Technical Specification

Document information	
Project title	Integration of Departure Management and Surface Management
Project N°	12.04.04
Project Manager	THALES
Deliverable	Technical Specification
Deliverable ID	D01
Edition	00.02.00
Template Version	02.00.00
Task contributors	
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Abstract

This document is the Technical Specification for the integration of departure management and surface routing management. It is based upon operational requirements available at the time this document has been produced, and contains technical requirements specifying this integration.

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4 Document History

Edition	Date	Status	Author	Justification
00.00.01	02/05/2011	Draft	All	Merge with all contributions
00.00.02	01/06/2011	Draft	All	Second draft with comments correction
00.00.03	15/06/2011	Draft	All	Updated version with comments correction
00.00.04	16/06/2011	Draft	All	Updated version
00.00.05	17/06/2011	Draft	All	Updated version
00.00.06	22/06/2011	Draft	[redacted]	Final version for approval
00.01.00	22/06/2011	Final		Final version
00.01.01	07/09/2011	Draft		Version correcting SJU remarks and some additional 06.08.04 comments.
00.01.02	12/09/2011	Draft		Updated version with corrections for approval.
00.02.00	12/09/2011	Final		Final version

5 IPR (foreground)

6 This deliverable consists of SJU foreground.

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Executive summary

This document is the Technical Specification for the integration of departure management and surface routing management. It is based upon operational requirements available at the time this document has been produced, and contains technical requirements specifying this integration.

For Phase 1, the scope of this integration is:

- For the surface routing to provide an optimised taxi time (more precisely defined as the EXOP) to the departure management that can use it to build a more reliable pre-departure sequence,
- For the departure management to provide more stable TSAT and TTOT that the surface routing function can use to build more realistic traffic forecasts.

1 Introduction

1.1 Purpose of the document

This document describes the technical requirements for integration of departure management and surface routing management. . Approach chosen to write requirements is to consider the improvements provided by the two functional blocks integrated and not to focus on each "block" enhancements for its own side.

This document covers functional, non-functional and interface requirements. They are addressing the “what” and not the “how”, therefore they don’t aim at specifying the physical design of the functional block (which remains for the industry), but the functional description and the necessary logical interfaces with other functional blocks.

The relations between this technical specification and the other SESAR deliverables are illustrated in Figure 1. For Phase 1, due to the lack of a 12.1.7 Technical Architecture Description that has to allocate operational requirements from the 6.X.Y projects to functional blocks, a bottom-up approach has been chosen: operational requirements from 06.08.04 OSED [8] are analysed and identified as "inside 12.04.04 scope".

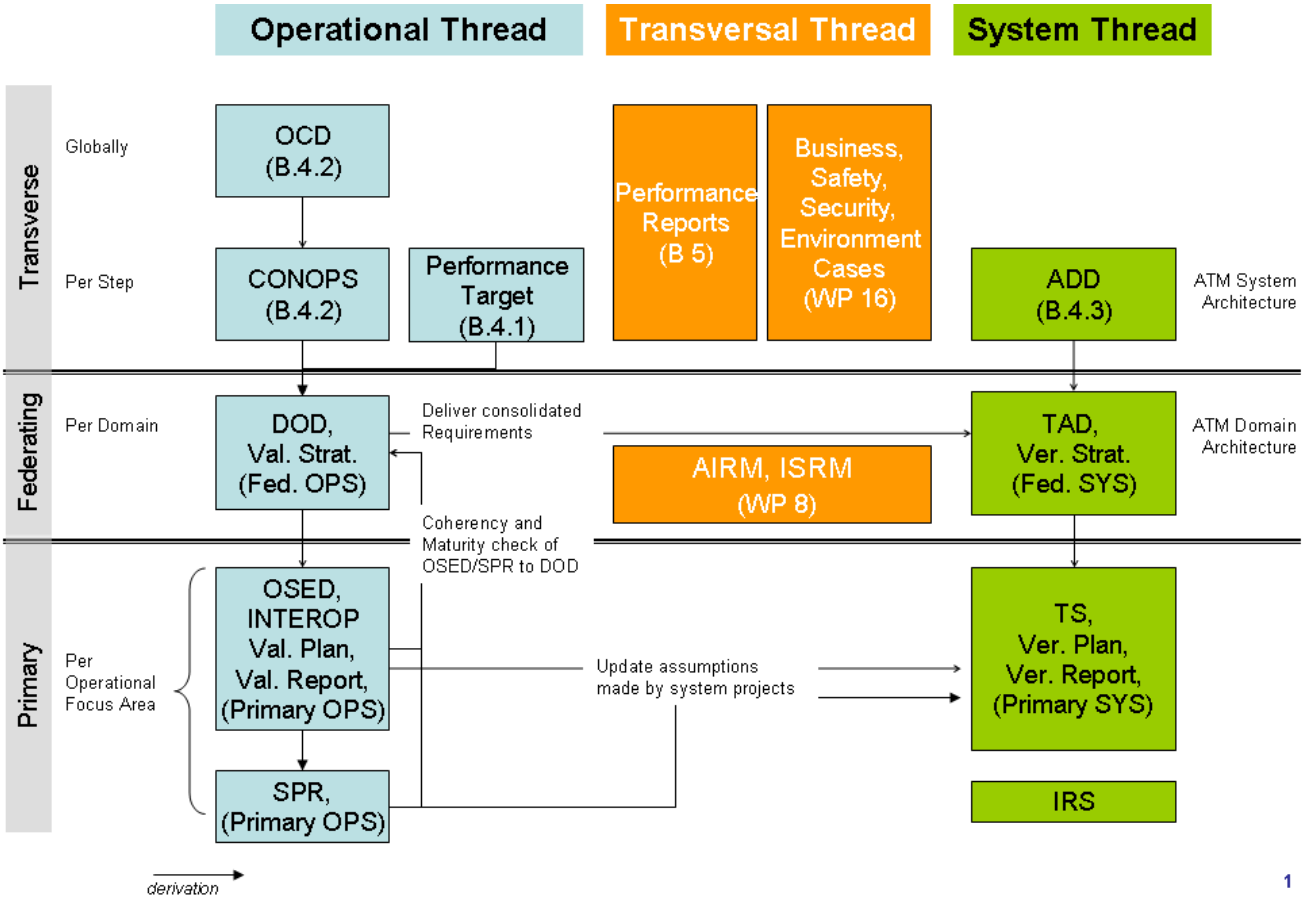

Figure 1: Flow of documentation overview [PMP]

1.2 Intended readership

This document is intended for the following audience:

- 12.01.07 (Airport system specification drafting and maintenance) is interested in the document to identify and maintain the consolidated list of requirements derived from each WP12 projects;
- 12.03.05 and 12.03.03 as specifying the DMAN and the Surface Routing function will check that the requirements written for the integrated functional blocks are compatible with the behaviours specified for each block internally,
- 12.05.03 and 12.05.04 working on the A-iCWP will be interested on the HMI requirements,
- 06.08.04 (Coupled AMAN-DMAN) as the principal source of operational requirements for integrated Departure Management / Surface Routing function, which will need to check the consistency between the operational and technical requirements,
- 10.09.01 and 10.09.02 as working on coupling between Arrival Management and Departure Management.

1.3 Inputs from other projects

The high level architecture of the Aerodrome ATC system is defined by B04.03 architecture description (B.04.03-D09 [9]).

Project 06.08.04 is identified as the main source for the input requirements. Operational requirements relevant for Departure Management / Surface routing function integration have been selected by 12.04.04 from the initial OSED (D06.08.04-D07 [8]). Requirements related solely with DMAN (for 12.3.5) or AMAN (10.9.1), were excluded.

Project 06.07.02 is describing the operational behaviour for the routing and is a source of information even if current OSED version [12] does not contain requirements applicable to 12.04.04.

The following projects were identified as possible source of requirements in PIR [14] but were not used for this document version:

- EMMA2 Project produced requirements related with DMAN – A-SMGCS integration but these requirements were not used because 06.08.04 initial OSED superseded them.
- Project 12.03.03 did not identified requirement linked with a DMAN interface.

1.4 Structure of the document

This document is organised as follow:

- Chapter 1: Purpose and scope; Requirements structure; Functional block purpose and high level overview
- Chapter 2: General functional block description;
- Chapter 3: Functional block requirements,
- Chapter 4: Referenced documents.

1.5 Requirements Definitions – General Guidance

Requirements have been developed according to the SESAR Requirements and V&V Guidelines [4] and SESAR Template Toolbox Latest version [3].

1.6 Functional block Purpose

The main objective of this project is to integrate Departure Management and Surface Routing Management tools and to enhance their functionalities developing a single integrated platform in order to improve the pre-departure, the taxi route calculation and the departure sequences.

This allows maintaining a safe and efficient flow of traffic on the ground and providing the flexibility to ensure the maximum use of runway capacity.

Knowledge of realistic taxi times:

- Enables ATC to optimise the push back, start-up, taxi and take off sequence and hence reduce queuing and taxiway congestion
- Improves CTOT compliance

The following topics have not been studied during this project phase (Step 1) and will be part of Step 2 activities:

- Taxi time will not be re-computed after aircraft push-back (track position is not taken into account),
- Monitoring of real-time traffic will not be used for taxi time update. Taxi times will be only updated by manual request of controller.
- The project will not produce an integrated HMI of Departure Management and Surface Routing function.

1.7 Functional block Overview

The integrated Departure Management / Surface Routing Management platform aims to improve the pre-departure sequence and taxi route calculation using more accurate information..

In order to obtain reliable sequences and routes, Departure Management / Surface Routing Management has to consider accurate information related to each flight, available from individual Departure Management and Surface Routing Management systems:

- TSAT: Target Start-Up Approval Time, the time that an aircraft can expect start-up / push-back approval. This information is calculated and provided by Departure Sequencing function
- TTOT: Target Take-Off Time, calculated and provided by Departure Sequencing function.
- Taxi Route: description of the path to be followed by the flight and the timing of events along this path; in particular start time, intermediate hold times and end time. This information is calculated by surface routing function.
- Taxi Time (EXOP): A-CDM has defined the term VTT “Variable Taxi Time” as the generic name for both inbound and outbound taxi time parameters. According to the scope of the project, this document will just refer to EXOP (Expected Taxi Period from Off-Block to Runway Holding Point (with no buffer or delay). It includes time to line up and roll to airborne).

The surface routing function has the objective of calculating the most suitable taxi route and the corresponding EXOP. This will improve the accuracy of both departure and pre-departure sequencing for the departure sequencing calculation:

$$TTOT = TOBT + EXOP + ERWP$$

$$TSAT = TTOT – EXOP – ERBP$$

The Figure 2 depicts the overview of the integrated Departure Management / Surface Routing Management platform and the related concerned functions.

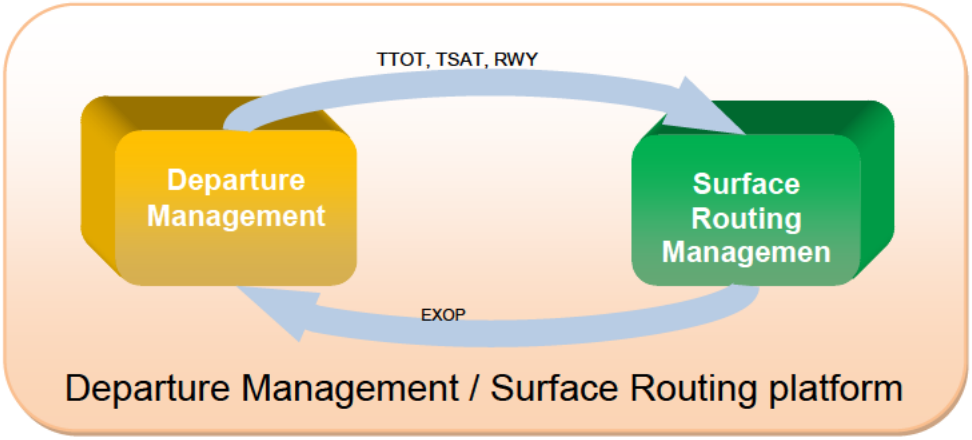

Figure 2 - Functional block overview

The integration of taxi time information into pre-departure planning is expected to contribute significantly to more reliable off-block and take-off prediction. Data measurements of actual traffic events, moreover, are the key to ensure accurate updates of plans made in earlier flight stages. This is possible thanks to an exchange of data:

- The surface routing management wants to optimize the solution search of the most suitable taxi route and EXOP, taking into account the departure sequence planning constraints.
- The departure management function wants to optimise pre-departure (off-block) and departure (take-off) sequences, based on accurate TOBT acquisition (from CDM process) and EXOP.

1.8 Acronyms and Terminology

Term	Definition
ADD	Architecture Definition Document
A-iCWP	Advanced integrated Controller Working Position
AMAN	Arrival Manager
A-SMGCS	Advanced Surface Movement Guidance & Control System
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Services
CDM	Collaborative Decision Making
CTOT	Calculated Take-Off Time
DMAN	Departure Manager

Term	Definition
DOD	Detailed Operational Description
E-ATMS	European Air Traffic Management System
EOBT	Estimated Off-Block Time
ERWP	Planned time waiting at runway hold
ERBP	Buffer of delay planned at runway hold to maintain pressure on runway
ETOT	Estimated Take-Off Time
EXOP	Expected Taxi Period from Off-Block (including push-back duration) to Runway Holding Point (with no other delay than the one coming from predicted traffic) including time to line up and roll to airborne
EXOT	Estimated taXi Out Time
FDPS	Flight Data Processing System
FPL	Flight Plan
HMI	Human Machine Interface
IRS	Interface Requirements Specification
INTEROP	Interoperability Requirements
ITOT	Initial Take-off Time
MDI	Minimum Departure Interval
OSED	Operational Service and Environment Definition
SESAR	Single European Sky ATM Research Programme
SID	Standard Instrument Departure
SMAN	Surface Manager
SPR	Safety and Performance Requirements
TAD	Technical Architecture Description
TMA	Terminal Manoeuvring Area
TOBT	Target Off-Block Time
TS	Technical Specification
TSAT	Target Start-Up Approval Time
TTOT	Target Take-Off Time

Term	Definition
VTT	Variable Taxi Time

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2 General Functional block Description

2.1 Context

The main objective of interlinking the Surface Routing Management function and Departure Management function is the improvement of the planning of the Departure Management function and the generation of more reliable planning results. The Surface Routing Management is also improved as realistic TSAT and TTOT can be used to predict traffic and thus calculate optimized taxi routes and taxi times. Further improvements of interlinked functions can be achieved in step 2 when continuous updates due to the actual traffic situation will be considered in the planning.

2.1.1 Operational and functional advantages of interlinking Surface Routing Management and Departure Management

2.1.1.1 Calculation of realistic taxi times

Instead of using static taxi times from a taxi time matrix, realistic taxi times (EXOP) for departures can be provided by the Surface Routing Management function as an input data for the departure management function. Based on the predicted traffic situation at either TOBT or TSAT the Surface Routing Management function can calculate a realistic EXOP. Predicted inbound traffic and tow operations have to be considered by the Surface Routing Management as they are sharing taxiways and apron areas with departures and may have a strong impact on the EXOP of departures.

2.1.1.2 Prediction of the traffic situation

Based on the realistic EXOP provided by the Surface Routing Management function a more realistic prediction of the traffic situation is available. This at the end allows a more realistic calculation of TTOT and TSAT by the departure management function.

2.1.1.3 Automatic recalculation of the EXOP

The EXOP calculation is always initiated again if the initial conditions have been changed. This is the case if an updated TOBT, a new runway or departure fix/SID is received or if a manual recalculation of the departure sequence is requested by the controller. In all these situations the Surface Routing Management function calculates EXOP under consideration of the actual conditions and the departure management function is recalculating the departure sequence and generates updates of TTOT and TSAT.

2.1.2 Information flows of interlinked departure and Surface Routing Management function

The departure management function and the Surface Routing Management function have a common data source. Flight plan data that is provided by this data source is e.g. call sign, registration, aircraft type, parking position but also the TOBT as depicted in Figure 3.

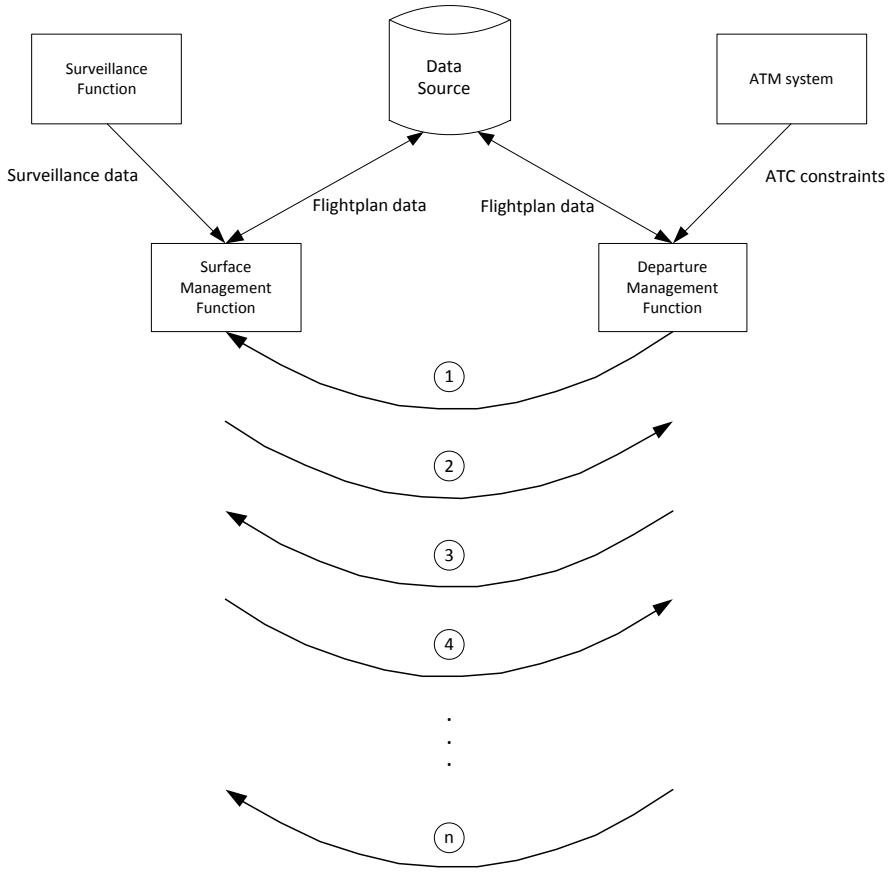

Figure 3 - Interlinked departure and Surface Routing Management function

Figure 3 gives an overview of the interlinked departure and Surface Routing Management function. It contains also elements which are especially relevant in future expansion stages. One of these elements is the input of the Surface Routing Management function from a surveillance function which will be used to calculate and predict the EXOP based on actual position data (update function).

The departure management function receives all ATC constraints like SID (standard instrument departure route), MDI (minimum departure interval) for specific departure fixes or sectors etc. directly via an interface to the ATM system. This input is needed from the beginning.

Further interfaces may exist to the departure and Surface Routing Management function which are not so relevant in this context.

The data exchange between surface and departure management function is done in several steps. The main steps are described below.

Step 1: If more than one runway can be used for a departure the optimal runway is defined by the departure management function and sent to the Surface Routing Management function. Configurable rules are used to determine the optimal runway for each departure.

Step 2: For each outbound flight the Surface Routing Management function calculates the EXOP based on the TOBT, parking position, aircraft type, departure runway and the expected traffic during taxiing. The EXOP is sent to departure management function.

Step 3: Based on EXOP and TOBT the departure management function calculates the optimal departure sequence and thus TTOT and TSAT. Both times are sent back to the Surface Routing Management function.

Step 4: Based on EXOP updates the TTOT may also be updated. EXOP is recalculated if e.g. the runway, SID etc. has changed or if the controller has initiated a recalculation of the departure sequence. Using the updates of the EXOP the departure management function checks if the existing departure sequence can still be realized using the multiple line-up alternatives at the specific runway. Only if this is no more possible the departure sequence is also updated including TTOT and TSAT. Both times are sent back again to the Surface Routing Management function.

The functionality of step 4 can vary dependent on the Surface Routing Management function. If EXOP is computed for a route starting at TSAT the process is as described. If EXOP is computed for a route (including line-up and roll to airborne) finishing at TTOT the Surface Routing Management function "guarantees" a taxi time to reach TTOT and the departure sequence is more stable and deviations must be covered by adaptations of taxi routes and EXOP. This way of computing EXOP is more complex and will not be studied in Step 1.

2.2 Functional block Modes and States

The mode characterizes the way the system is operating in respect to the availability of its functions. The Integration of Departure Management and Surface Routing Management can be in three different modes:

- **Operational:** In operational state, the system is designed to provide continuous operational service despite the failure of a function. Under normal circumstances all functions are in use, and actively processing data. This mode is the operational one which is the normal mode of operation of the system.
- **Degraded**: A function can automatically (as a result of failure) or manually be switched off, at any time, leading to a degraded mode of operation.
- **Failed**: In case a significant set of functions necessary for the continuation of the Tower ATC service (supported by the Departure Management /Surface Routing Management integrated) is not available, the system is considered in failed mode.

Transitions between these three modes can be illustrated as follows:

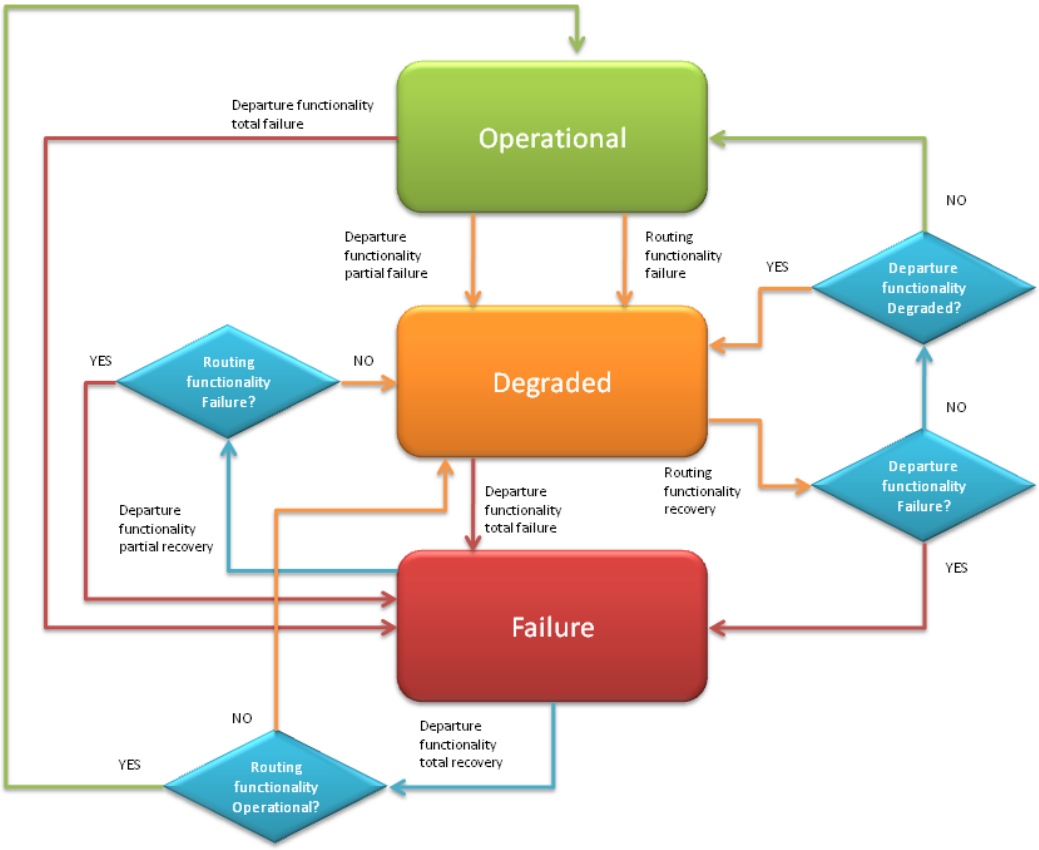

Figure 4 – Functional block modes and states

2.3 Major Functional block Capabilities

With the interlinking of the departure and Surface Routing Management functions the planning quality of both functions can be improved.

The planning of the departure sequence can be done based on realistic taxi times (EXOP) that is calculated by the Surface Routing Management function under consideration of the predicted traffic situation at TOBT of each departure.

Using the TOBT and EXOP the departure management function can calculate realistic ITOT (Initial Take-off Time) which are used for the calculation of the optimal departure sequence and for the determination of TTOT. In case of coupled Arrival Management / Departure Management the ITOT are also used to provide realistic times to the AMAN for the generation of gaps in the arrival sequence for departures.

Based on TTOT and under consideration of EXOP realistic TSAT can be calculated by the departure management function. These improved TSAT quality again allows an improved calculation of taxi times for further departures in the Surface Routing Management function.

Planning results of the departure and Surface Routing Management function must be displayed at the relevant controller working positions. Suitable HMI should be used to display the planned sequence of operations and the related target times. Therefore, the HMI should be adapted to the specific needs of the different working positions so that the Clearance Delivery Controller is getting the planned start-up/push-back sequence (TSAT) displayed while the Runway Controller is getting the planned take-off sequence (TTOT) displayed.

The planning results and with it the displayed sequence is always a proposal which can be adapted by the controller. So, suitable input means must be available to e.g. change the sequence or to fix a flight.

2.4 User Characteristics

The list of users for the function integrated departure management and surface routing management is illustrated by Figure 5 below. This list aligned with the list of Airport Operations actors as defined in the Airport DOD for step 1[13].

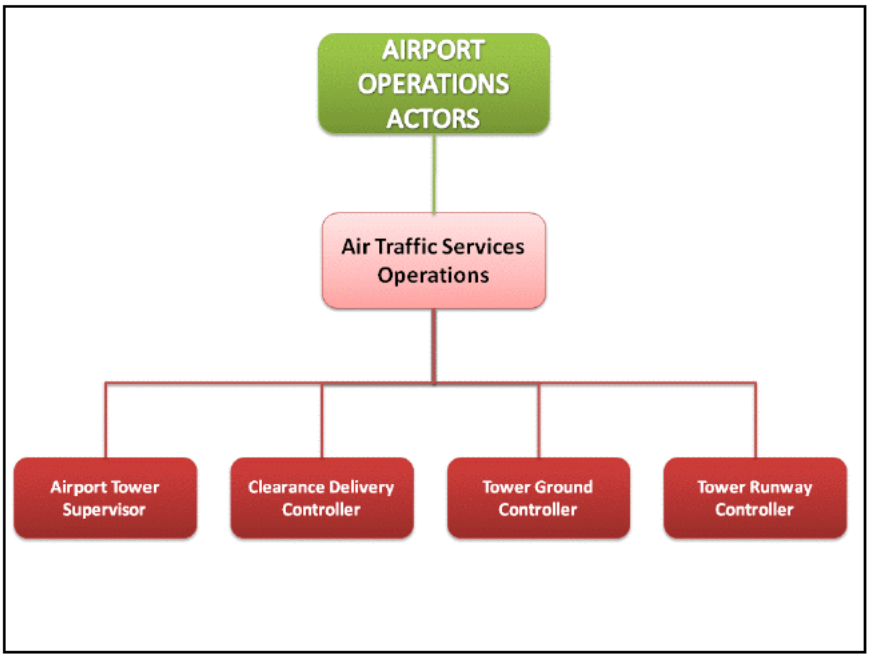

Figure 5 - Integrated departure management and surface routing management Users

The responsibilities of these different actors when using the **SESAR STEP1 Integrated departure and surface routing management** functions are summarized in the table hereafter.

Role Name	Summary of responsibility
Airport Tower Supervisor	The Tower Supervisor is responsible for the safe and efficient provision of air traffic services by the Tower/Approach crew. When the SESAR STEP1 Integrated Departure and Surface Routing Management is available, his responsibilities are more specifically to: • Decide on runway(s) for take-off in co-operation with all concerned partners **and set the corresponding configuration in the Departure Management;** • Coordinate with the ACC Supervisor and Local Traffic Manager regarding the implementation of traffic smoothing measures (i.e. spacing between same direction departures) **and set the corresponding configuration in the Departure**

Role Name	Summary of responsibility
	Management; • Coordinate with the Approach Supervisor regarding the measures related to Demand Capacity Balancing **and set the corresponding configuration in the Departure Management;** • Decide on runway(s) closure **and set the corresponding configuration in the Departure Management;**
Tower Clearance Delivery Controller	The Tower Clearance Delivery Controller is part of the controller team responsible for providing an Air Traffic Service at controlled aerodromes. His main task is the verification of Flight data (e.g.FPL, CTOT, Stand, TSAT etc) and the delivery of ATC Clearance (Departure Clearance) and Start-Up Approval. When the SESAR STEP1 Integrated departure and surface routing management is available, his responsibilities are more specifically to: • Manage the execution of the Pre-Departure Sequence (up to the Start-Up clearance) **provided by the Departure Management** • Issue Start-Up approval **with the support of the Departure Management**
Tower Ground Controller	The Tower Ground Controller is part of the controller team responsible for providing an Air Traffic Service at controlled aerodromes. His main task is the provision of ATS to aircraft and vehicles on the manoeuvring area. When the SESAR STEP1 Integrated departure and surface routing management is available, his responsibilities are more specifically to: • Manage the execution of the Pre-Departure Sequence (after Start-up clearance given by the Tower Clearance Delivery controller, up to Push-back clearance) **provided by the Departure Management** • Issue Push-Back approval **with the support of the Departure Management** • Give instructions to taxi to the take-off position for departing flights **with the support of the Surface Routing Management**
Tower Runway Controller	The Tower Runway Controller is responsible for the provision of air traffic services to aircraft within the control zone by issuing clearances, instructions and permission to aircraft, vehicles and persons as required for the safe and efficient flow of traffic. When the SESAR STEP1 Integrated departure and surface routing management is available, his responsibilities are more specifically to: • Sequence departures • Manage integration of departures in the arrival sequence in mixed-mode operations **with the support of the Departure**

Role Name	Summary of responsibility
	Management • Give take-off clearance to departing flights in accordance with the CTOT if issued **with the support of the Departure Management (TTOT sequence is respected if suitable)**

Table 1: Roles and responsibilities

2.5 Operational Scenarios

Due to the fact the Airport DOD step 1 was released early April and that it is an initial version, this section contains only the list of the Operational Scenarios to which the integrated Surface Routing and- Departure Management will contribute.

Operational Scenarios	Short description	S.M. D.M. Actor(s)	Integrated Surface and Departure Management use
Airport Medium/Short-Term Planning	The Airport Medium /Short-Term Planning scenario covers medium-term (Up to 6 months before the day of operations) and also details the short term activities **until the last hours on the day of operation.**	**Tower Supervisor**	The day of operations, the Tower supervisor coordinate with the ACC and APP Supervisors and elaborate the adequate departure sequence strategy
Surface-In	The Surface In scenario starts when the aircraft is landing, vacates the runway, which means when it leaves a runway exit, and starts taxiing on the surface on own power to a nose-in stand or open stand (milestone: ALDT = wheels touching the runway after final approach). The Surface In scenario ends when the aircraft is parked with chocks on (milestone: AIBT = stops moving on parking position).	**Tower Ground Controller** **Tower Supervisor**	The Tower Ground Controller is assisted by a Surface Management function constantly optimising the overall traffic situation. Taxi routing data is provided by the ATM system (Surface Management function), based on the runway exit actually taken by the aircraft and taxi routes designed to primarily adhere to pre-calculated target times, to minimize the taxi times and potential delays according to the taxi plan, ground rules and overall traffic situation. Adapt any configuration parameter of the departure management as needed.
Turnaround	The turn-round scenario encompasses the ground handling of an aircraft when parked at the stand/gate as well as the preparation of the aircraft to perform the next trajectory. The turn-round scenario at the moment the aircraft is on-blocks (AIBT - Actual In-blocks Time) and ending at the moment the aircraft is pushed back /vacated the parking position.	**Tower Delivery Clearance Controller** **Tower Supervisor**	Manages the execution of the Pre-Departure Sequence provided by the integrated Surface Routing - Departure Management Issue Start-Up approval; Adapt any configuration parameter of the Departure Management as needed.
Surface-Out	The surface-out scenario starts from AOBT and ends when aircraft takes off, i.e; at the Actual Take-Off Time (ATOT).	**Tower Ground Controller**	The ATM System displays a proposed routing the Tower Ground Controller. Manages the execution of the Pre-Departure Sequence provided by the Departure

			Management. The Tower Ground Controller assesses the tactical situation and, if needed, may update the taxi-routing through the ATM System. This may include holding and / or intermediate stops. The Tower Ground Controller issues a taxi clearance to the Flight Crew, by data link (D-TAXI) whenever possible. During the taxi-out, the Airport Tower Supervisor or Tower Runway Controller may decide to change the Planned Departure Sequence to take into account a revision in the TTOT for example departures from adjacent airports that are following the same departure route in the TMA Issue Push-Back approval;
		Tower Runway controller	Sequence departures Manage integration of departures in the arrival sequence in mixed-mode operations **with the support of the Departure Management** Give take-off clearance to departing flights in accordance with the CTOT if issued **with the support of the Departure Management (TTOT sequence is respected if suitable)** Give instructions to taxi to the take-off position for departing flights **with the support of the Surface Routing Management**
		Tower Supervisor	Adapt any configuration parameter of the Departure Management as needed.

Table 2 : Operational Scenarios

2.6 Functional

2.6.1 Functional decomposition

When not coupled, Departure Management and Surface Routing Management provide functionalities "on their own": building a departure sequence and computing a taxi route.

Considered as a single integrated functional block, Departure Management and Surface Routing Management allow a reliable departure sequence based upon an accurate EXOP computed by the surface routing function. They provide the following functions:

- Precise taxi times calculation: the surface routing function provides an accurate EXOP based upon the flight taxi route and taking into account various parameters such as aircraft type, parking position, the planned traffic during the taxiing…
- Enhanced sequence management: based upon the precise EXOP the departure management generates an enhanced departure sequence for each flight providing optimal TTOT and TSAT.

2.6.2 Functional analysis

The diagram below describes the Departure Management and the Surface Routing Management integrated and considered as a single functional block. It details also how the different internal functions interact with each other and with external functional blocks.

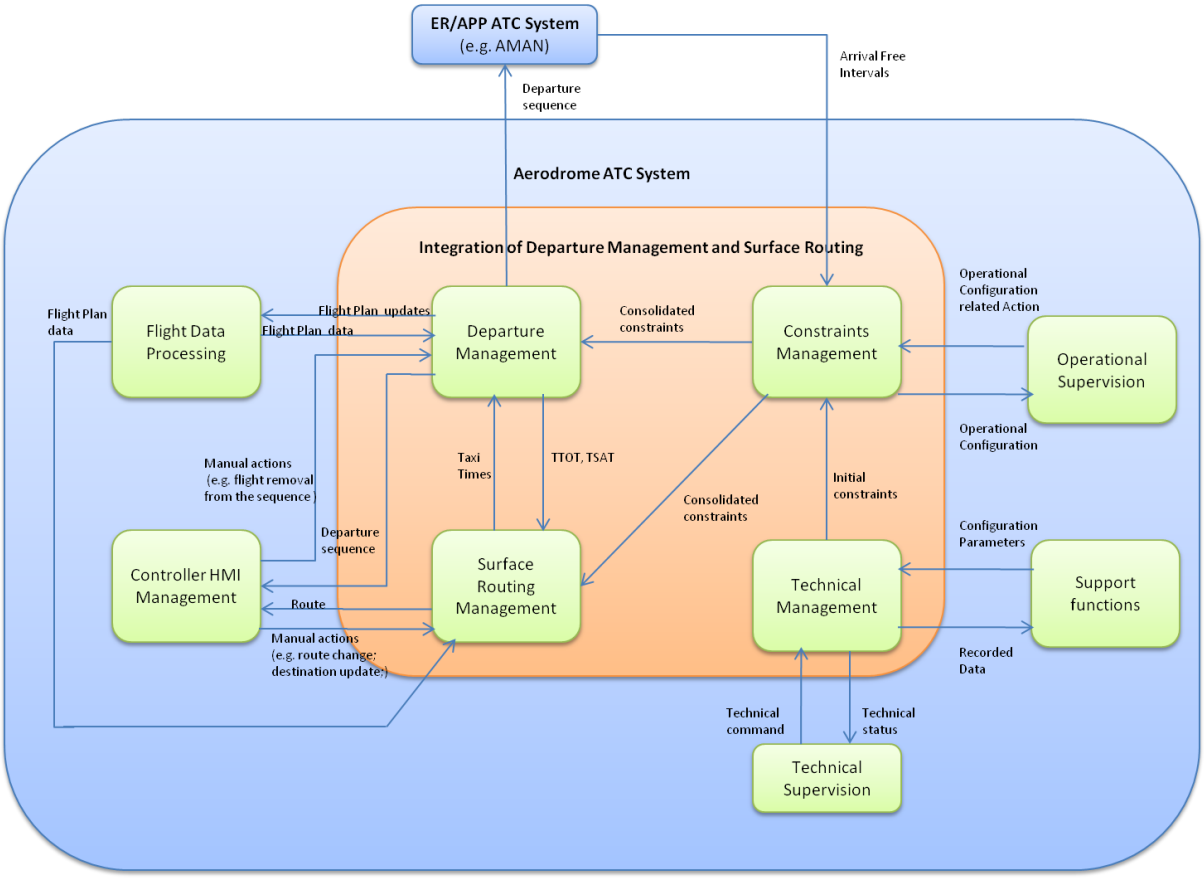

Figure 6: NSV-4 Integration of Departure Management and Surface Routing Management

The integrated functional block is composed by four sub-functions:

- Departure management in charge of providing departure sequence and optimum departure runway,
- Surface routing management responsible for providing a route and an accurate EXOP dependant on predicted traffic,
- Technical management: manages for the integrated functional block the transition between the different modes of operation,
- Constraints management: gathers constraints and rules for the two functions departure and surface routing management.

2.7 Service View

N/A

3 Functional block Functional and non-Functional Requirements

3.1 Capabilities

3.1.1 Precise taxi time (EXOP) calculation

Identifier	REQ-12.04.04-TS-0010.0010
Requirement	The surface routing functional shall receive for each flight plan the departure runway from the departure management and use: •the TOBT (if available, the EOBT otherwise), •parking position, •aircraft type, •departure runway, •expected traffic during taxiing. to calculate the EXOP accordingly.
	EXOP will be calculated based on TOBT as first approach and based on TSAT for refinement. Additionally the departure functionality calculates and communicates to surface routing functional the departure runway. The surface routing function shall be able to designate a route for each aircraft and for vehicles that need it. One part of the necessary information to design these routes is provided by FDPS (e.g. runway chosen by the operator, identification of aircraft, stand assigned).

Identifier	REQ-12.04.04-TS-0010.0020
Requirement	The surface routing function shall receive the departure runway, the TTOT and the TSAT for each flight plan from the departure sequencing function and shall calculate EXOP updates, if it is necessary.
	TOBT and TSAT are used by the surface routing function to calculate EXOP updates as the sequences evolves, TSAT and TTOT are also used to predict the future traffic situation.

Identifier	REQ-12.04.04-TS-0010.0030
Requirement	The departure sequencing function shall provide to the surface routing function an update of TTOT whenever it changes by more than <*parameter_1 TBD*>.
	In order to maintain a reliable picture of future traffic situation and to predict precise EXOP values, the surface routing function must be informed by the departure sequencing function of all known changes to TTOTs.

Identifier	REQ-12.04.04-TS-0010.0040
Requirement	The departure sequencing function shall provide to the surface routing function an update of TSAT whenever it changes by more than *<parameter_2 TBD>*.
	In order to maintain a reliable picture of future traffic situation and to predict precise EXOP values, the surface routing function must be informed by the departure sequencing function of all known changes to TSATs.

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388 ### 3.1.2 Enhanced sequence management

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390 [REQ]

Id	REQ-12.04.04-TS-0020.0010
Requirement	The departure sequencing function shall receive the EXOP from the surface routing function for each flight plan and shall calculate the TTOT and TSAT and thus the optimal departure sequence.
Title	EXOP provision
Status	<In Progress>
Rationale	The surface routing function is responsible for EXOP computation, which is then provided to the departure sequencing function in order to finalize the computation of TSAT and TTOT based on precise variable EXOP.
Category	<Functional>
Verification Method	<Test>

391

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394 [REQ]

Id	REQ-12.04.04-TS-0020.0020
Requirement	If changes in the push-back (TSAT) sequence occur, the departure sequencing function shall check if the existing departure (TTOT) sequence can still be realized (e.g. by using the multiple line-up alternatives at the specific runway). Only if this is no more possible the departure sequence is also updated.
Title	TTOT stability
Status	<In Progress>
Rationale	In order to avoid the excess of communications between pilots and controllers, the departure sequence will try to be kept once it has been communicated to them. Only if an aircraft can't fulfill the sequence, this one will be recalculated and the pilots will receive the sequence updated.
Category	<Functional>
Verification Method	<Test>

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399 [REQ]

Id	REQ-12.04.04-TS-0020.0030
Requirement	The departure sequencing function shall be able to use static taxi time data in case the surface routing function cannot provide EXOP.
Title	Standard EXOP
Status	<In Progress>
Rationale	In case the surface routing function cannot provide EXOP, departure sequencing function has to able to provide a departure sequence, based on standard EXOP.
Category	<Functional>
Verification Method	<Test>

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403 ### 3.1.3 Additional functional blocks capabilities

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[REQ]

Identifier	REQ-12.04.04-TS-0030.0010
Requirement	The surface routing function should estimate the planned traffic of inbound and outbound flights on the airport surface and take it into account to calculate precise EXOP.

[REQ]

Identifier	REQ-12.04.04-TS-0030.0020
Requirement	The Departure Management should identify the runway holding point at the same time than the allocated departure runway.

3.2 Adaptability

Integrating Departure Management with Surface Routing function does not create new adaptability constraints to those existing for the two functional blocks alone.

3.3 Performance Characteristics

Integrating Departure Management with Surface Routing function does not create new performance constraints to those existing for the two functional blocks alone.

3.4 Safety & Security

Integrating Departure Management with Surface Routing function does not create new constraints regarding Safety and Security to hose existing for the two functional blocks alone.

3.5 Maintainability

Integrating Departure Management with Surface Routing function does not create new maintainability constraints to those existing for the two functional blocks alone.

3.6 Reliability

Integrating Departure Management with Surface Routing function does not create new reliability constraints to those existing for the two functional blocks alone.

3.7 Functional block Internal Data Requirements

Integrating Departure Management with Surface Routing function does not create new internal data constraints to those existing for the two functional blocks alone.

3.8 Design and Construction Constraints

Identifier	REQ-12.04.04-TS-0100.0010
Requirement	The departure management and the Surface Routing Management shall be designed in such a way that the configuration for a same data (such as data related with airport layout or topology) contains the same information.

Identifier	REQ-12.04.04-TS-0100.0020
Requirement	Data access for the departure management and the surface routing function shall be design as such that changes to data common (e.g. flight plan data) for the two functional blocks are processed at the same time.

3.9 Functional block Interface Requirements

This chapter only contains the interface changes coming from the integration between departure management and surface routing management. The only interface change identified concerns interaction with HMI. Specific interfaces for the Departure management are described in 12.03.05 System Requirements [10], for routing in 12.03.03 System Requirements [11].

3.9.1 HMI improvements

The purpose of this chapter is to identify the enhancements / changes brought to the HMI due to integration between departure management and surface routing management.

An integrated HMI for routing and departure sequence functions is not in the 12.04.04 step 1 scope. Requirements are written in generic way "system HMI" without specifying in which "product" HMI (A-SMGCS, DMAN, Electronic Flight Strip) they have to be developed. This is considered as implementation detail and will anyway have to be modified in step 2 when an integrated HMI will have to be developed.

Requirements written by 12.03.05 regarding the Basic DMAN HMI apply also this "System HMI" and are not duplicated here, including the following capabilities:

- Entering manually a TSAT,
- Re-sequencing any flights,
- Removing a flight from the sequence,

Requirements under 12.05.XX projects responsibilities are not duplicated here, including the following capabilities:

- Displaying a default route,
- Modifying the detailed route,
- Entering/modifying flight data: Callsign, allocated runway, SID, …
- Displaying the track on the airport layout,
- Issuing Start-up, push-back … clearances,

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Identifier	REQ-12.04.04-TS-0200.0010
Requirement	The system HMI shall present the following data on the same display than the one used by the controller to enter clearances in the system: -TSAT for start-up clearances -TTOT for take-off clearances

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Identifier	REQ-12.04.04-TS-0200.0020
Requirement	The system HMI shall indicate specifically when a start-up clearance can be issued according to the TSAT, this indication is on the same display than the TSAT.

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Identifier	REQ-12.04.04-TS-0200.0030
Requirement	The system HMI shall highlight to the controller any changes performed by the system to the TSAT and TTOT.

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Identifier	REQ-12.04.04-TS-0200.0040
Requirement	The departure function shall prevent any change done to the TSAT when this value has been set by the operator.

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Identifier	REQ-12.04.04-TS-0200.0050
Requirement	The system HMI should display the EXOP duration while the route is modified by the operator.

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4 References

[1] SESAR SEMP Latest version
[2] SESAR PMP Latest version
[3] SESAR Template Toolbox Latest version
[4] SESAR Requirements and V&V Guidelines Latest version
[5] SESAR Toolbox User Manual Latest version
[6] SESAR EA models Guidelines and Templates_V00.01.05
[7] SESAR Definition Phase – Task 2.4.x Milestone 3 – System Architecture (DLT-0612-244-00-10), September 2007
[8] SESAR 06.08.04-D07 S01V1 Initial OSED V00.01.00 –
[9] SESAR B.04.03-D09 V00.01.00 dated 2011-05-11
[10] SESAR 12.03.05-D02 System Requirements Specification V00.01.00 28/04/2011
[11] SESAR 12.03.03-D02 System Requirements Specification V00.01.00 26/11/2010
[12] SESAR 06.07.02-D04 Initial OSED V00.01.00 11/04/2011
[13] SESAR 06.02-D06 Detailed Operational Description Step 1V00.01.03 11/03/2011
[14] SESAR 12.04.04 Project Initiation Report V00.01.01 21/09/2011

4.1 Use of copyright/patent material /classified material

4.1.1 Classified Material

N/A

Appendix A Traceability

Requirement Identifier	Requirement title	Functional block identifier
REQ-12.04.04-TS-0010.0010	EXOP calculation	Surface Routing Management
REQ-12.04.04-TS-0010.0020	EXOP update	Surface Routing Management
REQ-12.04.04-TS-0010.0030	TTOT updates	Departure Management
REQ-12.04.04-TS-0010.0040	TSAT updates	Departure Management
REQ-12.04.04-TS-0020.0010	EXOP provision	Surface Routing Management
REQ-12.04.04-TS-0020.0020	TTOT stability	Departure Management
REQ-12.04.04-TS-0020.0030	Standard EXOP	Departure Management
REQ-12.04.04-TS-0030.0010	Planned traffic estimate	Surface Routing Management
REQ-12.04.04-TS-0030.0020	Runway holding point selection by Departure Management	Departure Management
REQ-12.04.04-TS-0100.0010	Common configuration	Constraints Management
REQ-12.04.04-TS-0100.0020	Data access consistency	Departure Management
REQ-12.04.04-TS-0200.0010	Target Times Display	Controller HMI management
REQ-12.04.04-TS-0200.0020	Start-up clearance indicator	Controller HMI management
REQ-12.04.04-TS-0200.0030	System changes highlight	Controller HMI management
REQ-12.04.04-TS-0200.0040	TSAT Manual entry priority	Departure Management
REQ-12.04.04-TS-0200.0050	Display EXOP during route modification	Controller HMI management

Table 3: TS requirements / Functional block traceability

TS Requirement		Satisfied requirement	
Identifier	Title	Identifier	Title
REQ-12.04.04-TS-0010.0010	EXOP calculation	REQ-06.08.04-OSED-0300.0040	Make departure sequence
REQ-12.04.04-TS-0010.0020	EXOP update	REQ-06.08.04-OSED-0300.0040	Make departure sequence
REQ-12.04.04-TS-0010.0030	TTOT updates	REQ-06.08.04-OSED-0300.0040	Make departure sequence
REQ-12.04.04-TS-0010.0040	TSAT updates	REQ-06.08.04-OSED-0300.0040	Make departure sequence
REQ-12.04.04-TS-0020.0010	EXOP provision	REQ-06.08.04-OSED-0400.0010	Provide EXOP

TS Requirement		Satisfied requirement	
Identifier	Title	Identifier	Title
REQ-12.04.04-TS-0020.0020	TTOT stability	REQ-06.08.04-OSED-0300.0040	Make departure sequence
REQ-12.04.04-TS-0020.0030	Standard EXOP	REQ-06.08.04-OSED-0300.0040	Make departure sequence
REQ-12.04.04-TS-0030.0010	Planned traffic estimate	REQ-06.08.04-OSED-0400.0010	Provide EXOP
REQ-12.04.04-TS-0030.0020	Runway holding point selection by Departure Management	?????	#N/A
REQ-12.04.04-TS-0100.0010	Common configuration	????	#N/A
REQ-12.04.04-TS-0100.0020	Data access consistency	????	#N/A
REQ-12.04.04-TS-0200.0010	Target Times Display	REQ-06.08.04-OSED-0500.0050	Arrival info on DMAN display
REQ-12.04.04-TS-0200.0010	Target Times Display	REQ-06.08.04-OSED-0500.0090	Single HMI for Tower.
REQ-12.04.04-TS-0200.0020	Start-up clearance indicator	REQ-06.08.04-BASIC DMAN OSED-HMI.002	Basic DMAN Delivery HMI – Flight status
REQ-12.04.04-TS-0200.0030	System changes highlight	REQ-06.08.04-OSED-0500.0090	Single HMI for Tower.
REQ-12.04.04-TS-0200.0040	TSAT Manual entry priority	REQ-06.08.04-BASIC DMAN OSED-HMI.004	Basic DMAN Delivery HMI – Manual insertion of a flight in the sequence
REQ-12.04.04-TS-0200.0050	Display EXOP during route modification	REQ-06.07.02-OSED-HMI.0002	Change route
REQ-12.04.04-TS-0200.0050	Display EXOP during route modification	REQ-06.09.02-OSED-LIS-0005	Towed aircraft

Table 4: TS requirements traceability

Requirement Identification	Requirement title	Requirement description	Verification Method

Requirement Identification	Requirement title	Requirement description	Verification Method
REQ-12.04.04-TS-0010.0010	EXOP calculation	The surface routing function shall receive for each flight plan the departure runway from the departure management and use: •the TOBT (if available, the EOBT otherwise), •parking position, •aircraft type, •departure runway, •expected traffic during taxiing. to calculate the EXOP accordingly.	<Test>
REQ-12.04.04-TS-0010.0020	EXOP update	The surface routing function shall receive the departure runway, the TTOT and the TSAT for each flight plan from the departure sequencing function and shall calculate EXOP updates, if it is necessary.	<Test>
REQ-12.04.04-TS-0010.0030	TTOT updates	The departure sequencing function shall provide to the surface routing function an update of TTOT whenever it changes by more than <parameter_1 TBD>.	<Test>
REQ-12.04.04-TS-0010.0040	TSAT updates	The departure sequencing function shall provide to the surface routing function an update of TSAT whenever it changes by more than <parameter_2 TBD>.	<Test>
REQ-12.04.04-TS-0020.0010	EXOP provision	The departure sequencing function shall receive the EXOP from the surface routing function for each flight plan and shall calculate the TTOT and TSAT and thus the optimal departure sequence.	<Test>
REQ-12.04.04-TS-0020.0020	TTOT stability	If changes in the push-back (TSAT) sequence occur, the departure sequencing function shall check if the existing departure (TTOT) sequence can still be realized (e.g. by using the multiple line-up alternatives at the specific runway). Only if this is no more possible the departure sequence is also updated.	<Test>
REQ-12.04.04-TS-0020.0030	Standard EXOP	The departure sequencing function shall be able to use static taxi time data in case the surface routing functionality cannot provide EXOP.	<Test>
REQ-12.04.04-TS-0030.0010	Planned traffic estimate	The surface routing function shall estimate the planned traffic of inbound and outbound flights on the airport surface and take it into account to calculate precise EXOP.	<Test>
REQ-12.04.04-TS-0030.0020	Runway holding point selection by Departure Management	The Departure Management shall identify the runway holding point at the same time than the allocated departure runway.	<Test>
REQ-12.04.04-TS-0100.0010	Common configuration	The departure management and the Surface Routing Management shall be designed in such a way that the configuration for a same data (such as data related with airport layout or topology) contains the same information.	<Test>
REQ-12.04.04-TS-0100.0020	Data access consistency	Data access for the departure management and the surface routing function shall be design as such that changes to data common (e.g. flight plan data) for the two functional blocks are processed at the same time.	<Test>
REQ-12.04.04-TS-0200.0010	Target Times Display	The system HMI shall present the following data on the same display than the one used by the controller to enter clearances in the system: - TSAT for start-up clearances - TTOT for take-off clearances	<Test>
REQ-12.04.04-TS-0200.0020	Start-up clearance indicator	The system HMI shall indicate specifically when a start-up clearance can be issued according to the TSAT, this indication is on the same display than	<Test>

Requirement Identification	Requirement title	Requirement description	Verification Method
		the TSAT.	
REQ-12.04.04-TS-0200.0030	System changes highlight	The system HMI shall highlight to the controller any changes performed by the system to the TSAT and TTOT.	<Test>
REQ-12.04.04-TS-0200.0040	TSAT Manual entry priority	The departure function shall prevent any change done to the TSAT when this value has been set by the operator.	<Test>
REQ-12.04.04-TS-0200.0050	Display EXOP during route modification	The system HMI shall display the EXOP duration while the route is modified by the operator.	<Test>

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519 *Table 5: TS requirements Verification Methods*

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