
  - Activated Plan (RBTs + Activated Resources);

  - o Possible Apron & Taxiways Configurations.
- Human actors[11]:
  - o APOC Staff.
- Outputs:
  - o Capacity Over/Under Load (Apron & Taxiways).

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

Use Case	Description
Assess Surface Capacity Load	This Use Case describes how the capacity load of the airport apron & taxiways system is assessed in order to put in place a DCB solution if needed.

Table 3: Use Case for Assess Surface Capacity Load

4.1.4.2 Switch Surface Operational Rules (A3.1.2.1.2)

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 Airport Operational Rules and A3.1.2.2 Coordinate Temporary Airport Resource Closure are partially covered by Apron & Taxiways Management (E2/3 – this DOD).

Process A3.1.2.2 Coordinate Temporary Resource Closure is developed in next section (4.1.4.3).

Process A3.1.2.1 Switch Airport Operational Rules is run when a change of real-time operation rules is necessary, either at the level of airport or airspace operations. At airport level, it covers for example the case of a change in the taxiways configuration or a change in the runway configuration - e.g. from 27 to 09 because of a significant change in the wind direction.

This action may be done separately at runway, surface and stand (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 and A3.1.2.1.3 Switch Gate Operational Rules are out of the scope of Apron & Taxiways Management (E2/3 – this DOD) and are covered respectively by Runway Management (E1 DOD [8]) and Collaborative Airport Planning (M1 DOD [6]).

[11] Actors, roles and responsibilities are described in detail in Section 6.

Process A3.1.2.1.2 Switch Surface Operational Rules is run when a change of real-time operation rules is necessary. As an example, it covers the case of a change in the taxiways configuration. This process contributes to ***[AO-0501]*** in the case of adverse conditions where Airport CDM can improve operations.

Switch Surface Operational Rules sub-process presents the following main drivers:

- Inputs:
  - Possible Airport Configurations;
  - Activated Resources.
- Control constraints:
  - Activated Plan (RBTs + Activated Resources);
  - MET Nowcasts;
  - Unpredicted Events;
  - Constraints on Resources;
  - Runway Configuration.
- Human actors:
  - APOC Staff.
- Outputs:
  - Taxiway and Apron Configuration.

The following Uses Cases have been identified for Switch Surface Operational Rules process:

Use Case	Description
Change of Taxiway Configuration	This Use Case describes the collaborative process initiated by the APOC Staff to change the taxiway configuration. The APOC Staff contacts other actors involved to negotiate conditions of the transition.
Change of Apron Configuration	This Use Case describes the collaborative process initiated by the APOC Staff to change the stand configuration. The APOC Staff contacts other actors involved to negotiate conditions of the transition.
Change of De-icing Configuration	This Use Case describes the collaborative process initiated by the APOC Staff to change the de-icing configuration. The APOC Staff contacts other actors involved to negotiate conditions of the transition.
Change of Remote De-icing Configuration	This Use Case describes the collaborative process initiated by the APOC Staff to change the remote de-icing configuration. The APOC Staff contacts other actors involved to negotiate conditions of the transition.

Table 4: Use Cases for Switch Surface Operational Rules

4.1.4.3 Coordinate Temporary Airport Surface Resource Closure (A3.1.2.2.2)

Process A3.1.2. Adjust Resources Dynamically is run when there is an imbalance in the demand on a resource and its capacity, either at the level of airport or airspace operations. Variations that occur during this process have an impact on the sequence and dynamic management performed during the medium/short term planning phase.

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This process 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.

Process A3.1.2.3 Adjust Airspace Resources Dynamically is out of the scope of Apron & Taxiways Management (E2/3 – this DOD) and is covered by Network Management in the Execution Phase (E4 DOD).

Process A3.1.2.2. Coordinate Temporary Airport Resource Closure is run, for example, when maintenance works are actually performed on airport airside resources. This action could be addressed at runway, surface and gate (stand) 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 Resource Closure;
- A3.1.2.2.3 Coordinate Temporary Gate Closure.

Processes A3.1.2.2.1 Coordinate Temporary Runway Closure and A3.1.2.2.3 Coordinate Temporary Gate Closure are out of the scope of Apron & Taxiways Management (E2/3 – this DOD) and are covered respectively by Runway Management (E1 DOD [8]) and Collaborative Airport Planning (M1 DOD [6]).

Process A3.1.2.2.2 Coordinate Temporary Airport Surface Resource Closure is run, for example, when maintenance works are actually performed on airport surface. Variations that occur during this process have an impact on the sequence and dynamic management performed during the medium/short term planning phase. This contributes to ***[AO-0501]***, improving operations in adverse conditions through Airport CDM.

The Coordinate Temporary Airport Surface Resource Closure sub-process presents the following main drivers:

- Inputs:
    - Possible Airport Configurations (Apron & Taxiways);
    - Activated Resources;
    - Airport Resource Configuration (Apron & Taxiways).
- Control constraints:
    - Constraints (Unpredicted Events);
    - Activated Plan (RBTs + Activated Resources).
- Human actors:
    - APOC Staff;
    - AOC (or Aircraft Operator)[12];
    - Tower Ground Controller;
    - Apron Controller.
- Outputs:
    - Resource Configuration (Resource Unavailability) (Apron & Taxiways).

[12] The AOC could be considered part of the APOC.

The following Use Cases have been identified for Coordinate Temporary Airport Surface Resource Closure process:

Use Case	Description
Coordinate Temporary Taxiway Closure	This Use Case describes how the APOC Staff coordinates with the Tower Ground Controller surface cleaning operations on the taxiway. In order to be able to guarantee air traffic without or a minimum of delay, taxiways must be maintained in operational conditions at all times - e.g. kept clear of ice, snow and debris.
Coordinate Temporary Apron Closure	This Use Case describes how the APOC Staff coordinates with the Apron Controller surface cleaning operations on the stands. In order to be able to guarantee air traffic without or a minimum of delay, stands must be maintained in operational conditions at all times - e.g. kept clear of ice, snow and debris.
Coordinate Temporary De-icing Closure	This Use Case describes how the APOC Staff coordinates with the De-icing Manager surface cleaning operations on the de-icing stands - e.g. fluid collection.
Coordinate Temporary Remote De-icing Closure	This Use Case describes how the APOC Staff coordinates with the De-icing Manager surface cleaning operations on the remote de-icing stands - e.g. fluid collection.

Table 5: Use Cases for Coordinate Temporary Airport Surface Resource 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, the Tower Ground Controller and the Apron 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 APRON & TAXIWAYS 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. Airport Airside 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 is responsible for the optimisation and implementation of the departure queues and for the implementation of the arrival queues. ATC is responsible for optimising arrival queues and for optimising and implementing TMA queues.

As mentioned in section 2, the scope of E2/3 (this DOD) is related to Apron & Taxiways management in airport operations during the execution phase, thus following sections will only focus on the management of traffic queues at the apron and taxiways level, which covers the optimisation of departure sequences at stands and departure queues at active runway entries. Real-time management of departure and arrival queues at runways is covered by Runway Management (E1 DOD [8]). Additionally, the management of TMA queues and optimisation of arrival queues are covered by Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD [10]).

Thus, manage traffic queues at the apron and taxiways level will address the optimisation of departure queues taking into account the departure and arrival flows at the airport.

Optimising departure queues process mainly deals with the establishment and maintenance of the departure sequence, which takes into account all flights from their departure clearance (15' before push-back) to their actual take-off.

Where the service originally provided by Tower Controllers was limited to separation of aircraft with the aim of expediting the arrival and departure traffic when possible, the SESAR Operational Concept extends Airport ATC services to the timely insertion of departing flights into the departure sequence, in order to respect the agreed RBTs – e.g. especially the Target Take-Off Time (TTOT), as addressed by ***[TS-0302]*** and ***[TS-0306]***.

4.2.2 Assumptions

In nominal situations, it is assumed that the airport will be the primary actor involved in optimising departure queues. During this process, main interactions of the Airport will be with the AOC Staff, Airline Station Manager, Flight Crew and Sub-regional Network Manager.

4.2.3 Expected Benefits, Issues and Constraints

The expected benefits for optimising departure queues are the following:

- Improved predictability of the taxi times, leading to improved scheduled robustness and overall ATM operation predictability;
- Optimise use of airport capacity in line with aircraft operator priorities;
- Earlier prediction of bottlenecks on airport surface will allow for implementation of mitigation strategies, avoiding aircraft to be blocked on the surface or when departing from the parking area;
- Achieving the optimal take-off sequence in an early stage of the outbound ground movement phase will reduce the necessity of sequence changes;
- Increased efficiency due to a reduced queue at the runway (both in terms of time and fuel consumption) and a reduction on the environmental impact.

However, it has to be mentioned that mixed equipage may limit the efficiency and Tower Ground and Apron Controllers 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 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 (which reflects the effect of any airport event); 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 updated trajectories (i.e. Updated RBTs) or user preferences and requests - i.e. AU Originated RBT Changes and Pilot Request.

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 is the only process partially covered by Apron & Taxiways Management (E2/3 – this DOD). The operating method for this process, at apron and taxiways level, is developed below. Processes A3.2.2 Manage Terminal Area Exit Queue and A3.2.3 Manage Arrival Queue are covered by Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD [10]) and Runway Management (E1 DOD [8]).

4.2.4.1 Optimise Departure Sequence (A3.2.1.1.2)

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 surface movements, development of taxi movement plans and balancing departure queues in case of multiple runways. The main constraint here is the runway resource, but also complexity management constraints for departure metering from single or multiple airports ***[TS-0302]***. This process is broken down into two sub-processes:

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

Process A3.2.1.2 Implement Departure Queue is out of the scope of Apron & Taxiways Management (E2/3 – this DOD) and is covered by Runway Management (E1 DOD [8]). Anyway, coordination between both processes is necessary since the main input for implementing departure queues is the optimised departure sequence, coming as an output of the previous optimise departure queue process.

Process A3.2.1.1 Optimise Departure Queue deals with all the activities related to creation of a final optimised departure sequence that may further be refined and implemented by the Tower Runway Controller. This process is broken down into two sub-processes:

- A3.2.1.1.1 Change Pre-Departure Sequence;
- A3.2.1.1.2 Optimise Departure Sequence.

Process A3.2.1.1.1 Change Pre-Departure Sequence is out of the scope of Apron & Taxiways Management (E2/3 – this DOD) and is covered by Collaborative Airport Planning (M1 DOD [6]). Anyway, coordination between both processes is necessary since one input for optimising the departure sequence is the pre-departure sequence, coming as an output of the change pre-departure sequence process.

Process A3.2.1.1.2 Optimise Departure Sequence describes how the Tower Ground Controller optimises the departure sequence by changing the position of a flight which has already pushed back.

Optimise Departure Sequence sub-process presents the following main drivers:

- Inputs:
  - Activated Plan (RBTs + Activated Resources);
  - Resource Configuration;
  - Pre-departure Sequence;
  - Planned Terminal Area Exit Sequence;
  - Planned Arrival Sequence.
- Control constraints:
  - Departure Metering Constraints;
  - Revised RBTs.
- Human actors:
  - Tower Ground Controller;
  - Sub-regional Network Manager.
- Outputs:
  - ANSP Originated RBT Revision Request;
  - Runway Metering Constraints;
  - Planned Departure Sequence.

Advanced Surface Movement Guidance and Control System (A-SMGCS) is providing routing and planning service to perform the optimisation of the departures queues.

Routing and planning service of A-SMGCS shall be provided with a departure management (DMAN) capability or with the capability to interface with an external departure manager.

With the automatic routing function, optimised routes enhanced by the computation of optimal start up times are assigned automatically. However, to increase the overall aerodrome capacity an optimal departure sequence has to be applied. This should be addressed by a departure management capability that provides an optimal departure time for each flight and an optimal overall departure sequence taking into account arrivals, wake vortex categories, DCB solution, and departure routes (SID).

DMAN is a planning and decision-support tool which aims to achieve the most efficient departure sequence for aircraft departing at an airport. This leads to a more efficient use of runway capacity, and to a more accurate target take-off time (TTOT). The DMAN will also identify the optimal departure runway for aircraft at multiple runway airports.

Since arrival management is out of authority to the aerodrome controller, this service is not described here. However, A-SMGCS must provide an interface to an Arrival Management (AMAN) in order to take into account estimated landing times (ELDT) or even to negotiate in- and outbound traffic for optimal runway occupancy. The integration of both departure (DMAN) and arrival (AMAN) management processes is materialized in the ATM Process Model with the “planned arrival sequence” used as an input of this “Optimize Departure Sequence” process[13].

The DMAN calculates an optimal departure sequence by taking into account following constraints:

- Arrivals (ELDT, ALDT);
- ETOT or TOBT;
- Separation between aircraft depending on separation minima (based on wake vortex category, SID, regulations, occupancy time);
- Standard Departure Route (SID);
- Runway(s) in operational use including whether the runway is exclusively used for arrival, departure or both (i.e. allowing interlaced take-off and landing ***[AO-0402]***);
- Intersection take-offs;
- Prioritised flights;
- Runway inspections;
- Selected planning strategies;
- Additional constraints.

Output of the DMAN is an optimal Target Take-Off Time (TTOT) that is used by the automatic routing function to compute an optimal start-up time.

In order to get the best benefit of an automatic routing function supplemented with a departure manager, it must be aimed that a Target Start-up Approval time (TSAT) is negotiated and confirmed between ATC and the airline right in advance to meet both the airline constraints and the DMAN planning. Appropriate interfaces have to be designed to support this information exchange.

There will be no need to finalise a departure sequence earlier than necessary – flexibility being the key to maximum use of capacity. In addition, flight crews are provided via datalink with latest information regarding current meteorological and operational flight information ***[IS-0402]*** in order to support late decision making process regarding their flight.

The take-off sequence is built as predicted take-off times achieve a required level of accuracy and the arrival sequence is built by the relevant arrival management tools once the flight passes the sequencing horizon.

[13] And conversely, the “planned departure sequence” (an output of “Optimize Departure Sequence”) is used as an input of the “Optimise Arrival Queue”.

- A flight will not be allocated a departure slot time if the ATM network is operating normally. Flights should expect to be able to depart when they are ready to do so, subject only to any allocated Target Time of Arrival (TTA) at destination, ground delays and any departure runway capacity constraints.

This type of process maximises flexibility and capacity utilisation but still allows delays to be managed efficiently.

Shared information on the progress of turn-round[14] will be used to estimate departure demand and enable arrival/departure balancing. In the absence of any capacity shortfall, reference trajectories will be handled according to the normal plan. Prioritisation for departure in the event of reduced capacity will be the result of a collaborative process involving all partners.

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 Departure Manager tool (DMAN) will calculate the optimum Take-Off Time (TTOT) and A-SMGCS tools will determine the associated start-up (TSAT) and push-back times and taxi route ***[TS-0306]***. Taxiing process is closely linked to arrival and departure management, especially at airports with runways used for both arriving and departing flights ***[AO-0207]***. If the take-off time implies a ground delay, this will be taken with engines off at the stand or in a designated waiting area.

The following Use Case has been identified for Optimise Departure Sequence process:

Use Case	Description
Modify Departure Sequence by Tower Ground Controller	This Use Case describes how the Tower Runway Controller uses the System to change the position of a flight in the planned departure sequence at an airport.

Table 6: Use Case for Optimise Departure Sequence

4.2.5 Enablers

The main enablers to support Optimise Departure Queues within the SESAR concept are:

- Collaborative infrastructure supported by SWIM allowing data sharing between the ATM Stakeholders;
- Automated meteorological data reporting supported by data-link;
- Basic Departure Manager (DMAN);
- Integration of Routing constraints into Departure Management (DMAN);
- Integration of Arrival Management (AMAN) and DMAN with the CDM processes between airports and interferences.

4.2.6 Transition issues

IP1 OI steps related to Optimise Departure Queues are considered as already implemented.

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[14] Turn-round operations are covered by Collaborative Airport Planning - M1 DOD. See referenced document [6].

4.3 Apron & Taxiways 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 enabled 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 E2/3 (this DOD) is related to apron and taxiways management in airport operations during the execution phase, thus following sections will only focus on de-conflict and separate traffic at the airport surface level, outside the runway protected area. De-conflict and separate traffic inside the runway protected area at the airport level is covered by Runway Management (E1 DOD [8]). Additionally, de-conflict and separate traffic in terminal area is covered by Conflict Management in Arrival & Departure High & Medium/Low Density Operations (E5 DOD [10]) 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 [11]).

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

- Detect and solve hazardous situations outside runway protected area;
- Manage traffic movement outside the runway protected area.

Advanced Surface Movement Guidance and Control Systems (A-SMGCS) provides routing, guidance, surveillance and alerting functions for the control of aircraft and vehicles in order to maintain the declared surface movement rate under all weather conditions within the aerodrome visibility operational level (AVOL) while maintaining the required level of safety.

4.3.2 Assumptions

Not far identified.

4.3.3 Expected Benefits, Issues and Constraints

The expected benefits for separate and de-conflict traffic at apron and taxiways level are:

- To eliminate runway incursions;
- To improve safety of operations on the airport surface (outside the runway protected area);

- Reduction of Radio Telephony load, since the Tower Ground Controllers know the position and identity of concerned movements provided by A-SMGCS, position reports are no necessary anymore;
- Reduction of misunderstanding between Tower Ground Controllers and Pilots, since data-link communication displayed in an alphanumerical way or even visualised on an onboard airport moving map display could reduce potentially safety-critical misunderstandings between Tower Ground Controllers and Pilot;
- Better situational awareness of the Controllers, since the A-SMGCS traffic situation display provides the Tower Ground Controller with the position and identity of all concerned movements on the surface and vicinity of the airport. Planning displays operating with electronic flight strips show the clearance status of a flight and current flight plan data. All those improved information resources will increase the Tower Ground Controller's situation awareness;
- Better situation awareness of the Flight Crews and Vehicle Drivers, since graphically A-SMGCS fed onboard displays showing the own position and the surrounding traffic are additional information sources for the flight crew to navigate and steer the aircraft on the aerodrome;
- Reduction of average taxi time and congestions of taxi ways. New A-SMGCS services like automatic routing and planning functions, more efficient procedures, and more efficient communication will further support the Tower Ground Controllers to manage the taxiing traffic most efficiently. In addition to that, new onboard services like electronic moving map showing the own ship position on the aerodrome and the surrounding traffic will enable the flight crew to taxi the aircraft more efficient form the runway to the stand and vice versa. Particularly in reduced visibility conditions new A-SMGCS onboard services (e.g. head-up displays) will help to maintain the speed similar to those normally used in good visibility. This will further decrease the average taxi time;
- Shorter average reaction time of the Tower Ground Controllers to potential or even actual conflict situations. Automatic conflict predictions, detection and alerting tools (additional safety nets) monitor the current traffic situation by taking into account surveillance data and granted clearances. These data are used to crosscheck the actual and expected traffic situation and the consistency of new clearances to already granted clearances. In case of potential and actual conflicts the Tower Ground Controller is alerted. Particularly in high workload situations the Tower Ground Controller is supported to draw her/his attention on immediate critical situations;
- Shorter average reaction time of Flight Crews and Vehicle Drivers to critical surface movement situations. New onboard 'surface movement alerting' services crosscheck the own ship position with current surface restrictions. In case of the aircraft is entering a restricted area (e.g. a blocked runway or a closed taxiway) or deviates from an intended track, the service warns or alerts the Flight Crew respectively;
- Reduction of workload to an appropriate level in demanding situations. Additional weather independent surveillance sources and the facilitated access and exchange to/of important information to the status of a flight, and more efficient communication between different Controllers and with the Flight Crews and Vehicle Drivers will alleviate the working conditions in demanding situations for all users of an A-SMGCS. It should be noted that this reduction of workload might be counter-balanced by the fact that more delegation to flight crew may induce potential increase of their task-load.

However, it has to be mentioned that mixed equipage may limit the efficiency and Tower Ground and Apron Controllers 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 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 updated 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, as appropriate:

- 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 Apron & Taxiways Management (E2/3 – this DOD) and Runway Management (E1 DOD [8]). The operating method for this process, at apron and taxiways 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 [10]) 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 [11]).

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 out of the scope of Apron & Taxiways Management (E2/3 – this DOD), and is covered by Runway Management (E1 DOD [8]).

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 Apron & Taxiways Management (E2/3 – this DOD) and Runway Management (E1 DOD [8]). 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. E2/3 – this DOD only deals with the actions performed outside the runway protected area.

4.3.4.1 *Detect & Solve Hazardous Situations Outside the Runway Protected Area (A3.3.1.2.2)*

This process aims to control the aircraft and vehicles on the airport surface outside the Runway Protected Area (apron and taxiways) in order to detect and solve possible hazardous situations - i.e. aircraft exiting taxiway at unintended or non-approved location.

Detect & Solve Hazardous Situations Outside 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.
- Human actors:
  - Tower Ground Controller;
  - Apron Controller;
  - Flight Crew;
  - Vehicle Driver.
- Outputs:
  - Detected Hazardous Situations.

The A-SMGCS conflict prediction, detection, and alerting service (***[AO-0104]***) proposes to perform (refer to [14]):

- **Surveillance based alerting**: Radar reports (Surveillance Data Fusion output) are monitored and an alert is triggered if some convergence conditions are met;
- **Conformance monitoring**: the behaviour of the movements is monitored to check if they do what they are supposed to. The conflict monitoring function permanently looks for deviations from the instruction given by the ATCO (route conformance, clearance conformance…). Examples: deviation from assigned route, a movement entering the runway with no clearance…
- **Cross check of the clearances**: the set of clearances provided at the same time on an airport is to be cross checked in order to ensure that the set of instructions provided is consistent. Example: a crossing clearance is provided whereas a take off clearance was just provided on the same runway…

The A-SMGCS conflict prediction, detection, and alerting service provides the **Tower Ground Controller** with two types of alerts, named INFORMATION and ALARM.

- INFORMATION: When receiving an Information Alert, a hazardous situation may occur. The Tower Ground Controller will use his/her skill and backgrounds to decide if, with remaining possible actions, the situation can be saved without using a too restrictive procedure - e.g. go around. If successful, there will be no Alarm and if not successful the Alarm will be activated and be presented on the traffic situation display;
- ALARM: When receiving an Alarm, it is said that a critical situation is developing and that an immediate action should be performed.

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The most critical hazardous situations[15] to be detected and solved by the Tower Ground controllers concerning taxiways conflicts are:

- Crossing a lit stop bar. One can expect that switching stop bars on and off will be done by the Tower Ground Controller through his/her electronic stripping system (automatic link to the clearance). Considering this, one ensures the consistency between the state of the stop bar (lit or off) and the clearance provided (cleared to cross, line-up…). Thus, a movement crossing a lit stop bar performs an action without clearance;
- Aircraft exiting the taxiway at unintended or non-approved locations. It is covered by the notion of conformance monitoring. A movement deviating from its assigned route shall trigger at least an INFORMATION coding. Such an alert can be combined with other alerting situations. The coding triggered is thus at least an information coding. Such an alerting requires defining a deviation parameter associated with the precision of surveillance.

Other main hazardous situations to be detected and solved [16]by the Tower Ground controllers concerning taxiways conflicts are:

- Aircraft on a closed taxiway;
- Aircraft approaching stationary traffic;
- Aircraft overtaking same direction traffic;
- Aircraft with opposite direction traffic;
- Aircraft taxiing with excessive speed;
- Unauthorised traffic on the taxiways;
- Unidentified traffic on the taxiways;
- Inconsistent Clearances given by ATC.

Safety on the airport movement area will also be improved with:

- Detection of FOD (Foreign Object Debris) provided to the controller ***[AO-0202]***;
- Improved procedures and sharing of best practices to reduced risk of runway incursions ***[AO-0101]***.

[15] Those hazardous situations may be even more critical when the airport is operated in low visibility conditions.

[16] Airport Expert Group 5.3.2 notes that the resolution of certain hazardous situations may also require agreed priorities of traffic to be taken into account in procedures.

With regard to the on-board side, **Flight Crew** is provided with the following services:

- Airport Moving Maps (AMM) (*[AO-0206]* and *[AUO-0401]*) will supplement the out-of-window situation assessment by displaying own ship position with respect to aerodrome geographic locations, ground based facility locations in proximity of the aircrafts' position and the particular aerodrome elements referenced in the ATC instructions. Detect & solve task for the flight crew will thus be primarily based on 'see and avoid' procedure; In low visibility conditions, the out-of-window situation assessment will be supported by enhanced (*[AUO-0403]*) or synthetic (*[AO-0404]*) vision for the pilot, reducing the difficulties of transition from instrument to visual flight operations;

- Surface Movement Alerting (SMA) will provide alerts to flight crew in case of possible risk situations dealing with own ship runway incursion, usage of unsuitable taxiways, deviations from pre-defined routes and/or taxiway guidance/centre line, collision with fixed obstacles *[AO-0104]*. In Low Visibility Conditions (LVC), the SMA function will have an even more important influence on safety and efficiency compared to normal visibility conditions. Under LVP any nuisance warning /alert will undoubtedly lead to an intermediate stop of the aircraft;

- Ground Traffic Display provides the Flight Crew with the surrounding traffic information (ground/airborne), i.e. what aircraft and vehicles that may come into conflict with each other. The traffic information is displayed on an appropriate display in the cockpit *[AUO-0401]*. The Ground Traffic Display is envisaged as a path to conflict avoidance alerting. In Low Visibility Conditions (LVC), limited vision to identify potential conflicts will be counterbalanced with the electronic picture: shadow objects and aircraft/vehicles will be then 'visible'. The impact on safety and to some lesser extent to efficiency and capacity[17] will be tremendous; conflict avoidance alerting is expected to be a further step;

- Traffic Conflict Detection Function. Similar to the use of ACAS when airborne, Standard Operating Procedures (SOPs) must be developed to address how to cope with warnings depicted on the Ground Traffic display *[AO-0104]* and announced by voice. Whenever the commander is not satisfied with such warning s/he will – regardless of any clearance received from ATC – take appropriate action.

With regard to **Vehicle Drivers** the following services are provided:

- Airport Moving Maps (AMM) helps the vehicle driver to determine the actual position of his/her vehicle on the airport surface by displaying the own position with respect to aerodrome geographic location on a graphical display mounted in the vehicle [AO-0206];

- Surface Movement Alerting (SMA) will alert the driver if s/he penetrates restricted area by means of a combination of audio and visual alerts *[AO-0104]*. Particular attention should be paid to strictly reduce the number of false alarms.

All Vehicles Drivers who are subject to drive on the manoeuvring area should receive formal training and certification – in addition to specific driving qualifications, signage and markings - related to the equipment they will operate. In particular, rules, procedures and A-SMGCS aspects in all visibility conditions which would apply to vehicle drivers should be submitted to qualification.

The current operations, where the Tower Runway Controller is responsible for operations on the runways and surface traffic on the manoeuvring area, will not be changed for the time being even through the introduction of the AMM and SMA. A Vehicle Driver, who is operating

[17] As capacity provision can be maintained for the airport in low visibility conditions.

on the manoeuvring area, still has to request clearances and follow the instructions and clearances issued by the Tower Runway Controller.

The following Use Cases have been identified for Detect & Solve Hazardous Situations Outside Runway Protected Area process:

Use Case	Description
Detect & Solve Hazardous Situations Outside Runway Protected Area by the Tower Ground Controller	This Use Case describes how the Tower Ground Controller uses the system to detect a hazardous situation outside the Runway Protected Area and issues the necessary instructions to Pilots and/or Vehicle Drivers.
Detect & Solve Hazardous Situations Outside Runway Protected Area by the Flight Crew	This Use Case describes how the Flight Crew uses the system to detect a hazardous situation outside the Runway Protected Area and issues the necessary actions.
Detect & Solve Hazardous Situations Outside Runway Protected Area by the Vehicle Driver	This Use Case describes how the Vehicle Driver uses the system to detect a hazardous situation outside the Runway Protected Area and issues the necessary actions.

Table 7: Use Cases for Detect & Solve Hazardous Situations Outside Runway Protected Area

4.3.4.2 Manage Traffic Movement Outside the Runway Protected Area (A3.3.1.3.2)

This process aims to include the activities needed to manage aircraft and vehicles movements on the airport surface outside the Runway Protected Area with respect to safety requirements and planning constraints.

Managing traffic movement on the airport surface also has to be done in order to implement sustainable operations:

- Managing and mitigating aircraft noise (***[AO-0703]***);
- Managing aircraft fuel use and emissions (***[AO-0704]***).

Manage Traffic Movement Outside the Runway Protected Area sub-process presents the following main drivers:

- Inputs:
  - Detected Hazardous Situations;
  - Activated Plan (RBTs + Activated Resources).
- Control constraints:
  - Updated RBTs;
  - Revised RBTs.
- Human actors:
  - Tower Ground Controller;
  - Apron Controller;
  - Flight Crew;
  - Vehicle Driver.

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- Outputs:
  - Trajectory Change Instruction (Closed loop);
  - RBT Clearances & TMR[18];
  - Tactical Instruction (open loop)[19].

Related to sub-process “manage traffic movement outside the runway protected area”, the roles of the Tower Controllers (i.e. **Tower Ground Controller** and **Apron Controller)** will not really change with the implementation of the A-SMGCS surveillance service, but the controller’s tasks will evolve in the sense that the surveillance service will provide the Tower Controllers accurate data about the traffic situation in all visibility conditions. These data may replace visual observation. This is done by providing the Tower Controllers with a complete traffic situation on a designated surveillance display, also called Traffic Situation Display (TSD). The A-SMGCS traffic situation mainly includes the position and the identification of all cooperative movements and position of all non-cooperative movements. Radio telephony (R/T) reports from co-operative movements to inform the Tower Controllers of their position or that they have vacated the runway are not necessary anymore.

The A-SMGCS Traffic Situation Display (TSD) supports to the Tower Controllers in the following tasks:

- Identification of movements (aircrafts and vehicles);
- Issuance of clearances and instructions to all movements (***[AUO-0302]*** and ***[AUO-0303]***);
- Monitoring the execution of the clearances;
- Monitoring traffic situation on the movement area;
- Information of pilots/drivers about traffic surrounding their aircraft/vehicle;
- Providing guidance to the movements to find their way safe and efficiently.

The use of a Traffic Situation Display (TSD), instead of the present visual activity of the Tower Ground Controller for aerodrome control procedures, has introduced the notion of ‘identification’ of traffic on that display. Today the surveillance systems in use or expected to be used in a short term are based on Mode-S transmission of identification data.

It is mandatory for air traffic control to identify the aircraft ID prior to give traffic information, instructions, or clearances to this aircraft.

For that purpose, **Flight Crews** should input data and set their transponder box in accordance to the published **Transponder Operating Procedures**:

- Departure:
  - At the stand;
  - On requesting push back/taxi (whichever is earlier);
  - When Lining Up.

[18] The Airport Expert Group 5.3.2 has highlighted that, although a complex taxiway clearance could be given taking the aircraft between the stand and runway, it may be safer and more efficient to issue the clearance in stages and the system should allow this.

[19] The outputs need to include changed status of RBTs when the aircraft completes its parking procedures (e.g. Ended RBT and Reverted RBT).

- Arrival:
  - When still on the runway;
  - After Vacating the Runway;
  - Fully Parked on Stand.

Other basic procedures for Flight Crew to manage traffic movement outside the runway protected area are:

- Designation of Crew Members;
- ATC-Clearances;
- Pre-flight procedures in regard to A-SMGCS;
- Lookout during ground operations;
- Designation of tasks during Taxi;
- Commencement of Take-Off Roll;
- Initial Communication with ATC after take-off;
- Parking[20] procedures.

Regarding to above procedures, A-SMGCS provides the following services:

- Airport Moving Maps (AMM) will enhance the situational awareness of the flight crew (***[AO-0206]*** and ***[AUO-0401]***) and ease navigation on airports, especially at complex, congested and unfamiliar locations. The overall level of flight safety when manoeuvring on the ground will be increased considerably. In low visibility conditions, the out-of-window situation assessment will be supported by enhanced (***[AUO-0403]***) or synthetic (***[AO-0404]***) vision for the pilot, reducing the difficulties of transition from instrument to visual flight operations.

The flight crew will also be supported by advanced tools for their ground operations (e.g. enhanced trajectory management through flight deck automation systems ***[AUO-0604]***).

Regarding to **Vehicle Drivers** procedures to manage traffic movement, A-SMGCS provides the following services:

- Airport Moving Maps (AMM) will help the vehicle driver to determine the actual position of his/her vehicle on the airport surface by displaying the own position with respect to aerodrome geographic location on a graphical display mounted in the vehicle. Additionally, AMM will supplement the out-of window visual reference to navigate on the airport movement area, thus increasing the situation awareness of the vehicle driver (***[AO-0206]*** and ***[AUO-0401]***).

All Vehicles Drivers who are subject to drive on the manoeuvring area should receive formal training and certification – in addition to specific driving qualifications, signage and markings - related to the equipment they will operate. In particular, rules, procedures and A-SMGCS aspects in all visibility conditions which would apply to vehicle drivers should be submitted to qualification.

The current operations, where the Tower Runway Controller is responsible for operations on the runways and surface traffic on the manoeuvring area, will not be changed for the time being even through the introduction of the AMM. A Vehicle Driver, who is operating on the manoeuvring area, still has to request clearances and follow the instructions and clearances issued by the Tower Runway Controller.

[20] During the parking procedures the RBT must change status, either to ‘Close’/‘End’ when the flight is ended or cancelled or for it to ‘Revert’ to an SBT if the flight is delayed.

The following Use Cases have been identified for Manage Traffic Movement Outside the Runway Protected Area process:

Use Case	Description
Ensure Taxi-in	This Use Case describes how the Tower Ground Controller with the support of the Pilot assures safe movements of aircraft from the runway exit to the aircraft stand (separation) and ensures that traffic synchronization is guaranteed in case of deviation from schedule. The taxi-in procedure may be supported by routing clearances issued via data-link. The process depicted takes place in an airport equipped with Advanced – Surface Movement and Guidance Control System (A-SMGCS), bringing support for guidance of mobiles on the airport movement area.
Issue Surface Routing Clearances for Arriving Flights	Delivery of the surface routing clearances (taxi-in) in compliance with the arrival sequence and taking into account the handling of the surface movements.
Identify Flight Before Taxi-Out	This Use Case describes how a Tower Ground Controller (or Apron Controller) identifies a flight (that is about to commence movement on the airport surface to execute the first segment of the Reference Business Trajectory – RBT) before issuance of the start-up / push-back clearance.
Ensure Taxi-out	This Use Case describes how the Tower Ground Controller, with the support of the pilot, assures safe movements of aircraft from the aircraft stand to the runway holding point, prior to take-off. The taxi-out procedure may be supported by routing clearances issued via data-link. The process depicted takes place in an airport equipped with Advanced – Surface Movement and Guidance Control System (A-SMGCS), bringing support for guidance of mobiles on the airport movement area. The use case starts when ground handling is completed, aircraft doors are closed and the Pilot is ready to leave aircraft stand, and ends when the Pilot is instructed to contact the Tower Runway Controller, usually when the aircraft is at the runway holding area.
Issue Surface Routing Clearances for Departing Flights	Delivery of the surface routing clearances (push-back, possibly de-icing and taxi-out) in compliance with the TOBT and TTOT (departure sequence) and taking into account the handling of the surface movements.

Table 8: Use Cases for Manage Traffic Movement Outside the Runway Protected Area

4.3.5 Enablers

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

- A-SMGCS Surveillance, Control, Routing and Guidance functions (refer to ICAO doc 9830 [15]);
- Collaborative infrastructure supported by SWIM allowing data sharing between the ATM Stakeholders;
- 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 (*[AO-0103]*);

- Improved operations in low visibility conditions through enhanced ATC procedures (*[AO-0502]*).

4.3.6 Transition issues

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

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 apron and taxiways management activities during the execution phase.

6.1 MAIN ROLES AND RESPONSIBILITIES

Apron & Taxiways management activities during the execution phase involve:

- One primary actor making decisions under his/her area of responsibility:
  - **Tower Ground Controller**, responsible for the management of aircraft and vehicles movements on the airport surface outside the runway protected area.
- Several secondary actors:
  - **Apron Controller**, giving support to optimise departure queue;
  - **Tower Ground Controller**, transferring the responsibility of the flight from/to him/her;
  - **Airport Operations Centre (APOC) Staff**, balancing actual demand and capacity during the execution phase;
  - **Flight Crew(s)**, conducting flight according to RBT and applicable rules and assuring separation if separator;
  - **Aircraft Operator (or AOC where present)** representing the business interests of the user and supporting the flight crew in the collaborative processes at the airport, directly interacting with the APOC staff in managing demand;
  - **Vehicle Driver(s)**, avoiding collisions;
  - **Sub-regional Network Manager**, giving support to optimise departure queue.

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.

In the SESAR context the Tower Ground 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) digital as well as voice communications systems.

The main interactions of Tower Ground Controllers are with their counterpart within the domain of Air Traffic Control (Tower Runway Controller, Apron Controllers) or with pilots (Flight Crew) and Airport Operations Centre (APOC) Staff as appropriate.

Apron Controller: Mainly on international airports apron control is often carried out under the responsibility of the Airport Authorities. At some airports the task apron control is also called ground control or taxi control and is carried out by ATC.

The Apron Controller is responsible to guide aircraft on the apron[21] from the connected taxiway(s) to the parking stand(s) and vice versa. He/she has to (i) ensure the safe, according to the rules and efficient traffic management, movement of aircraft and vehicles in his/her area of responsibility, (ii) clear and monitor 4D business trajectory ground segments and (iii) make increasingly use of digital communications.

Main interactions of Apron control are with Airport Operations Centre (APOC) Staff within the domain of Airport Operations and with Flight Crew (Pilots) and Air Traffic Control (Tower Ground Controller).

Tower Runway Controller: Has to manage the runways for take-off and landing of aircraft. Tower Runway Control exist for civil and for military Tower Services. The principal task of the Tower Runway Controller is to ensure safe access to the runway for landing and departing aircraft, for aircraft and vehicles wishing to cross a runway, and or vehicles to operate on or within a runway protected area, according to appropriate rules.

In the SESAR long term, the Tower Runway Controller will be supported by A-SMGCS and will be part of Airport CDM processes (e.g. providing information on current runway capacity, wake vortex situation (from MET office), departure separation etc.).

The main interactions of Tower Runway Controllers are with their Ground counterpart within the domain of Air Traffic Control or with pilots (Flight Crew) and Airport Operations as appropriate.

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

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

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

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).

Airline Operator (or AOC): Represents operator's business interests and priorities so supporting the flight crew in the collaborative processes at the airport.

Main interactions of the Airline Operator are with the Flight Crew, the APOC and other Airline Operators.

[21] As a reminder, an Apron is defined in ICAO -Annex 11 as "A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail, or cargo, fuelling, parking or maintenance".

Vehicle Driver: Operates on the manoeuvring area (beyond the Apron). The main responsibility of the Vehicle Driver is to ensure the safe and efficient movement of his/her assigned vehicle on the aerodrome manoeuvring area.

Main interactions of the Vehicle Driver are with Air Traffic Control (Tower Runway Controller, Tower Ground Controller).

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: (i) 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; and (ii) 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 Apron & Taxiways Management 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 Ground Controller	A3.1.2.2.1.1 Coordinate Temporary Airport Surface Resource Closure A3.2.1.1.2 Optimise Departure Sequence A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area	Assure Separation Avoid Collisions, provide information to Airport Users as appropriate Optimise Queueing
Apron Control Unit (where existing)	Apron Controller	A3.1.2.2.1.1 Coordinate Temporary Airport Surface Resource Closure A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area	Ensure Safe Operation on Apron Optimize vehicular movement (including aircraft) on Apron

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Organisation/Unit	Individual Actor	Related Process(es)	Main Role(s) & Responsibilities
Airport Operations Centre (APOC, Civ. Aerodrome) WingOps (Mil. Aerodrome)	APOC Staff	A3.1.1.1.1.2 Assess Surface Capacity Load A3.1.1.2.1.1.2 Switch Surface Operational Rules A3.1.2.2.1.1 Coordinate Temporary Airport Surface Resource Closure	Set up Departure Queue Manage Airport Resources Manage Environmental issues Manage Flight Data
Airport Ground Handling Unit Third Party	Vehicle Driver	A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area	Avoid Collisions

Table 9: Airport actors involved in Apron & Taxiways management

Other areas actors

Organisation/Unit	Individual Actor	ATM process	Main Role(s)
Airlines, BA, GA, Military	Flight Crew	A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area	Conduct Flight according to RBT and applicable rules Assure Separation (if Separator) Avoid Collisions
Sub-regional Network Management Unit	Sub-regional Network Manager	A3.2.1.1.2 Optimise Departure Sequence	Optimise traffic flows in execution phase

Table 10: Other actors involved in Apron & Taxiways management

7 REFERENCES AND APPLICABLE DOCUMENTS

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[10] **Episode 3** SESAR DOD E5, Conflict Management in Arrival and Departure High & Medium/Low Density Operations Detailed Operational Description, D2.2-047

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[14] **EMMA 2** A-SMGCS Services, Procedures and Operational Requirements (SPOR)

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[17] **Episode 3** OS-12 Landing and Taxi to Stand - part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050

[18] **Episode 3** OS-13 Taxi-out and Take Off - part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050

[19] **Episode 3** OS-17 Solve Hazardous Situations during Taxiing - part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050

[20] **Episode 3** OS-21 Departure from Non-Standard Runway - part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050

[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

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[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] Episode 3 OS-39 Aborted Take-off - part of Annex to SESAR DOD G - Operational Scenarii - D2.2-050

[25] Use-Case UC-03 Identify Flight before Taxi-out.doc V0.3, August 2008

[26] Use-Case UC-08 Ensure Taxi-Out.doc V0.4, December 2008

[27] Use-Case UC-12 Ensure Taxi-In.doc V0.4, December 2008

[28] Episode 3 Airport Expert Group Report E3-D5.3.2-02 V0.15, November 2009

7.2 APPLICABLE DOCUMENTS

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[30] SESAR Operational Scenarios and Explanations – Network Airline Scheduled Operation, V0.6, November 2007

[31] SESAR WP2.2.3/D3, DLT-0707-008-01-00 V1.0, July 2007

[32] SESAR The ATM Master Plan (D5), DLM-0710-001-02-00 (approved), April 2008

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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 Apron & Taxiways management.

Scenario	Summary	Status
Landing and Taxi to Stand	The Operational Scenario describes the processes and interactions among actors during landing and taxing to stand operations at the airport level, within the context of SESAR 2020 concept of operations. 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. 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". 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.	**Produced (OS-12)**

Scenario	Summary	Status
Taxi-out and Take-off	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. 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. 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”. 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).	**Produced (OS-13)**
Solve Hazardous Situations during Taxiing	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. 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. 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”.	**Produced (OS-17)**

Scenario	Summary	Status
Departure from non Standard Runway	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. 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. 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. 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.	**Produced (OS-21)**
Handle Planned Closure of an Airport Airside Resource	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. 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. 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%. 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.	**Produced (OS-30)**

Scenario	Summary	Status
Handle Unexpected Closure of an Airport Airside Resource	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. 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. 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%. 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.	**Produced (OS-31)**
Management of Vehicles on Manoeuvring Area	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. 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. The Scenario covers all nominal and non-nominal procedures and is applicable for both CAVOK and Low Visibility Conditions (LVC). 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.	**Produced (OS-32)**

Scenario	Summary	Status
Aborted Take-off	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. 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. The Scenario is applicable for both CAVOK and Low Visibility Conditions (LVC). The Scenario starts when the aircraft, cleared for take-off, aborts its take-off roll. The Scenario ends when either, the aircraft takes-off after a second attempt or returns back at a parking stand.	**Produced (OS-39)**

Table 11: Operational Scenarios identified for Apron & Taxiways 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.

The following Apron & Taxiways Management Use Cases have been generated from the above higher-level processes in the Process Model.

Use Case	Status
Assess Surface Capacity Load	**Not Planned within Episode 3**
Change of Taxiway Configuration	**Not Planned within Episode 3**
Change of Apron Configuration	**Not Planned within Episode 3**
Change of De-icing Configuration	**Not Planned within Episode 3**
Change of Remote De-icing Configuration	**Not Planned within Episode 3**
Coordinate Temporary Taxiway Closure	**Not Planned within Episode 3**
Coordinate Temporary Apron Closure	**Not Planned within Episode 3**
Coordinate Temporary De-icing Closure	**Not Planned within Episode 3**
Coordinate Temporary Remote De-icing Closure	**Not Planned within Episode 3**
Modify Departure Sequence by Tower Ground Controller	**Not Planned within Episode 3**
Detect & Solve Hazardous Situations Outside Runway Protected Area by the Tower Ground Controller	**Not Planned within Episode 3**
Detect & Solve Hazardous Situations Outside Runway Protected Area by the Flight Crew	**Not Planned within Episode 3**
Detect & Solve Hazardous Situations Outside Runway Protected Area by the Vehicle driver	**Not Planned within Episode 3**
Ensure Taxi-in	**Produced (UC-12)**
Issue Surface Routing Clearances for Arriving Aircraft	**Not Planned within Episode 3**
Identify Flight Before Taxi-out[22]	**Produced (UC-03)**
Ensure Taxi-out	**Produced (UC-08)**
Issue Surface Routing Clearances for Departing Aircraft	**Not Planned within Episode 3**

Table 12: Use Case summary

[22] This UC might well be part of the M1 DOD « Collaborative Airport Planning » as it occurs while the aircraft has not pushed yet, thus in the planning phase.

10 ANNEX C: OI STEPS TRACEABILITY TABLE

The following table captures the SESAR Operational Improvements (OIs/OI Steps) addressed by Apron & Taxiways 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] (IP1)***	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.	A3.2.1.1.2 Optimise Departure Sequence
Management/Revision of Reference Business Trajectory (RBT) ***[L05-01]***			
Successive Authorisation of Reference Business/Mission Trajectory (RBT) Segments using Datalink ***[AUO-0302] (IP2)***	Controller's clearances are sent to the pilot by datalink for the successive segments of the Reference Business/Mission Trajectory (RBT) along the flight progress (this includes taxi route in case of surface operations). Pilot's requests to controller for start-up, push back, taxi, take-off clearances, etc. are also transmitted by datalink.	The SESAR concept of operations utilises digital data communication applications and services as the main means of communication even though there will remain circumstances in which clearances and instructions are issued by voice. In the shorter term, datalink will be used in non-time critical situations and may be applied instead of or in combination with voice communications.	A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area

OI Step	Description	Rationale	Related ATM Model Processes
Revision of Reference Business/Mission Trajectory (RBT) using Datalink ***[AUO-0303] (IP2)***	The pilot is automatically notified by datalink of trajectory change proposals (route including taxi route, altitude, time and associated performance requirements as needed) resulting from ATM constraints arising from, for example, ad hoc airspace restrictions or closing of a runway. ATM constraints may also be expressed in terms of requests such as RTA in support of AMAN operation or runway exit in support of BTV operation. On the other hand, the controller is notified by datalink of aircraft preferences in terms of STAR, ETA, ETA min/max, runway exit, etc.	This improvement may be in two steps starting with the uplink of simple flight specific constraints displayed on a dedicated cockpit screen as any datalink message. In a next stage, more complex constraints can be automatically generated by ground tools (incl. MTCD, AMAN, DMAN) and proposed to the controller for approval; on the cockpit side, the agreed constraints may be automatically loaded into the FMS, leading to a new trajectory computed and proposed to the flight crew.	A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area

OI Step	Description	Rationale	Related ATM Model Processes
Departure Traffic Synchronisation *[L07-02]*			
Optimised Departure Management in the Queue Management Process ***[TS-0306] (IP2)***	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.	A3.2.1.1.2 Optimise Departure Sequence
Departure Management from Multiple Airports ***[TS-0302] (IP2)***	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 consider 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.	A3.2.1.1.2 Optimise Departure Sequence

OI Step	Description	Rationale	Related ATM Model Processes
Airborne Situational Awareness ***[L08-03]***			
Air Traffic Situational Awareness (ATSAW) on the Airport Surface ***[AUO-0401] (IP1)***	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.	A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area
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] (IP1)***	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.	A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area
Airport Safety Nets including Taxiway and Apron ***[AO-0104] (IP2)***	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.	A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area

OI Step	Description	Rationale	Related ATM Model Processes
Improved Runway-Taxiway Lay-out, Signage and Markings to Prevent Runway Incursions *[AO-0103] (IP1)*	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.	A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area
Detection of FOD (Foreign Object Debris) on the Airport Surface *[AO-0202] (IP1 -> IP2)*	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.	A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area
Improving Traffic Management on the Airport Surface *[L10-02]*			
Enhanced Guidance Assistance to Airport Vehicle Driver Combined with Routing *[AO-0206] (IP2)*	The system displays dynamic traffic context information including status of runways and taxiways, obstacles, and an airport moving map.		A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area
Surface Management Integrated With Departure and Arrival Management *[AO-0207] (IP2)*	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.	A3.2.1.1.2 Optimise Departure Sequence

OI Step	Description	Rationale	Related ATM Model Processes
Enhanced Trajectory Management through Flight Deck Automation Systems ***[AUO-0604] (IP2)***	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.	A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area
Improving Airport Collaboration in the Pre-Departure Phase *[L10-03]*			
Improved Operations in Adverse Conditions through Airport Collaborative Decision Making ***[AO-0501] (IP1)***	Systematic strategies are agreed and applied by CDM partners to deal with predictable (e.g. forecast bad weather, industrial action, scheduled maintenance) or unpredictable adverse conditions (e.g. unforeseen snow or fog, accident). This involves effective methods of exchanging appropriate information on the expected or actual arrival of such conditions, special procedures, and system support to facilitate the sequencing of operations where needed (e.g. de-icing).	In contrast with today's ad hoc solutions to unforeseen disruptions, prompt decision making, flexibility and adaptability of partners are facilitated during periods of reduced capacity, allowing for a faster recovery to normal operations.	A3.1.1.1.1.2 Assess Surface Capacity Load A3.1.2.1.1.2 Switch Surface Operational Rules A3.1.2.2.1.2 Coordinate Temporary Airport Surface resource Closure
Using Runways Configuration to Full Potential *[L10-04]*			
Interlaced Take-Off and Landing ***[AO-0402] (IP1)***	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.	A3.2.1.1.2 Optimise Departure Sequence

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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] (IP1)***	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).	A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area
Enhanced Vision for the Pilot in Low Visibility Conditions ***[AUO-0403] (IP2)***	Out the window' positional awareness is improved through the application of visual enhancement technologies thereby reducing the difficulties of transition from instrument to visual flight operations.	Enabling in a transparent way the transition from IFR (head in) to visual flight operations (out the window).	A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area
Synthetic Vision for the Pilot in Low Visibility Conditions ***[AO-0404] (IP3)***	The system in the cockpit provides the pilot with a synthetic/graphical view of the environment using terrain imagery and position/attitude information.		A3.3.1.2.2 Detect & Solve Hazardous Situations Outside Runway Protected Area A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area

OI Step	Description	Rationale	Related ATM Model Processes
Implementing Sustainable Operations at Airport *[L10-08]*			
Aircraft Noise Management and Mitigation at and around Airports ***[AO-0703] (IP1)***	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).	A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area

OI Step	Description	Rationale	Related ATM Model Processes
Aircraft Fuel Use and Emissions Management at and around Airports ***[AO-0704] (IP1)***	The objectives are to ensure that: - Aircraft fuel use and gaseous emissions (both climate change and air quality) are minimised both in the air and on the ground, - The impacts considered associated with an airport reflect the emissions from that airport and not emissions from third party sources, - Gaseous emissions from airport-related non-aircraft sources (e.g. ground transport) are minimised and that where appropriate these reductions allow growth in aircraft movements, - Emissions are not emitted in locations where they can unnecessarily adversely impact local residents and that where this can not be avoided it is minimised and mitigated for, - any constraints, non-optimal procedures or economic burdens that are imposed strike the most appropriate balance between social, economic and environmental imperatives. Where a bigger strategic gain can be won by the voluntary adoption of lesser restrictions, that - These are developed following the balanced approach and with the full input from all relevant ATM stakeholders, and - The option with the best sustainability balance is selected.	Performance improvements gained are not wasted by failure to protect airport environmental capacity.	A3.3.1.3.2 Manage Traffic Movement Outside the Runway Protected Area

Table 13: Operational Improvements addressed

11 ANNEX D: HOT TOPICS

The hot topics potentially come from two sources:

- The review process where comments cannot be answered within the timescales and resources of Episode 3;
- The expert group sessions of the Airport Expert Group, WP5.3.2 where differences of opinion were raised against the concept described in the DOD.

Use of Speed in the taxi clearance

One of the aims of the SESAR CONOPS is to improve the predictability of the ATM system and a way of achieving this at the airport, is to include speed in the taxi instruction. The DOD has drawn on the A-SMGCS material to propose the following statement.

> *It [A-SMGCS] also provides a speed suggestion to the cockpit to control the taxiing phase for each aircraft.* **(Footnote 5)**

It is the view of the Airport Expert Group that proposing a speed to the cockpit will reduce the flexibility of the tower controller to manage the surface traffic efficiently given the diverse causes of speed variability of taxiing aircraft. Notwithstanding this difficulty, if the taxi-route clearance is intended to be conflict-free, then such timing or speed information will be required.

Change to RBT status when parking procedures have completed

No description is made of the process by which the RBT status changes at the end of a flight or when a flight is aborted. The RBT can be set to 'ended'/'closed' or reverted to an SBT, if the User still intends to execute the flight. This change affects the content of the concept description across a number of DODs and scenarios, so it would lead to inconsistencies if a change were only made in the stand and taxiway management processes. **(Footnote 19)**

Timing of delivery of taxiway clearance

The appropriate time for the delivery of the taxiway clearance is difficult to establish. The time needs to take into account on one hand, when sufficient information is available to determine the taxiway route and on the other, whether the pilot is able to deal with the extra workload during that particular phase of flight. (**Footnote 4**)

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