



EPISODE 3

Single European Sky Implementation support through Validation



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EXECUTIVE SUMMARY

This document is annex to the General SESAR Detailed Operational Description (DOD G). This document contains the Use Cases developed in various Work Packages “*Operational Concept Refinement*” (WPX.2.2) of the Episode 3 project. They intend to further specify the Detailed Operational Descriptions which are produced in Episode 3 *WP2.2 “Clarification and Refinement of SESAR ConOps”* (WP2.2) and will be disseminated to the SESAR Joint Undertaking.



1 INTRODUCTION

This document is annex to the General SESAR Detailed Operational Description (DOD G) [1]. This document contains the Use Cases developed in various Work Packages “*Operational Concept Refinement*” (WPX.2.2) of the Episode 3 project. They intend to further specify the Detailed Operational Descriptions which are produced in Episode 3 *WP2.2 “Clarification and Refinement of SESAR ConOps”* (WP2.2) and will be disseminated to the SESAR Joint Undertaking.

In total fourteen Use Cases were produced. They describe nominal and non-nominal situations, assumptions, roles and responsibilities of the different actors.

The first choice of Use Cases was based on the needs expressed by the Episode 3 validation activities leaders. They are linked to Operational Scenario(s) for which a specific situation/step is detailed.



2 UC-03 IDENTIFY FLIGHT BEFORE TAXI-OUT

2.1 SCOPE

System, black-box.

2.2 LEVEL

User Goal.

2.3 SUMMARY

This use case describes how a Tower Ground 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.

In normal circumstances the correlation between the flight and the surveillance track is established automatically. The Tower Ground Controller is informed of the correlation established and may take control back from the automated process any time it is required, in particular to correlate manually one track with a flight (manual correlation) or to release manually the established correlation in order to solve exceptional error cases.

2.4 ACTORS

2.4.1 Primary Actor

Tower Ground Controller¹ (primary) - wants to identify the flight before the aircraft starts to push or to taxi in the airport manoeuvring area.

2.4.2 Supporting Actor(s)

Flight Crew (support) – has to activate the Mode-S transponder² on the issued Mode 3/A code and flight identification.

2.5 PRECONDITIONS

A Reference Business Trajectory (RBT) has been agreed for the departing flight and published in the NOP.

The Flight Crew has received its departure clearance.

The System knows the flight plan and RBT (i.e. surface movements, the aircraft allocated to the flight, equipment status, etc...).

¹ Assumption is made here that Apron Control is part of Ground Control. However, some airports may have a distinct Apron Controller handing over to Ground Control after aircraft has left the apron.

² And/or ADS equipment.



The airport area is covered by a Mode-S multilateration system³.

The airport is equipped with Advanced Surface Movement and Guidance Control System (A-SMGCS, surveillance function), bringing support to the Tower Ground Controller for identification and positioning of mobiles on the airport movement area.

The aircraft is equipped with a Mode-S transponder⁴.

The System has assigned a conspicuity code (Mode 3/A code) for the flight.

The Flight Crew has entered the 4-digit Mode 3/A code and flight identification⁵ through the FMS or transponder control panel (according to aircraft equipment).

2.6 POSTCONDITIONS

2.6.1 Success End State

The System records the RBT, mentioning that the flight has been identified and that all information with respect to flight identification, Mode 3/A code, 24-bit address and equipage is consistent between the RBT and received surveillance track.

The Tower ground Controller can deliver the start-up / push-back clearance to the pilot.

2.6.2 Failure End State

The System is unable to correlate the RBT electronically with any target displayed upon the airport A-SMGCS Display. The flight has not been identified.

2.7 NOTES

The use case is focusing on the identification process; the handling of departure by ATC is addressed in a separate use case “Ensure Taxi-Out”.

The use case only covers IFR flights.

2.8 TRIGGER(S)

The use case starts when the pilot requests, using datalink, the start-up / push-back clearance.

2.9 MAIN FLOW

1. The Flight Crew activates⁶ the Mode-S transponder⁷ (and/or ADS equipment) on the issued Mode 3/A code and flight identification (included in the RBT).

³ And/or ADS system.

⁴ And/or ADS capable.

⁵ Flight identification (e.g. DAT1349) is composed of a 3-letter ICAO designator, followed by flight identification number.

⁶ This activation allows the flight identification (“call-sign”) to be displayed on ATC screen.



2. The System detects the aircraft, establishes automatic correlation, using the Mode 3/A code, the flight's identification and 24-bit-address.
3. The Tower Ground Controller identifies the flight by using the information presented by the system regarding the flight and confirmed by the flight crew.
4. The use case ends when the Tower Ground Controller notifies the System to record that the flight is identified.

2.10 ALTERNATIVE FLOWS

2.10.1 [2] – The system displays a different airframe in the reported location (Incorrect identification)⁸

5. The Tower Ground Controller contacts the Flight Crew by R/T to verify the situation.
6. The Flight Crew⁹ verifies the airframe number of the aircraft and confirms the correct correlation to the System.
7. The System updates the assigned aircraft (airframe) to the flight.
8. The flow returns to step 2.

2.10.2 [2] – The system detects an inconsistency between the assigned Mode 3/A code and flight's identification in the flight plan and the observed one, due to Flight Crew error¹⁰

9. The Tower Ground Controller contacts the Flight Crew by R/T to check the mode 3/A code and flight identification in order to remedy the situation.
10. The Flight Crew corrects the information in their on-board system.
11. The flow returns to step 2.

⁷ In the current operations, transponders are not switched from SBY to ON until the runway threshold. The reason is to prevent over-interrogation of the MSSR leading to garbling etc. However, Mode S does not suffer this limitation, hence it can be switched on at push-back (label clutter may be possible but this is a HMI/procedures issue).

⁸ This is the case of detection of incorrect 24-bit-address.

⁹ Flight Crew for this Use Case could also include ground personnel licensed to perform ground taxi movement or a licensed tug operator.

¹⁰ This alternate flow has to be confirmed (case of detection of incorrect mode 3/A code or flight identification) sine it is unsure that a flight operating in a Mode S environment will still need a 4096 transponder.



2.10.3 [2] – The System detects an inconsistency between the equipment definition in the flight plan and the equipment definition of the aircraft

12. The System notifies the Tower Ground Controller with the detected inconsistency.
13. The Tower Ground Controller contacts the Flight Crew by R/T to verify the situation and corrects the flight plan by updating the equipment description of the aircraft.
14. The flow returns to step 2.

2.11 FAILURE FLOWS

2.11.1 [2] – The System is unable to correlate the RBT electronically with any target observed upon the airport A-SMCGS Display (i.e. no target corresponding to the Mode S 24-bit-address)

15. The Tower Ground Controller informs the Flight Crew via R/T that there is no visible target with the corresponding airframe number.
16. The Use Case ends when the System records that the flight has not been identified.



3 UC-05 HANDLE AIRCRAFT LANDING

3.1 SCOPE

System, black-box.

3.2 LEVEL

User Goal.

3.3 SUMMARY

This Use Case describes how the Tower Runway Controller uses the System to control the landing of an aircraft.

It starts when the intermediate approach phase is completed and the aircraft is ready for final approach and ends when the Tower Runway Controller is ensured that the aircraft has vacated the runway.

All actions take place in the Execution Phase.

3.4 ACTORS

3.4.1 Primary Actor

Tower Runway Controller (Primary) – wants to make sure that the aircraft lands and safely vacates the runway.

3.4.2 Supporting Actor(s)

Flight Crew (Support) – has to land the aircraft safely.

Executive Controller (Arrival TMA) (Offstage) – has to take control of the aircraft back from the Tower Runway Controller in case of a missed approach and wants to be informed of any runway closure.

Tower Ground Controller (Offstage) – has to assume responsibility for the control of the aircraft right after vacating the runway.

3.5 PRECONDITIONS

The Flight Crew has been cleared for the final approach by the Executive Controller (Arrival TMA).

The transfer of responsibility between the Executive Controller (Arrival TMA) and the Tower Runway Controller is completed. In particular the communication contact, Radio Telephony (R/T) and Data Link (D/L) between the Tower Runway Controller and the Flight Crew is established.

The System has informed the Flight Crew via data link on the runway configuration and the weather conditions at the airport (e.g. wind, visibility).



The System knows the final approach procedure (profile, speed constraints, missed approach), the flight's ground segment of the Reference Business Trajectory (RBT) - i.e. proposed runway exit for the aircraft and the taxi plan to the assigned stand.

3.6 POSTCONDITIONS

3.6.1 Success End State

The System records that the aircraft has vacated the runway and the communications have been transferred to the Tower Ground Controller for the arrival taxi.

3.6.2 Failure End State

The System records that the landing has been aborted. The System knows the current flight status e.g. either resuming a landing sequence or is returning to the holding area.

The System records that the aircraft has not vacated the runway.

3.7 NOTES

Under normal circumstances a flight that is unable to land will carry out a Missed Approach Procedure (MAP). However that does not preclude the Controller (Approach/Tower) issuing alternative instructions. For the purposes of this Use Case, it is assumed that a MAP will be the norm as appropriate.

3.8 TRIGGER(S)

The Use Case starts when the System detects the transfer of responsibility between the Executive Controller (Arrival TMA) and the Tower Runway Controller is completed.

3.9 MAIN FLOW

1. The Tower Runway Controller, using the System, verifies that the runway is free of obstacles for the landing of the aircraft.
2. The Tower Runway Controller issues the landing clearance using R/T and monitors the aircraft's final approach to ensure safety.
3. The Flight Crew lands the aircraft. The System detects the landing¹¹ and updates the RBT with the Actual Landing Time (ALDT) if necessary.
4. The Tower Runway Controller, by visual reference, or assisted by the System, verifies that the aircraft has vacated the runway.
5. The System detects that the aircraft has vacated the runway via the planned¹² exit and updates the RBT if necessary.

¹¹ Landing means that the aircraft remains on the surface and decelerates.

¹² "planned" exit means the one stipulated in the RBT.



6. The System instructs the Flight Crew to transfer communications to the Tower Ground Controller.
7. The Use Case ends when the System records that the aircraft has safely vacated the runway.

3.10 ALTERNATIVE FLOWS

3.10.1 [6,14] – System-initiated communication transfer is unavailable

8. The System informs the Tower Runway Controller about the unavailability of the automatic initiation of communication transfer.
9. The Tower Runway Controller instructs the Flight Crew to contact the Tower Ground Controller using R/T.
10. The flow returns to step 7.

3.10.2 [5] – The aircraft fails to vacate the planned runway exit

11. The System detects and notifies the Tower Runway Controllers that the aircraft has missed the planned runway exit.
12. The Tower Runway Controller issues to the Flight Crew by R/T an instruction for vacating the runway via an alternative exit.
13. The System updates the RBT taxi plan for approval by the Tower Ground Controller¹³.
14. The System instructs the Flight Crew to transfer communications to the Tower Ground Controller.
15. The flow continues at step 7.

3.10.3 [5] – The runway exit time differs significantly from the taxi plan

16. The System detects and computes the time deviation.
17. The system updates the RBT accordingly (e.g. the estimated in-block time).
18. The System instructs the Flight Crew to transfer communications to the Tower Ground Controller.

¹³ The approval of the taxi plan will be transmitted to the Flight Crew as part of the taxi clearance.



19. The flow continues at step 7.

3.10.4 [2] – The System detects that the aircraft deviates significantly from the final approach procedure (profile, speed constraint)

20. The system detects that the aircraft is deviating significantly from the final approach procedure (profile, speed constraint) and notifies the Flight Crew and the Tower Runway Controller.
21. The Tower Runway Controller contacts the Flight Crew using R/T and warns the Flight Crew of the deviation.
22. The flow continues at step 3.

3.11 FAILURE FLOWS

3.11.1 [1] – The Runway is not free of obstacles (e.g. due to an Aborted Take-off)

23. The Tower Runway Controller is unable to issue the landing clearance. The Tower Runway Controller instructs the Flight Crew to execute a missed approach, notifies the System of the missed approach and instructs the Flight Crew by R/T to contact the Approach Executive Controller.
24. The Use Case ends when the System records that the aircraft has not landed.

3.11.2 [5] – The Flight Crew is unable to land

25. The Flight Crew informs the Tower Runway Controller that he is unable to land, initiates a go-around, states his intentions and requests an alternative clearance to meet his intentions.
26. The Tower Runway Controller issues the appropriate missed approach instructions to the Flight Crew, notifies the System of the missed approach and instructs the Flight Crew by R/T to contact the Approach Executive Controller¹⁴.
27. The Use Case ends when the System records that the aircraft has not landed.

3.11.3 [6] – The Flight Crew does not vacate the Runway

28. The Tower Runway Controller, assisted by the System, detects that the aircraft is obstructing the runway.

¹⁴ The flight will be re-inserted in the landing sequence and then a new estimate for the landing time will be calculated.



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29. The Tower Runway Controller confirms with the Flight Crew that he has not vacated the runway and notifies the System that the runway is obstructed for an undefined period.
30. The system invalidates the taxi plan and the estimated in-block time.
31. The Use Case ends when the System disseminates the runway obstruction.



4 UC-08 ENSURE TAXI-OUT

4.1 SCOPE

System, black-box.

4.2 LEVEL

User Goal.

4.3 SUMMARY

This use case describes how the Tower Ground Controller, with the support of the Flight Crew, 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 the Flight Crew requests push-back and start-up clearance, and ends when the Flight Crew is instructed to contact the Tower Runway Controller, usually when the aircraft is at the runway holding area.

4.4 ACTORS

4.4.1 Primary Actor

Tower Ground Controller¹⁵ (primary) – has to ensure the safe and expeditious movement from the aircraft stand to the runway holding point.

4.4.2 Supporting Actor(s)

Flight Crew (support) – wants to move aircraft from aircraft stand to departure runway.

Tower Runway Controller (support) – has to assure safety of departing and arriving aircraft within the runway protected area.

4.5 PRECONDITIONS

The airport is equipped with Advanced – Surface Movement and Guidance Control System (A-SMGCS) Level 4 (see ref [2]), bringing support for guidance of mobiles on the airport movement area.

¹⁵ Assumption is made here that Apron Control is part of Ground Control. However, some airports may have a distinct Apron Controller handing over to Ground Control after aircraft has left the apron.



A Reference Business Trajectory (RBT) for the departing flight has been agreed/recorded in the NOP and has been up-linked by the on-board system (aircraft FMS). The flight is operating under instrument flight rules and is requesting ATC separation services.

The departure clearance has been issued for the flight.

Ground handling is completed, aircraft doors are closed and the Flight Crew is ready to leave aircraft stand.

The Flight Crew has R/T contact with the Tower Ground Controller.

4.6 POSTCONDITIONS

4.6.1 Success End State

The aircraft is at the runway holding point and the System (A-SMGCS) records that the departing flight has been transferred to the Tower Runway Controller.

4.6.2 Failure End State

The aircraft has gone back on stand or holding bay and the System (A-SMGCS) records the reason for the interruption to the aircraft departure.

4.7 NOTES

The ground movement of an aircraft is considered as part of the Business Trajectory by SESAR. However, it is not practical to issue the ground taxi plan before the a/c indicates that it has completed the boarding process and is ready for engine start and push back. The filed SBT (Shared Business Trajectory) will contain generic times/routings for ground taxi but, except at airports where no options exist, will not specify the precise routing. The ground taxi portion of the RBT will be instantiated by the Tower Ground Controller when the flight crew indicates that it is ready for push/start. At this point the System (A-SMGCS) will calculate the most advantageous routing, taking into account the a/c preferred departure slot (if any) and provide it to all concerned actors via SWIM i.e. the Flight Crew, the Tower Ground Controller and the Ground Handler. The proposed taxi plan will be synchronously added to the Business Trajectory, refining the generic data agreed with the RBT.

It is also assumed that each time the RBT is updated in the System (whether made by ATC Control or the Flight Crew), all parties involved will automatically share this update via the NOP. Thus, a RBT update performed by Ground control will automatically be up-linked to the aircraft. Likewise, any on-board change to the RBT will be automatically down-linked into Ground systems.

Assumption is made that R/T communication is always available (i.e. the Use Case does not cover voice communication failure). Also, when not specified, it is assumed that communication between Tower Ground Controller and the Flight Crew may be performed either by voice or datalink.

An assumption is also made that the aircraft considered in this use case is at a terminal gate and needs a full pushback/start-up procedure. However, in some cases, the pushback part might be skipped (only start-up needed) when the configuration of the stand allows the aircraft to directly move forward and taxi out.



4.8 TRIGGER(S)

The use case starts when the Flight Crew requests push-back and start-up clearance.

4.9 MAIN FLOW

1. The Flight Crew requests push-back/start-up clearance via the System (A-SMGCS).
2. The System (A-SMGCS) validates that the departure clearance for the flight has been issued, updates the RBT taxi plan if needed and presents the push-back/start-up clearance request to the Tower Ground Controller.
3. The Tower Ground Controller issues the push-back/start-up clearance to the Flight Crew, using the System (A-SMGCS).
4. The System (A-SMGCS) notifies the Flight Crew of the push-back/start-up clearance.
5. The Flight Crew proceeds to aircraft push-back/start-up¹⁶ and informs the Tower Ground Controller (after push-back/start-up completion) that he is ready for taxi.
6. The Tower Ground Controller issues the taxi clearance by voice or datalink.
7. The Flight Crew starts taxiing, manoeuvring the aircraft in accordance with the RBT taxi plan.
8. The System (A-SMGCS) detects the aircraft movement¹⁷ and tracks its progress against the RBT taxi plan. The System (A-SMGCS) displays the progress of the aircraft to both the Tower Ground Controller and the Flight Crew and updates the RBT if necessary.
9. The Use Case ends when the aircraft has reached the runway holding point. The System (A-SMGCS) transfers control and communication of the aircraft to the Tower Runway Controller.

4.10 ALTERNATIVE FLOWS

4.10.1 [3] – The Tower Ground Controller Delays Issue of the Push-Back Clearance

10. The Tower Ground Controller informs the Flight Crew that the request is denied (including the reason for denial) and provides the new TSAT. The RBT is updated in the System.
11. The System (A-SMGCS) sets up a Reminder for the clearance to be issued a given time before the TSAT.

¹⁶ Start-up is in accordance with published local procedures.

¹⁷ See Use Case “Identify Flight before Taxi-out”.



12. The System (A-SMGCS) notifies the Tower Ground Controller of the clearance reminder¹⁸.
13. The Flow continues at step 3.

4.10.2 [6] – The Tower Ground Controller Delays Issue of the Taxi Clearance

14. The Tower Ground Controller informs the Flight Crew that his taxi clearance is denied including the reason for denial and updates the RBT (i.e. start time of the taxi phase) in the System.
15. The Flow continues at step 6.

4.10.3 [5] – The Flight Crew Is Not Ready to Taxi the Aircraft (Before Receiving Taxi Clearance)

16. The Flight Crew informs the Tower Ground Controller that he is not ready to taxi, providing time information regarding the delay. The Flight Crew updates the RBT (i.e. start time of the taxi phase) in the System.
17. The Flow continues at step 5.

4.10.4 [7] – The Flight Crew Is Not Ready to taxi The Aircraft (After Receiving Taxi Clearance)

18. The Flight Crew informs the Tower Ground Controller that he is not ready to taxi, providing time information regarding the delay. The Tower Ground Controller cancels the taxi clearance¹⁹ and updates the RBT (i.e. start time of the taxi phase) in the System.
19. The Flow continues at step 5.

4.10.5 [4] – The Flight Crew Is Not Ready to Push-Back (After Receiving Clearance)

20. The Flight Crew informs the Tower Ground Controller that he is no longer ready to push-back. The Tower Ground Controller cancels the push-back/start-up clearance and updates the RBT (i.e. with a new TSAT) in the System²⁰.
21. The Flow continues at step 1.

¹⁸ A given time before TSAT.

¹⁹ This does not cancel the ground taxi portion of the RBT: only the authorization to proceed.

²⁰ The allocation of a new TSAT by the Tower Ground Controller is possible only if the delay provided by the Flight Crew is reasonable enough to prevent a RBT renegotiation.



4.10.6 [Anywhere] – The Tower Ground Controller Wants to Modify the Taxi Plan

22. The Tower Ground Controller modifies the taxi plan for the Flight in the System.
23. The System (A-SMGCS) estimates the resulting impact on the RBT (i.e. recomputes all RBT times) and validates the values with respect to departure sequence. The System (A-SMGCS) modifies the RBT taxi plan accordingly.
24. The flow returns to the original calling step.

4.10.7 [7] – The System (A-SMGCS) Detects a Deviation of Aircraft from Planned Route

25. The System (A-SMGCS) sends a deviation from route warning to the Tower Ground Controller and the Flight Crew. The System (A-SMGCS) presents one or more advisories to the Tower Ground Controller to resolve the deviation.
26. The Tower Ground Controller takes account of the advisories and guides the aircraft to recover the planned route track.
27. The flow continues at step 7.

4.10.8 [Anywhere] – The System (A-SMGCS) Detects a Hazardous Situation²¹

28. The System (A-SMGCS) issues a conflict alert to the Flight Crew and to the Tower Ground Controller.
29. When alerted, the Tower Ground Controller acknowledges and responds to system warnings by issuing instructions to the Flight Crew via voice.
30. The Flight Crew (and other Flight Crews and/or Vehicle Drivers concerned) acknowledges and responds to system warnings and controller instructions, by adjusting the movement of the aircraft.
31. The flow returns to the original calling step.

²¹ Hazardous situations detected by the Tower Ground Controller are resolved via voice contact.



4.11 FAILURE FLOWS

4.11.1 [Anywhere] – The Tower Ground Controller Wants to Cancel Departure Movement (e.g. blocked runway[s])

32. The Tower Ground Controller informs the Flight Crew that the departure clearance is cancelled including the reason for cancellation.
33. The Tower Ground Controller cancels all previous clearances of the RBT and reverts it into a SBT²².
34. The Tower Ground Controller requests from the System (A-SMGCS) a stand and return taxi route for the cancelled flight.
35. The System (A-SMGCS) issues a stand²³ and a return taxi route to the Tower Ground Controller.
36. The Tower Ground Controller issues taxi route instructions²⁴ to the Flight Crew to return to stand.
37. The Use Case ends when the System (A-SMGCS) records that the Flight has returned to stand.

4.11.2 [34,35²⁵] – The Tower Ground Controller wants to manually input the stand and return taxi route for the cancelled flight

38. The Tower Ground controller inputs the stand and return taxi route in the System (A-SMGCS).
39. The System (A-SMGCS) checks and validates the input stand and return taxi route.
40. The flow continues at step 36.

²² The RBT should be reverted into a SBT as soon as the departure is cancelled. This will allow execution phase activities to disregard this flight (i.e. no longer a RBT) while planning activities should take it into account again (i.e. active SBT).

²³ In all cases, a parking position should be provided.

²⁴ Since the flight has no longer a RBT but a SBT, new taxi route instructions must be issued to supersede previous RBT-related clearances.

²⁵ This alternative flow also branches at step 35 in case the Tower Ground Controller still wants to manually input a stand and return taxi route after one (or several) tentative(s).



4.11.3 [39] – The System (A-SMGCS) does not validate the input stand and return taxi route (e.g. busy stand or taxi route)

41. The System (A-SMGCS) informs the Tower Ground controller that the input stand and return taxi route are not valid.
42. The flow continues at step 35.

4.11.4 [1,2,3,4] – The Flight Crew Wants to Cancel Departure²⁶ (while at stand)

43. The Flight Crew informs the Tower Ground Controller that he cancels departure.
44. The Tower Ground Controller cancels all previous clearances of the RBT and reverts it into a SBT²⁷.
45. The Use Case ends when the System (A-SMGCS) records that the flight departure has been cancelled.

4.11.5 [Anywhere from step 5] – The Flight Crew Wants to Cancel Departure (during taxiing)

46. The Flight Crew informs the Tower Ground Controller that he cancels departure.
47. The Use Case continues at step 33.

²⁶ Assumption is made that the Flight Crew wants only to cancel departure and not the flight itself (i.e. the intention of the airspace user is to maintain flight operations at a later departure time).

²⁷ The RBT should be reverted into a SBT as soon as the departure is cancelled. This will allow execution phase activities to disregard this flight (i.e. no longer a RBT) while planning activities should take it into account again (i.e. active SBT).



5 UC-12 ENSURE TAXI-IN

5.1 SCOPE

System, black-box.

5.2 LEVEL

User Goal.

5.3 SUMMARY

This use case describes how the Tower Ground Controller, with the support of the Flight Crew, ensures the safe movement of a flight from the runway exit to the allocated stand following the taxi plan²⁸. It also ensures that any deviation from schedule (i.e. EIBT) is notified through an update of the RBT in the NOP.

The use case starts when the aircraft exits the runway and is in R/T contact with the Tower Ground Controller. It covers taxiing in and ends when the aircraft is in-block.

5.4 ACTORS

5.4.1 Primary Actor

Tower Ground Controller (primary) - has to ensure safe, expeditious ground movement of aircraft and vehicles on the movement area (taxiing).

5.4.2 Supporting Actor(s)

Flight Crew (support) - wants to arrive at the designated stand/gate/parking on schedule.

Vehicle Driver (support) – has to acknowledge and respond to System warnings and controller instructions in case of hazardous situations (i.e. potential conflicts).

5.5 PRECONDITIONS

The airport is equipped with Advanced – Surface Movement and Guidance Control System (A-SMGCS – Level 4), bringing support for guidance of mobiles on the airport movement area.

The taxi plan is available as part of the ground segment of the RBT for the Flight Crew and the Tower Ground Controller.

The Tower Ground Controller and the System know the allocated stand.

The Flight Crew has R/T contact with the Tower Ground Controller.

²⁸ See Use Case 05 handle Aircraft Landing.



5.6 POSTCONDITIONS

5.6.1 Success End State

Aircraft is in-block. The System records the arrival of the aircraft on the designated stand.

5.6.2 Failure End State

The aircraft is parked at the wrong stand.

5.7 NOTES

The ground movement of an aircraft is considered as part of the Business Trajectory by SESAR. However, it is not practical to issue the definitive arrival taxi plan before the a/c is in final approach. The published RBT (Reference Business Trajectory) will contain generic times/routings for ground taxi but, except at airports where no options exist, will not specify the precise routing. The ground taxi portion of the RBT will be instantiated by the Tower Ground Controller when the flight is in final approach. At this point the System will calculate the most efficient routing, taking into account the airport movement plan, the designated arrival stand etc., and provide it to all concerned actors via SWIM i.e. the Flight Crew, the Tower Ground Controller and the Ground Handler.

It is also assumed that each time the RBT is updated in the System, all parties involved will automatically share this update via the NOP. Thus, a proposed RBT update performed by Ground control will automatically be made available to the Flight for acceptance. Likewise, any on-board updates to the RBT will be automatically down-linked into Ground systems.

Assumption is made that R/T communication is always available (i.e. the Use Case does not cover voice communication failure).

The crossing of active runways by aircraft is not addressed.

5.8 TRIGGER(S)

The use case starts after the aircraft has vacated the landing runway.

5.9 MAIN FLOW

1. The Tower Ground Controller issues a taxi-in clearance validating the taxi plan. The Flight Crew acknowledges the clearance and follows the designated route using visual navigation aids (e.g. taxiway lighting) and the guidance information displayed in the cockpit.
2. The Tower Ground Controller uses the System to monitor the progress of the aircraft with regard to the taxi plan (e.g. taxi route, speed, designated stand) and other surface traffic and information relating to airport resources usage and environment (stand status, obstacles, taxiways in service, etc ...).
3. The System performs the detection of potential hazardous situations for the aircraft (e.g. conflict with fixed and mobile obstructions, with protected areas or movement on a closed taxiway).



4. The use case ends when the aircraft is in-block at the stand and the System records the actual in-block time (AIBT).

5.10 ALTERNATIVE FLOWS

5.10.1 [1] – Inconsistency in the taxi plan provided by the System

5. The Flight Crew rejects the taxi plan proposed by the System and informs the Tower Ground Controller of the reason for rejection.
6. The Tower Ground Controller uses the System to create a new taxi plan which is displayed to the Flight Crew.
7. The flow resumes at step 1.

5.10.2 [2] – Deviation from the cleared taxi plan is detected

8. The System issues an alert to the Tower Ground Controller, and proposes an alternative taxi plan (including update of the EIBT) to the Tower Ground Controller for approval.
9. The Tower Ground Controller acknowledges the proposal²⁹ and issues the appropriate new taxi clearances.
10. The Flight Crew acknowledges the controller instructions.
11. The flow continues at step 2.

5.10.3 [3] – The System Detects an Hazardous situation

12. The System issues a conflict alert to the Flight Crew and to the Tower Ground Controller.
13. When alerted, the Tower Ground Controller acknowledges and responds to System warnings by issuing instructions to the Flight Crew and/or Vehicle Drivers via R/T.
14. The Flight Crew (and other Flight Crews or Vehicle Drivers concerned) acknowledges and responds to System warnings and controller instructions, by adjusting the movement of the aircraft/vehicles. The system updates the RBT (e.g. EIBT) if necessary.
15. The flow continues at step 3.

²⁹ The alternative taxi plan is then automatically displayed to the Flight Crew (see “Notes” section).



5.10.4 [1,2,3] – A change of arrival stand allocation has occurred

16. The System informs the Flight Crew and the Tower Ground Controller about the change and proposes a change to the taxi plan.
17. The Tower Ground Controller validates the new taxi plan and issues a revised clearance to the Flight Crew.
18. The Flight Crew accepts the new taxi plan and updates the RBT which is made available in the NOP through SWIM.
19. The flow resumes at the original calling step.

5.11 FAILURE FLOWS

5.11.1 [Anywhere] – Flight fails to arrive at the designated stand for whatever reason

20. The System records that the flight has failed to arrive at its designated stand and its current position.



6 UC-17 MODIFY DEPARTURE SEQUENCE BY TOWER RUNWAY CONTROLLER

6.1 SCOPE

System, black-box.

6.2 LEVEL

User Goal.

6.3 SUMMARY

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.

6.4 ACTORS

6.4.1 Primary Actor

Tower Runway Controller (primary) - wants to modify the planned Departure Sequence by changing the position of a flight in the sequence.

6.4.2 Supporting Actor(s)

None.

6.5 PRECONDITIONS

The System knows the planned Departure Sequence for flights departing from the concerned airport.

There is a given System time parameter from which the planned Departure Sequence is considered "stable" (i.e. that part of the sequence can now be modified only by a manual intervention of the controller). In practice, this applies to flights in the sequence whose Estimated Off-Block Time (EOBT) is close (i.e. less than the given time parameter) or that have been cleared for start-up/push back or are pushing back or taxiing.

The System knows which flight(s) in the Departure Sequence are eligible³⁰ for manual re-sequencing by the Tower Runway Controller.

The System knows all Reference Business Trajectories (RBTs) for the flights present in the Departure Sequence.

³⁰ In case a flight is already constrained at arrival or En-Route, it will be "eligible" for manual re-sequencing only if the time shift does not require a revision of the RBT.



6.6 POSTCONDITIONS

6.6.1 Success End State

The planned Departure Sequence has been updated with the sequence change.

6.6.2 Failure End State

The Departure Sequence does not change.

6.7 NOTES

The Departure Sequence specifies the **order** and **time** at which the flights are planned to take-off as well as any applicable constraints.

The use case is only activated in case of tactical changes to the planned departure sequence.

This use case does not address the insertion of a new flight³¹ into the planned departure sequence.

6.8 TRIGGER(S)

The use case starts when the Tower Runway Controller decides to change the planned Departure Sequence using the System.

6.9 MAIN FLOW

1. The Tower Runway Controller indicates to the System the flight and the desired position in the Departure Sequence.
2. The System updates the position of this flight in the Departure Sequence and its departure time accordingly (as well as for all the other flights impacted by this update), taking into account the applicable constraints (e.g. potential En-Route and/or arrival constraints associated to the RBT, departure runway rate and planned time at holding position) and validates that the result meets the constraints.
3. The Tower Runway Controller validates all changes proposed in the Departure Sequence.
4. The use case ends when the System records the changed Departure Sequence.

³¹ The insertion of a new flight is performed by the Tower Ground Controller (refer to the corresponding UC).



6.10 ALTERNATIVE FLOWS

6.10.1 [1] - The Tower Runway Controller wants to remove the flight from the Departure Sequence

5. The Tower Runway Controller indicates to the System the flight to be removed from the Departure Sequence.
6. The System removes the designated flight from the Departure Sequence.
7. The flow continues at step 2.

6.11 FAILURE FLOWS

6.11.1 [1,3,5] - The Tower Runway Controller decides to cancel the Departure Sequence change

8. The Tower Runway Controller informs the System that he wants to cancel the change in the Departure Sequence.
9. The use case ends in its failed state (the Departure Sequence is not changed).



7 UC-22 OBTAIN FLIGHT BRIEFING

7.1 SCOPE

System, black-box.

7.2 LEVEL

User Goal.

7.3 SUMMARY

This Use Case describes how the Flight Crew is supplied with all relevant information in order to plan or to execute a given flight, or to obtain generic information related to flights.

The process provides the knowledge to support the decision-making if a flight or a flight related action can be safely and efficiently performed.

The briefing will be provided for the selected flight intentions and will contain the type of information as specified in the selected user profile.

Before a flight, the Flight Crew will require detailed or updated information concerning the flight³².

7.4 ACTORS

7.4.1 Primary Actor

Flight Crew – wants to obtain the relevant aeronautical and meteorological briefing information for planning, preparing or executing the flight.

AOC Staff – wants to obtain the relevant aeronautical and meteorological briefing information for planning and preparing the commercial flight³³.

7.4.2 Supporting Actor(s)

AI Data Manager (Off stage) – has to provide pilot briefing information relevant to the proposed flight.

MET Data Manager (Off stage) – has to provide Meteorological information relevant to the proposed flight.

³² This UC does not cover the briefing update that could be received during the flight. There are many initiatives (AIS/MET Data Link, Cascade D-OTIS, SESAR WP 13, etc.) for providing updates of the briefing during the flight. This is directly supported the EFB devices for new aircraft types.

³³ For simplicity, the UC will only refer to the “Flight Crew” in the flows.



7.5 PRECONDITIONS

The Flight Crew (or AOC Staff) is identified to the System (e.g. logged on).

The Flight Crew (or AOC Staff) knows the destination city/airport name (ICAO designator).

7.6 POST CONDITIONS

7.6.1 Success End State

The Flight Crew (or AOC Staff) has received the relevant briefing information and is logged by the System.

The request for automatic update notifications has been recorded and the Flight Crew (or AOC Staff) has received confirmation that automatic update notification messages of the briefing information will be provided when available.

7.6.2 Failure End State

The System logs that the relevant briefing information was not delivered.

7.7 NOTES

7.7.1 Flight information briefing³⁴

The briefing information covers the following:

- Digital NOTAM (presenting a composite picture made of static information overlaid with dynamic/temporary AIS data);
- MET Information;
- DCB information: the Network Operations Plan for the area including capacities, constraints, DCB solutions, Airspace Use Plan for the indicated times (where applicable) Sectorization Schemes, Optimal available routing available based upon requested times, availability and applicability of 2D and 3D routes as well as self-separation airspace;
- Airspace availability information, Active military areas;
- GNSS NOTAM.

Mandatory briefing items that require acknowledgement are included as information with the briefing package. Since the System has no method of verifying delivery, this process does not satisfy the requirements of ICAO Annex 11³⁵ regarding the broadcast of this essential information.

³⁴ Also referred to as integrated Pre-Flight Information Bulletin (iPIB).

³⁵ ANNEX 11 Chapter 4.2.3.



7.7.2 Links

The Flight Information briefing is linked to the File a Flight Plan Web site and information entered in the Profile can be automatically transferred to the relevant areas of the Flight Plan form, i.e. Point of Departure, Destination Aerodrome and Alternate Airport.

7.7.3 Briefing Profile

A briefing profile is used to define the extent of the briefing report. It is used to define the parameters of the information request and does not require flight planning information, i.e. Aircraft identification, type, pilot etc.

The Briefing Profile Form provides the ability to request items of interest (e.g. MET or Dynamic AIS information) specific to the briefing profile.

7.8 TRIGGER(S)

The use case starts when the Flight Crew (or AOC Staff) enters a request in the System for briefing information.

7.9 MAIN FLOW

1. The Flight Crew (or AOC Staff³⁶) enters the profile request in the System.
2. The System assigns a profile identification number to the request and presents the profile form to the Flight Crew.
3. The Flight Crew selects the desired profile items and notifies the System.
4. The System collates the information required from (all sources available through) SWIM in order to compile the briefing information according to the profile and presents it graphically³⁷ to the Flight Crew.
5. The Flight Crew accepts the presented briefing.
6. The Flight Crew requests the System to baseline the briefing information for future comparison and notifies his intention to receive updates to the baseline (notification briefings)³⁸.

³⁶ For readability of the flows, only Flight Crew will be mentioned in main, alternative and failure flows. It is understood that “Flight Crew” must read “Flight Crew or AOC Staff”.

³⁷ Currently, the briefing is presented to the Flight Crew in the form of a report. In future (2020 SESAR Timeframe), using fully digital aeronautical information and meteo information, it is expected that the briefing information will become mainly graphical. For example, a map of the airport of departure with all items of interest highlighted, a map of the route, a map of the airport of arrival. The graphical briefing can significantly decrease the risk for the crew to miss important information, as compared to the traditional text report of a PIB. Because of the increase in the NOTAM amount world-wide, PIBs are becoming longer and longer. A radical change is needed and this can only come with a graphical approach. However, where appropriate they will still be supported by text.



7. The System records the message and message delivery.
8. The System flags the requested information sources for revised information and supplies the profile identification number as the destination.
9. The use case ends when the Flight Crew logs off from the System.

7.10 ALTERNATIVE FLOWS

7.10.1 [1] - The Flight Crew wants to view previously saved and updated data relating to the briefing

10. The Flight Crew chooses to select existing briefing data.
11. The Flight Crew enters the profile identification number to the System.
12. The System updates the saved data based on the previously defined profile and displays it to the Flight Crew in the form of a report.
13. The flow continues at step 5.

7.10.2 [13] - The Flight Crew wishes to update the saved briefing Parameters

14. The Flight Crew modifies the parameters of the profile request (i.e. additional Met reporting stations, different wind altitudes, etc...) and notifies the system.
15. The flow continues at step 4.

7.10.3 [5] - The Flight Crew decides not to save the briefing information

16. The Flight Crew informs the System not to save the briefing information.
17. The flow continues at step 9.

7.10.4 [4] - The System does not recognize an entered location identifier

18. The System identifies the unknown Location Identifier to the Flight Crew and a list of options for locating the correct identifier.

³⁸ Such updates are expected to be provided in-flight also. The Flight Crew shall indicate the “SWIM address” and the type of equipment/standard that is the target of the updates. For example, if future updates are expected on the EFB, the format of the updates might be different from a simple bulletin.



19. The Flight Crew selects the correct identifier.
20. The flow continues at step 4.

7.10.5 [3,14] - The Flight Crew does not know the location identifier

21. The Flight Crew requests from the System the 4-letter ICAO designator for the Met. Reporting station.
22. The flow continues at step 3,14.

7.10.6 [3,14] - The Flight Crew wishes the location (name) of reporting stations between Departure and Destination Aerodromes

23. The Flight Crew requests from the System the location of any Aerodromes/Met reporting stations between his Departure and Destination.
24. The System displays all known information as requested.
25. The flow continues at step 3,14.

7.10.7 [4] - Some of the information requested is not available

26. The System reports to the Flight Crew that some of the requested information is not available on line.
27. The Use Case continues at step 4.

7.11 FAILURE FLOWS

7.11.1 [Anywhere] - The Flight Crew decides to forgo further briefings

28. The Flight Crew decides for whatever reason (e.g. weather) that he no longer requires information updates and notifies the System.
29. The Use Case ends when the System records that the briefing request has been cancelled.

7.11.2 [2] - The System is unable to provide the briefing information

30. The System informs the Flight Crew that the System is unable to provide the briefing information.



31. The Use Case ends when the System logs that the relevant briefing information was not delivered.



8 UC-23 CHANGE OF RUNWAY CONFIGURATION

8.1 SCOPE

System, black-box.

8.2 LEVEL

User Goal.

8.3 SUMMARY

This use case describes how the ATS Supervisor [TWR]³⁹ uses the System during the Execution phase to update the runway configuration plan (as part of the Airport Operational Plan - AOP) due to a forecasted event. He is supported in the change to the runway configuration plan by the parent ATS Supervisor [APP] who selects the last arrival flight(s) for each concerned runway and by the Tower Runway Controller who selects the last departure flight(s). The selected flights will then determine the exact start time of the new runway configuration.

As a consequence of the update, the airport capacity may be impacted either positively or negatively. The capacity change(s) will be reflected in the new runway configuration plan of the AOP.

8.4 ACTORS

8.4.1 Primary Actor

ATS Supervisor [TWR] (primary) – wants to update the runway configuration plan.

8.4.2 Supporting Actor(s)

Tower Runway Controller (support) – has to select the last departure flight(s) for each concerned runway of the current configuration.

ATS Supervisor [APP] (support) – has to select the last arrival flight(s) for each concerned runway of the current configuration.

APOC Staff (off stage) – will have to align/update the AOP if a new runway configuration plan is recorded by the System (see section “Success End State”).

8.5 PRECONDITIONS

The System knows the current runway configuration plan and all possible runway configurations.

³⁹ SESAR defines various types of “ATS Supervisor”: ACC for En-Route, APP for Approach, TWR for Airport Tower.



8.6 POSTCONDITIONS

8.6.1 Success End State

The runway configuration plan is updated by the System in the AOP.

8.6.2 Failure End State

The runway configuration plan remains unchanged in the AOP.

8.7 NOTES

Updates to the runway configuration plan in the AOP are implicitly reflected in the NOP.

In this use case, the term “airport” is used to cover all types of aerodrome.

8.8 TRIGGER(S)

The use case starts when the ATS Supervisor [TWR] informs the System that he/she wants to update the runway configuration plan (e.g. active runway, runway mode, runway orientation, duration, with the associated taxi plans) in the AOP.

8.9 MAIN FLOW

1. The System presents the current runway configuration plan and all possible configurations.
2. The ATS Supervisor [TWR] selects a configuration to replace the current runway configuration plan at a specified start time.
3. The System presents the selected runway configuration plan to the ATS Supervisor [APP] and the Tower Runway Controller and proposes the last arrival and departure flights for each concerned runway satisfying at best the specified start time.
4. The ATS Supervisor [APP] accepts the proposal for the last arrival flight for each concerned runway.
5. The Tower Runway Controller accepts the proposal for the last departure flight for each concerned runway.
6. The System presents the selected last arrival and departure flights to the ATS Supervisor [TWR] and the resulting start time for the new runway configuration.
7. The ATS Supervisor [TWR] confirms the changes to the runway configuration plan.
8. The use case ends when the System records the changes the runway configuration plan in the AOP.



8.10 ALTERNATIVE FLOWS

8.10.1 [4,14] – The ATS Supervisor [APP] does not accept the last arrival flight(s)

9. The ATS Supervisor [APP] selects an alternative last arrival flight for each concerned runway.
10. The system re-determines the proposed last departure flight accordingly and presents it to the Tower Runway Controller.
11. The flow continues at step 5.

8.10.2 [5] – The Tower Runway Controller does not accept the last departure flight(s)

12. The Tower Runway Controller selects an alternative final departure flight for each concerned runway.
13. The system re-determines the last arrival flight(s) accordingly and presents them to the ATS Supervisor [APP].
14. The ATS Supervisor [APP] accepts the proposed last arrival flight for each concerned runway.
15. The flow continues at step 6.

8.10.3 [7] – The ATS Supervisor [TWR] wants to specify another start time for the runway configuration change

16. The ATS Supervisor [TWR] selects a configuration to replace the current runway configuration plan at another specified start time.
17. The flow continues at step 3.

8.10.4 [2, 16] – The ATS Supervisor [TWR] wants to change a configuration parameter⁴⁰

18. The ATS Supervisor [TWR] selects and changes the configuration parameter(s).
19. The flow continues at step 3 or 17.

⁴⁰ Configuration parameters (e.g. landing rate) are modified without permanently changing their default values.



8.11 FAILURE FLOWS

8.11.1 [2,7,16,18] – The ATS Supervisor [TWR] selects to cancel the update of the runway configuration plan

20. The ATS Supervisor [TWR] cancels the update process.
21. The use case ends when the System discards any uncommitted changes.



9 UC-31 REFINE A TARGET OFF-BLOCK TIME

9.1 SCOPE

System, black-box.

9.2 LEVEL

User Goal.

9.3 SUMMARY

The Use Case describes how an Airline Station Manager uses the System to refine the Target Off-Block Time (TOBT) of an outbound flight in order to improve the predictability and accuracy of off-blocks.

The TOBT is determined from the analysis of the actual aircraft operational status, Ground Handling Agent's internal turn-round milestones, airport operational situation and Airline Operations Centre's (AOC) operational decisions.

9.4 ACTORS

9.4.1 Primary Actor

The Airline⁴¹ Station Manager (primary) – wants to closely monitor and optimise the turn-round operations of a flight.

9.4.2 Supporting Actor(s)

The Ground Handling Agent (support) – has to provide information to the Airline Station Manager about the progress of turn-round operations.

9.5 PRECONDITIONS

The turn-round plan (linking an inbound flight with the outbound flight under consideration, including actual aircraft operational status⁴², actual, estimated and target milestone information⁴³), as an element of the Airport Operational Plan (AOP), is available through the NOP (via SWIM).

⁴¹ This generic definition actually applies to all airspace users.

⁴² The Airport CDM concept has identified the following aircraft operational status: INI (INITIAL), SCH (SCHEDULED), AIR (AIRBORNE), FIR (flight entered local FIR), FNL (FINAL), ARR (LANDED), IBK (IN-BLOCK), BRD (BOARDING), RDY (READY), OBK (OFF-BLOCK), DEP (DEPARTED).

⁴³ E.g. Actual Landing Time (ALDT) and Actual In-Block Time (AIBT) of the corresponding inbound flight, Estimated Off-Block Time (EOBT), Target Off-Block Time (TOBT) and Target Take Off Time (TTOT) of the outbound flight.



The SBT of the outbound flight (part of the AOP) is available through the NOP (i.e. latest TOBT is known to the System).

A set of turn-round timing rules with which the TOBT should comply (e.g. feasibility of TOBT vs. boarding time or minimum turn-round time; TOBT within EOBT tolerance window) is defined in the System.

9.6 POST CONDITIONS

9.6.1 Success End State

The TOBT of the flight has been updated (i.e. the corresponding SBT has been updated).

9.6.2 Failure End State

The TOBT of the flight does not change (i.e. the corresponding SBT remains unchanged).

9.7 NOTES

The TOBT is defined in the context of SESAR⁴⁴ as the time that an aircraft operator / handling agent estimates that an aircraft will be ready, all doors closed, boarding bridge removed, push back vehicle connected, ready to commence push back and start up immediately upon reception of an ATC clearance.

Internal turn-round milestones⁴⁵ are used to manage the TOBT.

At some airports, there might be a delegation from the airspace user that enables the Ground Handling Agent to cover, in addition to its role and responsibilities, those of Airline Station Manager. However, this use case remains generic and clearly separates the role and responsibilities of the Airline Station Manager and those of the Ground Handling Agent.

It is assumed that full coordination with the Airline Operations Centre's (AOC) regarding operational decisions has already taken place once the Airline Station Manager wants to update a TOBT.

9.8 TRIGGER(S)

The Use Case starts when the Airline Station Manager wants to refine the TOBT of a flight following e.g. a significant inbound delay, a Ground Handling Agent's operations delay, a System notification.

⁴⁴ This SESAR definition of the TOBT is based on the "EUROCONTROL CDM project" 2008 definition (source: [http://www.eurocontrol.int/airports/gallery/content/public/pdf/CDM_Implementation_Manual.pdf]). It differs in the 2 following areas: the push back vehicle should be "connected" to the aircraft (and not only "available") and the aircraft should be ready to commence "push back and start up" (instead of "taxi").

⁴⁵ The internal turn-round milestones are associated with the following activities: Aircraft in-block; Passengers disembarkation; Baggage, mail and freight unloading; Cleaning; Catering; Fuelling; Baggage, mail and freight loading; Passenger boarding; Aircraft ready; etc.



9.9 MAIN FLOW

1. The Airline Station Manager informs the System that he wants to refine the TOBT of a particular flight.
2. The System displays to the Airline Station Manager specific data from the flight's SBT (actual and estimated time information, including the latest recorded TOBT) as well as the operational status of the corresponding turn-round plan⁴⁶.
3. The Airline Station Manager inputs a proposed⁴⁷ TOBT into the System.
4. The System checks that the input TOBT complies with pre-defined turn-round timing rules.
5. The System displays to the Ground Handling Agent the proposed TOBT for the corresponding SBT.
6. The Ground Handling Agent acknowledges the proposed TOBT by using the System.
7. The Airline Station Manager validates the TOBT, initiating an update to the SBT for the Flight by using the System.
8. The use case ends when the System records the updated SBT (i.e. new TOBT) which is propagated to the AOP/NOP through SWIM.

9.10 ALTERNATIVE FLOWS

9.10.1[3] – The Airline Station Manager decides to input a new TOBT without requiring acknowledgement from the Ground Handling Agent

9. The Airline Station Manager inputs a new TOBT into the System without requiring acknowledgement from the Ground Handling Agent.
10. The System checks that the input TOBT complies with pre-defined turn-round timing rules.
11. The flow continues at step 7.

⁴⁶ The turn-round plan mainly holds the information linking an inbound flight with an outbound flight.

⁴⁷ The main flow covers the case where the Airline Station Manager requires acknowledgement of the proposed TOBT by the Ground Handling Agent.



9.10.2[4, 10] – The System detects that the input TOBT does not comply with pre-defined turn-round timing rules

12. The System alerts the Airline Station Manager that the input TOBT is not compatible with pre-defined turn-round timing rules.
13. The Airline Station Manager confirms his input by using the System.
14. The flow continues at step 5.

9.10.3[6] – The Ground Handling Agent cannot comply with the proposed TOBT

15. The Ground Handling Agent informs the System that he cannot comply with the proposed TOBT.
16. The Ground Handling Agent inputs an alternative TOBT into the System.
17. The System checks that the input alternative TOBT complies with pre-defined turn-round timing rules.
18. The System displays to the Airline Station Manager the alternative TOBT.
19. The flow continues at step 7.

9.10.4[18] – The Airline Station Manager is not satisfied with the input TOBT

20. The Airline Station Manager informs the System that he wants to modify the input TOBT.
21. The flow returns at step 3.

9.10.5[17] – The System detects that the input alternative TOBT does not comply with pre-defined turn-round timing rules

22. The System alerts the Ground Handling Agent that the input alternative TOBT is not compatible with pre-defined timing rules.
23. The Ground Handling Agent confirms his input by using the System.
24. The System displays to the Airline Station Manager the alternative TOBT and notifies the incompatibility.
25. The flow continues at step 19.



9.10.6[23] – The Ground Handling Agent wants to make another input

26. The Ground Handling Agent informs the System that he wants to modify his input.
27. The flow returns at step 16.

9.10.7[6] – The System detects that no response has been received from the Ground Handling Agent in due time

28. The System notifies the Airline Station Manager that no response has been received from the Ground Handling Agent in due time.
29. The flow continues at step 7.

9.11 FAILURE FLOWS

9.11.1[Anywhere] – The Airline Station Manager does not want to update the TOBT anymore

30. The use case ends when the Airline Station Manager cancels the TOBT update.



10 UC-33 REFINE DE-ICING CAPACITY

10.1 SCOPE

System, black-box.

10.2 LEVEL

User Goal.

10.3 SUMMARY

This Use Case describes how the APOC Staff uses the System to either:

- Refine the de-icing capacity according to the available de-icing resources;
- Check the de-icing capacity against newly updated airport operating parameters;
- Determine the requested de-icing resources to match a given de-icing capacity.

10.4 ACTORS

10.4.1 Primary Actor

The APOC Staff (primary) – wants to update the de-icing capacity to better reflect availability of human resources and equipment.

10.4.2 Supporting Actor(s)

The ATS Supervisor [TWR] (off stage) – has to be informed when the airport operating parameters are limiting the departure throughput (in the context of a revised de-icing capacity).

10.5 PRECONDITIONS

The pre-defined de-icing capacity per de-icing area per time slot⁴⁸ is known to the System.

The expected departure demand⁴⁹ and de-icing demand for each time slot is known to the System.

The current stand allocation plan is known to the System.

The current and forecasted weather are known to the System.

The current de-icing capacity is known to the System.

The current airport operating parameters are known to the System.

⁴⁸ A time slot is defined as a 1-hour time period.

⁴⁹ Includes also aircraft type information, network constraints.



10.6 POSTCONDITIONS

10.6.1 Success End State

The updated de-icing capacity is recorded in the System.

10.6.2 Failure End State

The updated de-icing capacity is not recorded in the System.

10.7 NOTES

A de-icing capacity determines the number of aircraft that can be de-iced per de-icing area per time slot. It includes remote de-icing and on-stand de-icing⁵⁰.

The determination of the number of aircraft to be de-iced is based on local rules set by the APOC Staff (e.g. in some weather conditions, all night-stops must be de-iced, aircraft with a stop greater than 3 hours must be de-iced etc.).

De-icing resources include both human resources and equipment (pads, trucks and de-icing fluid quantity, etc...).

For the determination of the de-icing area capacity, in addition to the available resources and estimated demand, the APOC Staff may also consider the airport operating parameters, e.g. expected departure runway capacities within the time interval, specific taxi times from stand to remote de-icing areas and from remote de-icing areas to each departure runway.

This de-icing Use Case endeavours to generically describe interactions between the APOC Staff and the System. The responsibilities, procedures and available infrastructure (areas used for de-icing) vary considerably from airport to airport (site specific) and this Use Case should be adapted to any applicable location.

10.8 TRIGGER(S)

The Use Case starts when the APOC Staff informs the System that he wants to update the de-icing capacity (e.g. following a meteorological forecast or a System notification).

10.9 MAIN FLOW

1. The System displays the current de-icing capacity to the APOC Staff.
2. The APOC Staff inputs into the System the current de-icing resources available per time slot.
3. The System computes the de-icing capacity (i.e. the number of aircraft that can be de-iced for each de-icing area per time slot), taking into account the estimated de-icing demand.

⁵⁰ Stands are considered as de-icing areas.



4. The System checks that the revised de-icing capacity is compliant with current airport operating parameters (e.g. departure throughput).
5. The System displays the revised de-icing capacity to the APOC Staff.
6. The APOC Staff validates the updated de-icing capacity by using the System.
7. The Use Case ends when the System records the updated de-icing capacity.

10.10 ALTERNATIVE FLOWS

10.10.1 [3] – The APOC Staff wants to input manually the de-icing capacity⁵¹

8. The APOC Staff informs the System that he wants **to input manually the de-icing capacity** (i.e. the number of aircraft that can be de-iced for each de-icing area per time slot).
9. The APOC Staff inputs **the de-icing capacity**.
10. The System computes the corresponding de-icing resources required.
11. The flow returns at step 4.

10.10.2 [4] – The System detects that the de-icing capacity is limiting the departure throughput⁵²

12. The System informs the APOC Staff and the ATS Supervisor [TWR] that the de-icing capacity is limiting the departure throughput.
13. The APOC Staff validates the de-icing capacity.
14. The System publishes the new departure throughput and updates the airport operating parameters.
15. The flow continues at step 7.

⁵¹ In the Main Flow, the APOC Staff inputs the available resources and wants the system to compute the corresponding de-icing capacity; in this Alternative Flow, the APOC Staff inputs the de-icing capacity and wants the System to compute the corresponding available resources.

⁵² “Stand Load Schedule” and “Stand Allocation Plan” designate the same notion in the entire document.



10.10.3 [6, 13] – The APOC Staff wants to modify the de-icing resources available

16. The APOC Staff informs the System that he wants to modify the de-icing resources available.
17. The flow returns at step 2.

10.11 FAILURE FLOWS

10.11.1 [Anywhere] – The APOC Staff does not want to update the de-icing capacity anymore

18. The Use Case ends when the APOC Staff cancels the update of the de-icing capacity.



11 UC-35 DETERMINE/REVISE STAND LOAD SCHEDULE

11.1 SCOPE

System, black-box.

11.2 LEVEL

User Goal.

11.3 SUMMARY

The Use Case “Determine/Revise Stand Load Schedule⁵³” describes how the AOC Staff uses the System to establish or update a stand allocation plan.

11.4 ACTORS

11.4.1 Primary Actor

APOC Staff (primary) - wants to establish or update a stand allocation plan.

11.4.2 Supporting Actor(s)

AOC Staff (support) - has to confirm the established or updated stand allocation plan that should match their stand preferences in the Aircraft Operator' preferred area.

Ground Handling Agent (support) - has to confirm the established or updated stand allocation plan.

11.5 PRECONDITIONS

Flight information (inbound RBTs and outbound SBTs as well as turn-round plans) is known to the System.

Ground Handling Agents' capability for the planning period is known to the System.

The airport configuration and non-mandatory criteria (cf. 11.7 Notes) are known to the System.

The latest recorded stand allocation plan (in case of update) is known to the System.

⁵³ “Stand Load Schedule” and “Stand Allocation Plan” designate the same notion in the entire document.



11.6 POSTCONDITIONS

11.6.1 Success End State

The established or updated stand allocation plan is recorded in the System.

11.6.2 Failure End State

The established or updated stand allocation plan is not recorded in the System.

11.7 NOTES

The term “Stand Allocation Plan” is used throughout the document to indicate the planning of both stand and gate usage.

A stand allocation plan is a plan describing how aircraft are assigned to their stands for a given time period. A stand allocation plan includes stand availability, in-block and off-block time estimates and necessary buffers⁵⁴.

The criteria for building stand allocation plans are of two kinds: airport configuration (including compatibility between aircraft type and stand size) and non-mandatory criteria (Aircraft Operator’s preferences and stand planning policy⁵⁵).

When established, the stand allocation plan is developed based on flight information (SBT’s), the seasonal stand plan⁵⁶, AOC Staff’ preferences, stand planning policy and infrastructure configuration available. Furthermore, the stand allocation plan will be established for the full day of operation.

Once the stand allocation plan is established, the stand allocation planning process becomes iterative through stand allocation plan updates (i.e. this use case is performed iteratively).

When updated, the impact on the current stand allocation plan should be minimized (i.e. few modifications are done between the two versions of the plan). Also, an update of the stand allocation plan can be performed following e.g. a System notification, an update of the flight information or turn-round progress, a change in Aircraft Operator’s preference, a change in Ground Handling Agent’ capability, a change in stand planning policy.

11.8 TRIGGER(S)

The Use Case starts when the APOC Staff informs the System that he wants to establish or update the stand allocation plan.

⁵⁴ To enhance stability of the stand allocation plan.

⁵⁵ The APOC Staff may specify rules for updating a stand allocation plan, e.g. minimising the number of stand changes induced in the next hour.

⁵⁶ The stand seasonal plan, if it has been established, is a rough plan describing how flights are assigned to groups of stands along the entire season period (refer to UC-32 Determine/Revise Stand Load Plan).



11.9 MAIN FLOW

1. The System computes a set of possible stand allocation plans based on the seasonal stand plan (if available) and taking into account available flight information (SBTs as well as turn-round plans), airport configuration, stand planning policy, Aircraft Operators' stand preferences and Ground Handling Agents' capability, and displays the result to the APOC Staff.
2. The APOC Staff selects one possible stand allocation plan.
3. The System presents the stand allocation plan to the concerned Ground Handling Agent(s) and AOC Staff(s) for confirmation.
4. The concerned Ground Handling Agent(s) and AOC Staff(s) confirm the stand allocation plan based on their internal capabilities.
5. The APOC Staff validates the stand allocation plan.
6. The use case ends when the stand allocation plan is recorded in the System.

11.10 ALTERNATIVE FLOWS

11.10.1 [1] – The APOC Staff wants to update the existing stand allocation plan

7. The System computes a set of possible stand allocation plan updates taking into account flight information (inbound RBTs, outbound SBTs as well as turn-round plans), airport configuration, stand planning policy, Aircraft Operators' stand preferences and Ground Handling Agents' capability, and displays the result to the APOC Staff.
8. The APOC Staff selects one possible stand allocation plan update.
9. The flow returns at 3.

11.10.2 [7] – The APOC Staff wants to update his stand allocation plan manually

10. The APOC Staff informs the System that he wants to update his stand allocation plan manually.
11. The APOC Staff inputs into the System his updated stand allocation plan.
12. The System checks that the proposed stand allocation plan is compliant with the airport configuration.
13. The APOC Staff validates his input stand allocation plan.
14. The flow continues at step 3.



11.10.3 [7] – The System cannot find any stand allocation plan update that complies with the airport configuration

15. The System informs the APOC Staff that there is no stand allocation plan update that complies with the airport configuration.
16. The APOC Staff informs the System that he wants to update the stand allocation plan update manually.
17. The flow continues at step 11.

11.10.4 [8] – The APOC Staff is not satisfied with any of the System-computed stand allocation plans and he wants to update the stand allocation plan manually

18. The APOC Staff informs the System he wants to update the stand allocation plan manually.
19. The flow continues at step 11.

11.10.5 [4] – The System detects that Ground Handling Agent(s) or AOC Staff(s) did not respond in due time

20. The System informs the APOC Staff that no response has been received from the concerned Ground Handling Agent or AOC Staff.
21. The System records this lack of response and informs the APOC Staff.
22. The flow continues at step 5.

11.10.6 [4] – The Ground Handling Agent(s) or AOC Staff(s) cannot comply with the proposed stand allocation plan update

23. Any concerned Ground Handling Agent or AOC Staff informs the System that he cannot comply with the proposed stand allocation plan.
24. The System records this non-compliance and informs the APOC Staff.
25. The flow continues at step 5.

11.10.7 [12] – The System detects that the proposed stand allocation plan does not comply with the airport configuration

26. The System alerts the APOC Staff that the proposed stand allocation plan is not compliant with the airport configuration.



27. The APOC Staff informs the System that he wants to input a new proposal.
28. The flow returns to step 11.

11.10.8 [13] – The APOC Staff wants to modify his proposed stand allocation plan

29. The APOC Staff informs the System that he wants to modify his proposed stand allocation plan.
30. The flow returns to step 11.

11.10.9 [13, 27] – The APOC Staff wants a System-computed stand allocation plan

31. The APOC Staff informs the System that he wants a system-computed stand allocation plan.
32. The flow returns to step 1.

11.11 FAILURE FLOWS

11.11.1 [5] – The APOC Staff does not want to validate the stand allocation plan

33. The APOC Staff informs the System that he does not validate the stand allocation plan update.
34. The use case ends in its failed state.



12 UC-38 HANDLE AIRCRAFT TAKE-OFF

12.1 SCOPE

System, black-box.

12.2 LEVEL

User Goal.

12.3 SUMMARY

This Use Case describes how the Tower Runway Controller uses the System to control that the aircraft takes off in a safe manner and according to the departure sequence.

All actions take place in the Execution phase.

12.4 ACTORS

12.4.1 Primary Actor

Tower Runway Controller (Primary) – wants to make sure that the aircraft takes-off in a safe manner with respect to the risk of collision with other traffic or obstacles and to maintain safe separation with other aircraft.

12.4.2 Supporting Actor(s)

Flight Crew (Support) – has to operate the aircraft in a safe and efficient manner.

Executive Controller (Departure TMA) (Offstage) – has to take control of the aircraft from the Tower Runway Controller after the take-off.

Tower Ground Controller (Offstage) – has to take control of the aircraft from the Tower Runway Controller in case the aircraft aborts the take-off and vacates the runway.

12.5 PRECONDITIONS

The flight has completed the taxi out and is at the departure runway holding point.

The transfer of responsibility between the Tower Ground Controller and the Tower Runway Controller is completed. In particular the Communication contact (voice and D/L) between the Tower Runway Controller and the Flight Crew is established.

The system knows the position of the aircraft in the optimized departure sequence.

The System has informed the Flight Crew via data link on runway configuration and weather conditions at the airport (e.g. wind, visibility).

The Flight Crew and the System knows the assigned standard instrument approach departure (part of the departure clearance) and the applicable constraints for the climb profile (speed, minimum climb rate).



12.6 POSTCONDITIONS

12.6.1 Success End State

The system records that the aircraft has taken-off and communications have been transferred from the Tower Runway Controller to the Executive Controller (Departure Controller).

12.6.2 Failure End State

The system records that the take-off has been aborted, invalidates the target take-off time and reverts the RBT (Reference Business Trajectory) into a SBT (Shared Business Trajectory).

12.7 NOTES

Assumption is made that R/T communication is always available (i.e. the UC does not address total communication failure).

12.8 TRIGGER(S)

The Use Case starts when the aircraft is at the runway holding point, ready to line up.

12.9 MAIN FLOW

1. The Tower Runway controller gives the clearance to the Flight Crew for “line up and wait” via R/T.
2. The Flight Crew lines-up the aircraft.
3. The Tower Runway controller checks that the runway is free of obstacles using visual observation and the System.
4. The Tower Runway controller gives the “take-off” clearance to the pilot via R/T.
5. The Flight Crew initiates the take-off roll and lifts-off. The System detects the take-off, receives the downlinked RBT initialized with the Actual Take-off Time and publishes the updated synchronised RBT in the NOP.
6. The Tower Runway Controller, assisted by the System, verifies that the aircraft has safely taken-off.
7. At the agreed point and/or altitude, the System instructs the Flight Crew to transfer communications to the Executive Controller (Departure TMA).
8. The use case ends when the system records that the flight has been safely transferred to the Executive Controller (Departure TMA).



12.10 ALTERNATIVE FLOWS

12.10.1 [7] - System-initiated communication transfer is not available

9. The System informs the Tower Runway Controller about the unavailability of the automatic initiation of communication.
10. The Tower Runway Controller instructs the Flight Crew to transfer communications using R/T.
11. The flow returns to step 8.

12.10.2 [3] - The Flight Crew decides to delay the take-off

12. The Flight Crew informs the Tower Runway Controller that he/she wants to delay the take-off by a given time period⁵⁷.
13. The Tower Runway Controller authorizes the Pilot to hold on the runway in order to resolve the problem and enters the new target take-off time in the system.
14. The System updates the RBT according to the new target take-off time.
15. The Flow returns to step 3.

12.11 FAILURE FLOWS

12.11.1 Failure at [3] – The Runway is no longer available for departures for an unknown period of time (e.g. due to an Aborted Take-off)

16. The Tower Runway Controller is unable to issue a take-off clearance. The Tower Runway Controller cancels the departure clearance, informs the Flight Crew the reasons for the delay, instruct the Flight Crew to vacate the runway and transfer him/her to the Tower Ground Controller for a holding bay or return to stand.
17. The Tower Runway Controller notifies the System that the runway is unavailable for an unknown period of time.
18. The Use Case ends when the System records that the aircraft has not taken-off, invalidates the target take-off time and reverts the RBT into a SBT.

⁵⁷ For example, if a potential problem can easily be fixed within that time period.



12.11.2 Failure at [3] [5] – The Flight Crew is unable to take-off and wants to return to stand or holding bay

19. The Flight Crew informs the Tower Runway Controller that he is unable to take-off and ask for a holding bay or to return to stand.
20. The Tower Runway Controller cancels the departure clearance and instructs the Flight Crew to vacate the runway and transfer him/her to the Tower Ground Controller for a holding bay or return to stand.
21. The Use Case ends when the System records that the aircraft has not taken-off, invalidates the target take-off time and reverts the RBT into a SBT.

12.11.3 Failure at [5] – The Flight Crew aborts the take-off and is not able to vacate the runway

22. The Tower Runway Controller, assisted by the System, detects that the aircraft is obstructing the runway.
23. The Tower Runway Controller confirms with the Flight Crew that he has aborted the take-off and notifies the System that the runway is obstructed for an undefined period.
24. The Use Case ends when the System invalidates the target take-off time and reverts the RBT into a SBT.

12.11.4 Failure at [13] – The Tower Runway Controller refuses to authorise further delay for take-off

25. The Flow goes to step 20.



13 UC-44 MERGE ARRIVAL FLOWS USING ASPA S&M

13.1 SCOPE

System, black-box.

This Use Case is associated to the ASAS Spacing – Sequencing and Merging step of the “*Flying CDA merging without Structured Routes*” scenario described in the General Purpose DOD [3].

13.2 LEVEL

User Goal.

13.3 SUMMARY

This Use Case describes how an Executive Controller in the Terminal Manoeuvre Area (TMA) is merging arrival flights into a consistent flow relying on Airborne Spacing techniques (separation responsibility still remains to the ground) involving different spacing task distribution between Flight Crew and Controller.

The Use Case starts when the Executive Controller has identified the flight to be included into the relevant arrival flow.

The Use Case ends when the aircraft incorporated into the relevant arrival flow has reached the spacing limit⁵⁸ (e.g. Final Approach Fix (FAF)), or the Executive Controller decides to terminate the instruction.

All actions take place during the Execution Phase.

13.4 ACTORS

13.4.1 Primary Actor

Executive Controller (EC) – wants to integrate a given flight into an arrival flow. The integration is performed with respect to the associated Controlled Time of Arrival (CTA) and with the support of Airborne Spacing Sequencing and Merging (ASPA S&M) techniques.

13.4.2 Supporting Actor(s)

Flight Crew (FC) of the Instructed aircraft (support) – has to execute the procedure, provide and maintain the required spacing behind the Target aircraft whilst flying other procedures as normal.

Flight Crew of the Target aircraft (off-stage) – is involved in the manoeuvre, but without any specific task with regard to it.

⁵⁸ The spacing limit represents the end point of the spacing instruction.



13.5 PRECONDITIONS

The traffic pattern is appropriate to apply ASPA S&M procedures, there are flights sharing segment(s) of same or converging 2D routes/trajectories.

An absolute to relative spacing transition for better flow efficiency has been detected.

The Reference Business Trajectories (RBTs) of the involved flights are known by the System. The CTAs of the relevant aircraft are available to the Controller and Flight Crew.

The Target aircraft has at least ATM Capability Level 1, the Instructed Aircraft has ATM Capability Level 3 and the Flight Crew have indicated via the NOP that they will accept ASPA applications.

The Instructed aircraft and ground are data-link connected and are able to exchange relevant messages for ASPA S&M procedures (e.g. CPDLC instruction messages).

13.6 POSTCONDITIONS

13.6.1 Success End State

The flight has reached the spacing limit⁵⁹. The System records the end of the manoeuvre and that the flight complies with the arrival conditions (CTA).

13.6.2 Failure End State

The failed end state takes place when the proposed manoeuvre cannot be initiated and is therefore cancelled or when the manoeuvre that is being carried out is abnormally interrupted.

13.7 NOTES

The “Instructed aircraft” is the aircraft instructed by the controller to implement the ASPA-S&M instruction.

The “Target aircraft” is the aircraft from which the Instructed aircraft will space.

There are three⁶⁰ types of basic manoeuvre (Figure 1):

- Remain behind; both aircraft are following the same routing. The Instructed aircraft remains behind the Target aircraft at a spacing value determined by the Controller.
- Merge behind; the two aircraft are flying along merging trajectories towards the same waypoint. The Instructed aircraft adjusts its speed to be at the assigned spacing when the Target aircraft passes over the achieve-by point⁶¹. The Instructed

⁵⁹ Clearance limit is more ICAO compliant, however Requirement Focus Group (RFG) mentions spacing limit.

⁶⁰ There may potentially be a fourth manoeuvre that is: Vector then remain (To be further investigated).

⁶¹ The achieve-by point is the point along the route by which the spacing interval needs to be achieved. This can be any point along the common route from the merge point to the runway touchdown.



aircraft then remains behind the Target aircraft until the spacing limit (instruction end point).

- Vector then merge behind; speed variation alone is not suitable to achieve desired spacing. The Instructed aircraft is therefore given a vector by the controller, with the instruction to resume own navigation when the desired spacing can be obtained at the rejoin point. The Instructed aircraft will then rejoin the planned trajectory by flying to the Target aircraft's lateral route position as the resume turn is made, whilst obtaining the assigned spacing behind the Target aircraft, then maintaining the assigned spacing when back on-route.

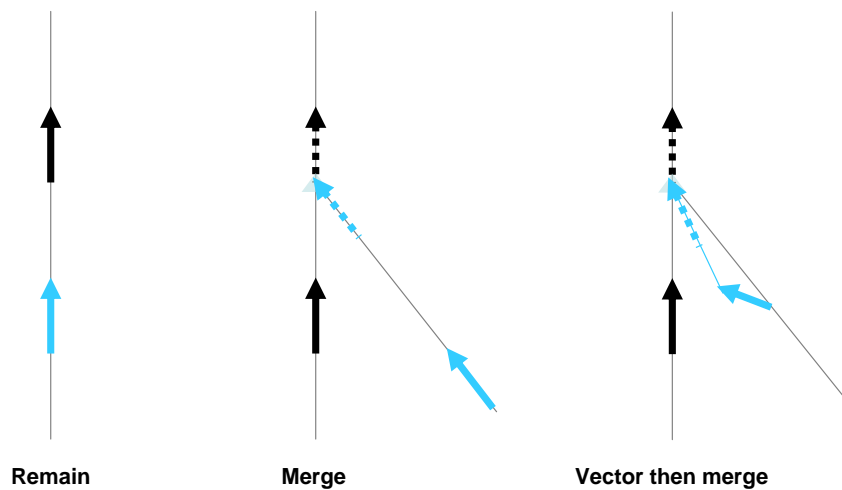


Figure 1: ASPA S&M basic manoeuvres

For each of these manoeuvres the following applicability parameters should be met [4].

Manoeuvre	Applicability conditions
Remain	<ul style="list-style-type: none"> • Compatible positions of aircraft (altitude, relative position and current spacing); • Both involved aircraft are flying along the same horizontal route from the initiation of the manoeuvre until the termination; • Compatible performances of aircraft, particularly speed; • Appropriate ASAS capability of Instructed aircraft; • Appropriate ADS-B capability of Target aircraft.
Merge	<ul style="list-style-type: none"> • Compatible positions of aircraft (altitude, relative position and current spacing); • The two aircraft are flying along merging trajectories towards the same waypoint; • Compatible performances of aircraft, particularly speed; • Appropriate ASAS capability of Instructed aircraft; • Appropriate ADS-B capability of Target aircraft.



Vector then merge	<ul style="list-style-type: none">• Compatible positions of aircraft (altitude, relative position and current spacing);• The two aircraft are flying along merging trajectories towards the same waypoint;• Compatible performances of aircraft, particularly speed;• Appropriate ASAS capability of Instructed aircraft;• Appropriate ADS-B capability of Target aircraft.
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Table 1: Applicability conditions for ASPA S&M manoeuvres

13.8 TRIGGER(S)

The Use Case starts when the Executive Controller, or ground system automation support, has detected a potential situation for which the manoeuvre may be applied.

13.9 MAIN FLOW

1. EC, or ground system automation support, identifies a potential situation for which the manoeuvre may be applied. The appropriate⁶² Instructed and Target aircraft, the Initiation point (i.e. optimum point at which the procedure should start) and the required spacing to be achieved are determined.
2. The EC detects, or is warned by the System (a time parameter prior to the Instructed aircraft reaching the Initiation point), that the Instructed aircraft is close to the Initiation Point and ensures that lateral and vertical profiles are allowing separation to be assured.
3. The EC notifies the FC that the aircraft is the proposed Instructed aircraft for an ASPA S&M manoeuvre and nominates the Target aircraft.
4. The FC identifies the Target aircraft on the on-board traffic display.
5. The FC reports the positive Target aircraft acquisition to the EC.
6. The EC reassesses applicability conditions⁶³.
7. The EC sends a “Remain behind” instruction message to the FC.
8. The FC validates the feasibility of the manoeuvre (using airborne system).
9. The FC sends compliance of the ASPA S&M instruction to the EC.

⁶²Applicability conditions (compatible position of aircraft, compatible routes/trajectories, compatible performances of aircraft and appropriate aircraft capability) are met (refer to §13.7).

⁶³ Refer to 13.7 for various instructions and associated parameters.



10. The Instructed aircraft manoeuvres according to the instruction.
11. The FC (and airborne system) monitors the progress of the manoeuvre. Concurrently, the EC (with necessary support from ground system) monitors the progress of the manoeuvre.
12. The Use Case ends when the Instructed aircraft reaches the spacing limit, the ASPA S&M manoeuvre is terminated and the EC resumes conventional operations and the System records the termination of the ASPA S&M manoeuvre.

13.10 ALTERNATIVE FLOWS

13.10.1 [4] – The Target aircraft is not positively identified

13. The FC informs the EC that the Target aircraft is not positively identified.
14. The EC reassesses the applicability conditions of the ASPA S&M procedure.
15. The flow continues at step 3.

13.10.2 [6] – The EC detects/is warned that the FC identifies a wrong aircraft

16. The EC informs the FC that the identification is on a wrong target.
17. The EC reassesses the ASPS S&M procedure.
18. The flow continues at step 3.

13.10.3 [7] – The EC sends a “Merge behind” instruction message to the FC

19. The flow continues at step 8.

13.10.4 [7] – The EC sends a “Vector then merge behind” instruction message to the FC

20. The FC validates the feasibility of the manoeuvre (using airborne system).
21. The FC sends compliance of the ASPA S&M instruction to the EC.
22. The Instructed aircraft flies instructed vector.
23. The FC (and airborne system) monitors the progress of the manoeuvre. Concurrently, the EC (with necessary support from ground system) monitors the progress of the manoeuvre.
24. The FC notifies the EC when resuming to waypoint.



25. The flow continues at step 10.

13.10.5 [11] – The EC decides to modify the spacing parameter

26. The flow continues at step 6.

13.11 FAILURE FLOWS

13.11.1 [2] – The EC detects that profiles conditions are not met

27. The Use Case ends when the EC does not initiate the procedure and the System records it.

13.11.2 [4] – The FC cannot identify an aircraft with the given identifier

28. The FC informs the EC that the Target aircraft cannot be identified for whatever reason.

29. The EC confirms the identifier, but the FC is still unable to identify the target.

30. The Use Case ends when the EC notifies the termination of the procedure to the FC and the System records the termination.

13.11.3 [6] – Applicability conditions are not met

31. The EC notifies the termination of the procedure to the FC.

32. The Use Case ends when the EC resumes conventional control and is recorded by the System.

13.11.4 [8] – The FC detects that the manoeuvre is not feasible:

33. The Use Case ends when the FC informs the EC that the spacing instruction cannot be implemented and provides reasons that are recorded by the System.

13.11.5 [11] – The FC detects a problem in the implementation of the procedure

34. The FC communicates the problem to the EC.

35. The EC notifies the termination of the procedure to the FC.

36. The Use Case ends when the EC resumes conventional control and is recorded by the System.



13.11.6 [12] – The EC decides to terminate the procedure

37. The EC notifies the FC of the termination of the procedure.
38. The Use Case ends when the EC resumes conventional operations and is recorded by the System.

13.11.7 [Anywhere] – The EC decides to abort the procedure (e.g. loss of spacing detected while the manoeuvre is being carried out)

39. The EC notifies the termination of the procedure to the FC and issues an alternative clearance.
40. The Use Case ends and System records the termination of the procedure.



14 UC-45 REFINE THE AIRPORT OPERATIONAL PLAN

14.1 SCOPE

System, black-box.

14.2 LEVEL

User Goal.

14.3 SUMMARY

This Use Case describes how the APOC Staff consolidates the runway, stand, de-icing and taxiway load schedules in a refined Airport Operational Plan, taking account of airport airside and landside constraints from the available Resource Available Capacity Plan. The refined Airport Operational Plan identifies hot spots between available resources and possible demand capacity imbalance at airport level. The Use Case ends when the refined Airport Operational Plan is recorded by the System.

All actions take place in the Medium/Short Term Planning Phase.

14.4 ACTORS

14.4.1 Primary Actor

APOC Staff – wants to consolidate the runway, stand, de-icing resources and taxiway load schedules in order to refine the Airport Operational Plan (e.g. to identify hot spots between available resources and possible demand capacity imbalance at airport level).

14.4.2 Supporting Actor(s)

None.

14.5 PRECONDITIONS

The Airport Operational (Local) Plan determined/ revised at the Long Term Planning Phase or last Medium/Short term Airport Operational Plan is known to the System.

The runway, stand, de-icing resources and taxiway load schedules are available in the System.

14.6 POSTCONDITIONS

14.6.1 Success End State

The refined Airport Operation Plan is recorded to the System.

14.6.2 Failure End State

The Airport Operation Plan is not refined.



14.7 NOTES

The refined Airport Operational Plan presents the results of mapping the traffic demand on to 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.

For large or busy airports, handling medium/short term planning of all airport resources in one big step may prove very difficult, if not impossible. That is why the process proposed for the establishment of the various parts of the medium/short term Airport Operational Plan is stepwise:

- Airport resources at the gate & stand level are particularly addressed in the stand and de-icing load schedules;
- Airport resources at the surface & runway levels are particularly addressed in the runway, taxiway and eventual de-icing load schedules.

Stand, runway and taxiway load schedules make the core of the medium/short term refined Airport Operational Plan.

14.8 TRIGGER(S)

The Use Case starts when the APOC Staff wants to consolidate the runway, stand, de-icing resources and taxiway load schedules in a refined Airport Operational Plan.

14.9 MAIN FLOW

1. The APOC Staff informs the System that he wants to refine the Airport Operational Plan via System-aided computation.
2. The System retrieves the following input data:
 - a. the Long Term Planning Airport Operational (Local) Plan or last Medium/Short term Airport Operational Plan as the starting point for refining the Medium/Short Term Airport Operational Plan;
 - b. the determined/revised Runway Load Schedule;
 - c. the determined/revised Stand Load Schedule;
 - d. the determined/revised De-icing Resources Load Schedule;
 - e. the determined Taxiway Load.
3. The System merges the runway, stand, de-icing resources and taxiway load schedule into the Airport Operational Plan and builds a working draft of the refined Medium/Short Term Airport Operational Plan.



4. The System presents the refined Airport Operational Plan to the APOC Staff and detects and presents:
 - a. all possible inconsistencies:
 - i. conflicting demands regarding all airport resources;
 - ii. conflicting demands with other Airport Operational Plans, in case of high traffic inter-dependency between airports (i.e. city pairs).
 - b. all possible hot spots between resources, sorted by category:
 - i. runway-runway crossings;
 - ii. taxiway-runway crossings;
 - iii. taxiway-taxiway crossings (including taxiways leading to de-icing and holding bay areas).
 - c. potential airport demand capacity imbalance.
5. The System identifies that there are no inconsistencies at the refined Airport Operational Plan.
6. The APOC Staff confirms and validates the refined Airport Operational Plan, including detected hot spots and potential demand capacity imbalance.
7. The Use Case ends when the refined Airport Operational Plan, including detected hot spots and potential demand capacity imbalance, is recorded by the System.

14.10 ALTERNATIVE FLOWS

14.10.1 [5] - Inconsistencies are identified in the refined Airport Operational Plan

8. The APOC Staff uses the System to resolve the inconsistencies without modifying the individual Resources Load Schedules.
9. The flow continues at step 6.

14.11 FAILURE FLOWS

14.11.1 [2] - Late planning because AOP elaboration is closed

10. The System indicates that the medium/short term planning phase is closed for the selected request.
11. The Use Case ends in a failed state and is recorded by the System.



14.11.2 [6] - The APOC Staff does not validate the refined Airport Operational Plan, including detected hot spots and potential demand capacity imbalance

12. The APOC Staff asks the System to record a request for revision of individual Resources Load Schedules.
13. The Use Case ends in a failed state and is recorded by the System.

14.11.3 [8] - The APOC Staff is not able to solve the inconsistencies without modifying the individual Resources Load Schedules

14. The APOC Staff asks the System to record a request for revision of individual Resources Load Schedules⁶⁴.
15. The Use Case ends in a failed state and is recorded by the System.

⁶⁴ For revision of individual Resources Load Schedules, refer to the following Use-Cases: Determine/Revise Runway Load Schedule, Determine/Revise Taxiway Load Schedule, Determine/Revise De-icing Resources Load Schedule, Determine/Revise Stand Load Schedule.



15 UC-46 IDENTIFY A LONG TERM DEMAND/CAPACITY IMBALANCE

15.1 SCOPE

System, black-box

15.2 LEVEL

User Goal.

15.3 SUMMARY

This use case describes how a Sub-Regional Network Manager or the Regional Network Manager detects a demand/capacity imbalance during the long-term planning phase. The imbalance is detected during the long-term planning phase on the basis of historical data including traffic demand and capacity, of predicted traffic growth, and of the planned capacity.

15.4 ACTORS

15.4.1 Primary Actor

The Regional Network Manager - wants to identify the demand and capacity imbalances during the long-term planning phase.

15.4.2 Supporting Actor(s)

The Sub-Regional Network Managers concerned by the imbalance (support) – have to take part in the local analysis of DCB.

15.5 PRECONDITIONS

All concerned actors have access to the NOP. The long-term capacity planning process has already been done.

15.6 POSTCONDITIONS

15.6.1 Success End State

A demand/capacity imbalance is identified (flagged) in the NOP as a problem needing a solution together with the list of Sub-Regional Network Managers that will have to address it.

15.6.2 Failure End State

None.



15.7 NOTES

“System” in the context of the use case, refers to the Network Operations Planner (NOPLA) i.e. the set of interactive applications providing access to NOP.

15.8 TRIGGER(S)

The use case starts when a Regional Network Manager or the Sub-Regional Network Manager accesses the System in order to analyse respectively network and local DCB.

15.9 MAIN FLOW

1. A Sub-Regional Network Manager accesses the System in order to analyse DCB in their area of responsibility.
2. The Sub-Regional Network Manager detects an imbalance.
3. The Sub-Regional Network Manager uses the System to inform the Regional Network Manager.
4. The Regional Network Manager acknowledges the imbalance.
5. The Regional Network Manager uses the System to assess network effect.
6. The Regional Network Manager uses the System to inform the Sub-Regional Network Managers that they will have to address the imbalance collectively.
7. The Sub-Regional Network Managers that want to take part in the resolution acknowledge their involvement.
8. The use case ends when the imbalance is identified as a problem and published by the System, together with the list of involved Sub-Regional Network Managers, who will address the imbalance.

15.10 ALTERNATIVE FLOWS

15.10.1 [1] – The Regional Network Manager accesses the System in order to analyse DCB throughout the network.

9. The Regional Network Manager detects an imbalance.
10. The flow continues at step 5.



16 REFERENCES AND APPLICABLE DOCUMENTS

- [1] **Episode 3** SESAR DOD G - General Detailed Operational Description, D2.2-040
- [2] **EMMA2** A-SMGCS Services, Procedures and Operational Requirements (SPOR)
- [3] **Episode 3** Annex to SESAR DOD G – Operational Scenarios, D2.2-050
- [4] Package I Requirement Focus Group, Enhanced Sequencing and Merging Operations (ASPA-S&M), Application Description



Episode 3
D2.2-051 - Annex to SESAR DOD G – Use Cases

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