OCD

Operational Scenarios and Business Use Cases

TAMS OS & BUC

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1. Executive Summary

The TAMS operational concept document (OCD) [5] promotes an approach of a new airport management philosophy. In chapters one to five, the OCD explains the TAMS project's approach for this philosophy. It starts from a high-level perspective and ends with a description how the various systems of the TAMS industrial partners are interacting to build the TAMS industrial variant of the depicted approach.

This document covers an assorted selection of Operational Scenarios (OSs) and Business Use Cases (BUCs). These will explain in more detail the application of the TAMS industrial tool suite within this new management philosophy. All descriptions are exemplified with the project's Generic International Airport (GIA) but could potentially be situated at any other major airport.

After introducing GIA in chapter 0, the Operational Scenarios (chapter 3) set up the frame for the scenarios GIA is facing, sketching the situations and the views how the situations will develop. It includes a comparison between the management of the respective situation with and without the TAMS solution employed. This chapter additionally gives first links to Business Use Cases that can be derived from the course of the situations.

How GIA's operators and stakeholders will in detail solve specific operational problems (framed in the Operational Scenario chapter) by utilising TAMS components and procedures is described with an additional level of detail within the Business Use Cases in chapter 4.

Earlier iterations of the TAMS project focussed on the practical implementation of A-CDM. The concept documents correlated to these earlier iterations also addressed Operational Scenarios and Business Use Cases. Since their structure oriented itself towards a transparent explanation of the implementation and utilisation of the TAMS iteration 2 system within the A-CDM context, it differs from the structure applied to OSs and BUCs in this document. Therefore, it has been decided to exclude the earlier OSs and BUCs from this document, these remain available within the TAMS Iteration 2 OCD [6].

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2. Introduction

Generic International Airport (GIA) is the artificial model of the airport the TAMS project uses. It is of average size and features hub and regular activities of airlines, averaging a daily movement total of about 600 flights. The mix of traffic and airlines depends upon the individual scenario definition. Given here are some more general descriptions, which are valid for most scenarios. Deviations thereof are described in the respective scenario section. Each scenario is based on certain assumptions concerning the traffic mix as well as the participating stakeholders.

In most scenarios the main traffic at GIA is composed of short and medium haul connections operated mainly by medium sized aircraft (wake vortex class medium), but it also includes intercontinental heavy sized aircraft. The traffic flow is handled on two runways that are intersecting each other and cannot be operated independently but in mixed mode and any direction. Figure 2-1 depicts the airside layout of GIA while an overview of the landside infrastructure is given in Figure 2-2.

Figure 2-1: Overview of Generic International Airport

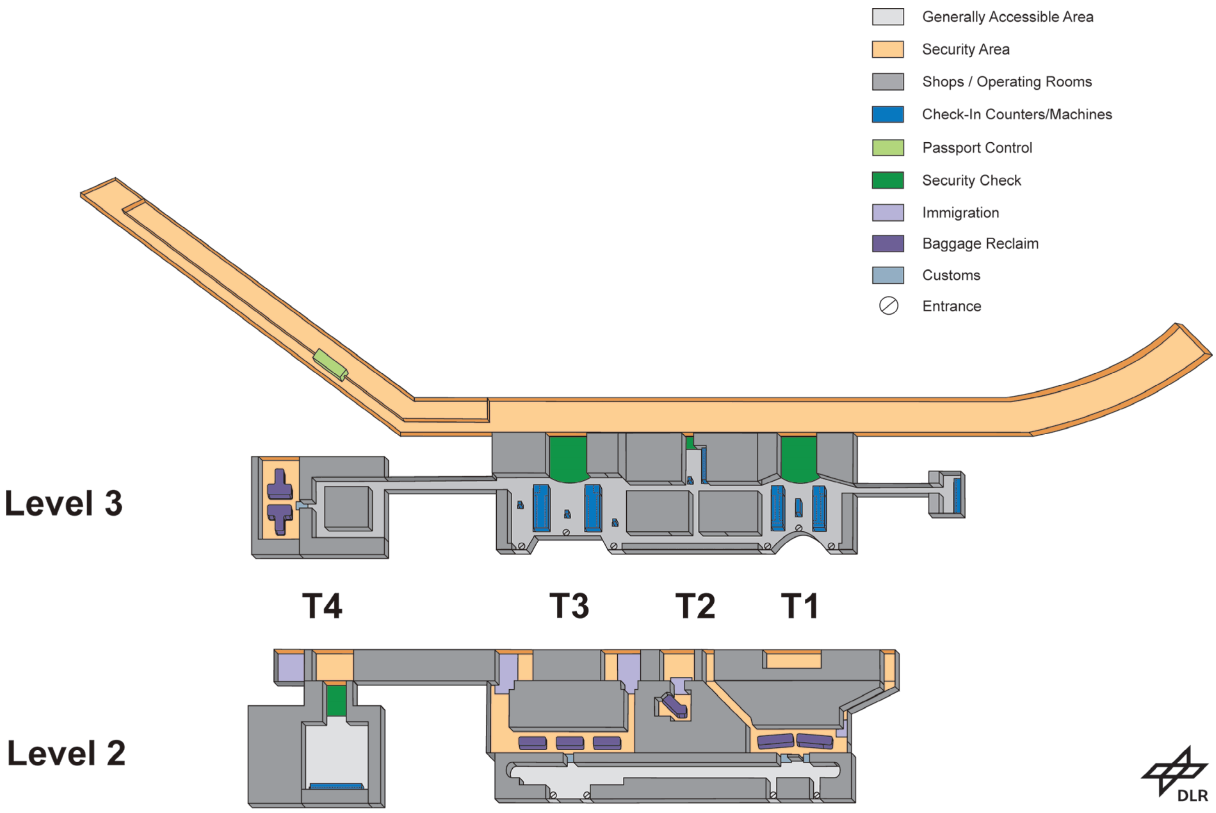

Figure 2-2: Overview of Generic International Airport Terminals

The terminal layout at Generic International Airport is based on a linear concept, consists of four parts (terminal T1 to T4) and has mainly locally arranged service facilities. All four terminals together are able to handle approximately 20 millions passengers per year. The terminal infrastructure comprises all service facilities for the handling of passengers and their baggage, such as check-in desks and self-service equipment, security control, passport control, immigration and baggage belts as well as facilities for the comfort of passengers, like shops and restaurants.

GIA has one main airline operator serving passenger traffic in a hub fashion. The other present airlines more or less have similar numbers of flight movements, comparable passenger numbers and supplement this destination rich airport. The hub operation of GIA's main airline operator implies that during its hub peak hours a significant amount of transfer passengers has to be handled by the stakeholders operating not only inside the terminal but equally by GIA ground handling. In the given scenarios, the traffic distribution and hub characteristic between airlines may vary.

The flexibility of the TAMS industrial suite yields no limitation to the size GIA can feature; it can be easily extended to represent a very big major hub with a set of major airlines running hub operations, as necessary for demonstration purposes of some (unwritten) scenarios.

3. Operational Scenarios

The following scenarios demonstrate in practice the functionality of the TAM concept elements as described in the operational concept document [5]. Mainly, the operational scenarios highlight exemplarily different situations as they can occur during every day operations at an airport. The sample of scenarios was retrieved during a two-staged selection procedure including first the identification of possible scenarios and secondly the evaluation in respect of pre-established criteria, particularly with respect to the time horizon, the involvement of all stakeholders, the expected benefit, and the integration of landside airport processes. The objective of this selection process was the deduction of scenarios covering a wide spectrum of airport operations since the implementation of the TAMS industrial suite is not restricted. The selected scenarios exemplify a variety of events at an airport occurring ad-hoc or already predicted in advance, on the land- or airside, during every day operations or under special circumstances and with an impact on all airport processes. So the wide spectrum for the possible application of TAM concept elements is shown.

Each scenario starts with a short description of the event and, if necessary, preconditions and assumptions. Then in table form the course of the scenario and the actions taken during the event are highlighted in contrast to the event without the implementation of TAMS. Finally, each scenario concludes with a summary presenting the benefits of the TAMS industrial system suite during the particular event.

3.1. Closed Terminal Area

Event

Passengers, employees, camera monitoring crew, or police find an abandoned piece of luggage in a security check's access area. This is a critical security incident.

All security services in the respective area are discontinued due to evacuation and closure of checkpoints as well as the surrounding area. All passengers and employees have to leave the affected area. One goal is to keep influences on unconcerned areas as small as possible. To avoid panic, everything that is suited to attract major attention as e.g. audible signals is disregarded.

For this scenario, a period of at least 30 minutes is needed to asses the situation and, if need be, to disarm the bomb. No passengers are handled at the closed security checkpoint; therefore, the capacity at this check declines to zero passengers during the closure. Staff requirements increase for security service, terminal management, and/or federal police.

For TAMS Generic International Airport GIA, it can be assumed that a closed inspection point can lead to an omission of 1/3 of all security check lanes at the airport. Due to the design of GIA, passengers have access to all gates through the remaining control stations. In this case, a closure of the whole terminal will not be taken into account. Generally, a total closure is possible but a rare exception.

Affected operation centres:

- federal police
- security service provider (if existent)
- terminal management
- ground handling operation centre
- airline station management

Scenario

Workflow without TAMS	***Workflow with TAMS***
Terminal management receives information about the security incident and informs the police. If the police are informed first, the police department will inform the terminal management.	Terminal management receives information about the security incident and informs the police. If the police are informed first, the police department informs the terminal management. Concerned working positions: Airport Agent (federal police)
Police decides about the size of the area that has to be closed and about the actions to be taken. In this case, the police decide to close and evacuate the affected terminal area. Closures in front of a security check lead to	Police decides about the size of the area that has to be closed and about the actions to be taken. In this case, the police decide to close and evacuate the terminal area. Closures in front of a security check lead to

Workflow without TAMS	***Workflow with TAMS***
closedown of the control point. Passengers have to switch to other control stations.	closedown of the control point. Passengers have to switch to other control stations. Concerned working positions: Airport Agent (federal police)
The closure blocks direct walkways to the gates for passengers. Alternative routes are not obvious for passengers. Service personnel might redirect passengers at the closed checkpoint with some delay. Information about location of alternative security checks is available but capacity analysis answering dimensions of expected queue lengths and waiting times rarely exists.	The terminal management inserts the information about the closure of the terminal area and the affected security checks in coordination with the security management into the integration platform and an alert/message is generated and distributed to all other stakeholders, esp. airlines, ground handling, ATC. This ensures situation awareness of all stakeholders. First alternatives for plan changes can be considered. Direct walkways for passengers are not available due to the closure. Passengers have to be redirected in a reasonable way. [BUC: Passenger Flow Management] Concerned systems: FIDS (situation awareness passenger), Video Wall (situation awareness APOC/alert display), ACISP (distribution of information) Concerned working positions: all stakeholders
A closure of the security check leads in combination with a high number of passengers definitely to waiting queues at other checkpoints. It is up to police / security service to decide whether to increase security personnel. Depending on the airport layout, the service / check points will be relocated to alternative check-in, security service, or passport control stations. It is not examined if the chosen measures are optimal.	PaxMan can predict queues at alternative checkpoints in case of a closure of the security check. This allows initiating coordinated counteraction early. A single what-if within PaxMan helps to decide which measures – e.g. more personnel for open service points or redirection to other check points – have the best impact to reduce queues. Measures to be taken will be coordinated by the stakeholders within the APOC. [BUC: Passenger Flow Management] Concerned systems: FIDS (situation awareness passenger), Video Wall (situation awareness APOC/ alert display / negotiation display), ACISP (distribution of information), PaxMan (calculation of queues)

Workflow without TAMS	*Workflow with TAMS*
	Concerned working positions: all stakeholders
Due to longer waiting periods at checkpoints and longer walkways to alternative checkpoints, passengers may arrive late at the gate so that they potentially miss their flight.	Due to longer waiting periods at checkpoints and longer walkways to alternative checkpoints, passengers may arrive late at the gate. PaxMan is able to predict the passenger arrival time early on. PaxMan writes the “Estimated Time of Passengers at Gate” (EPGT) into AODB. (Trigger for this event could be a defined percentage of passengers that are at the gate. The HMI of PaxMan can allow the definition of the necessary percentage value.) [BUC: Refine TOBT in case of updated ERDT, BUC: Handling of updated ELDT or EIBT] Concerned systems: PaxMan (EPGT calculation), ACISP (distribution of information) Concerned working positions: Airport Agent
Possibly airlines do not wait until all passengers which are impacted by the closure are on board. Reasons can be that the airline does not jet have information about the problem within the terminal or the airline cannot yet estimate the delay.	Airlines will be able to judge how much delay they will be facing due to this event and what their options and limits for waiting are. Therefore, airlines decide which flights will wait for passengers based on the best solution for redirection of passengers and its impact. [BUC: Passenger Flow Management] Concerned working positions: Airline Agent
If airlines decide to wait for delayed passengers, aircraft have a delayed off-block time leading in turn to an unplanned occupation of stands. Other stakeholders might be informed about a delay.	If airlines decide to wait for delayed passengers, aircraft have a delayed off-block time leading in turn to an unplanned occupation of stands. All stakeholders have access to the information on the delay through the integration platform. Concerned systems: ACISP (distribution of information, FUM), TMAN (planning update of turnaround), possibly SMAN/DMAN (planning update of sequence); SGMAN (planning update of stands if subsequent traffic is concerned) Concerned working positions:

Workflow without TAMS	*Workflow with TAMS*
	Airport Agent, Airline Agent, Ground Handling Agent, possibly ATC Agent
The rescheduling of parking positions for arrivals is difficult, because it is difficult to estimate how long waiting aircraft will block positions.	Parking positions for arrivals are rescheduled, taking into account airline decisions about waiting aircraft and EPGT from PaxMan. [BUC: Stand- and Gate Management] Concerned systems: SGMAN (change of parking positions), ACISP (distribution of information), SMAN / DMAN (planning update of sequence), TMAN (planning update of turnaround), Video Wall (Situation awareness of stakeholders) Concerned working positions Airport Agent, Airline Agent, Ground Handling Agent, possibly ATC Agent
After 30 minutes, police informs terminal management that the affected area is reopened. The information about the reopening has to be distributed in a conventional manner and possibly reaches airlines with some delay.	After 30 minutes, police informs terminal management that the affected area is reopened. Terminal management inserts the information in the integration platform that distributes in turn a new message about the reopening. Concerned systems: FIDS (reset), Video Wall (situation awareness APOC/alert display), ACISP (distribution of information), Concerned working positions: all stakeholders

Result without TAMS	*Result with TAMS*
Passengers have longer waiting times and walkways. This leads to decreasing comfort and delayed passengers eventually resulting in delayed outbound flights. Staff has to cope with high workload at security checks and information counters.	A faster actualisation of plans enabled by the linking of systems as well as the automatic distribution of information leads to enhanced situation awareness and improved coordination. Optimised planning of available resources and systematic information of passengers – as timely as possible and via media usually used by passengers (FIDS) to gather information – help to reduce walking ways, waiting times and delays.

Potential Business Use Cases

- 4.6 Handling of updated ELDT or EIBT
- 4.7 Refine TOBT in case of updated ERDT
- 4.9 Passenger Flow Management
- 4.10 Stand- and Gate Management

3.2. De-Icing and Winter Services

Event

This scenario describes de-icing/snow removal of operation areas and de-icing of aircrafts (only via de-icing pads). During the operation of winter services, the runway capacity will be reduced to zero movements. It is assumed that the winter service needs 30 minutes for one runway. This duty has influences on the arrival and departure capacity of the airport. The capacity of the de-icing pads will limit the maximum throughput of departures (compared to the capacity of other resources as runway or stands/gates etc.). That means, the possible departure flow will be reduced.

The weather service predicts temperatures below the freezing point for the day of operation. In addition, snowfall is expected. Furthermore, it is expected that most of the departure flights will have to be de-iced. The airport has only remote de-icing pads. It is assumed that the resources (personnel and vehicle fleet) are adequate to use all de-icing pads optimally. There are no foreseen problems during this operation.

At 14:00, it is expected that snowfall will hit the airport area around 16:30. During a peak of departure flights between 16:00 – 16:30, the capacity of the de-icing pads will not be sufficient. Following the departure peak an arrival peak is expected.

Resources for de-icing and winter service will be activated, planned and coordinated. In this case, an additional entity plans these resources. Due to expected delays available resources of terminal (e.g. boarding staff) and apron (stands and gates) will need to be adapted.

The result is a pre-tactical/tactical problem because sudden snowfall is rarer than predicted need for winter service. In this scenario, it will be concentrated on the winter service on the runways.

The Ground Handler will carry out the winter service.

Affected Operation Centres

- de-icing/winter service planning/coordination
- airport traffic centre
- airline station management
- airport stand and gate management
- ground handling operation centre

Scenario

De-Icing

Workflow without TAMS	*Workflow with TAMS*
About 14:00: Some stakeholders may notice that the weather forecast assumes snowfall at around 16:30.	About 14:00: The APM adds “de-icing” in his process chains and defines new process times for departure flights. The performance forecast

Workflow without TAMS	***Workflow with TAMS***
	indicates that the situation will be difficult. That means, agreed performance levels cannot be met. Constraints due to de-icing and factors influencing the performance will be presented on the Video Wall. Concerned systems: APM (prediction), Video Wall (situation awareness) Concerned working positions: Airline Agent, Airport Agent, Ground Handling Agent
	(Assumption: All aircraft have to be de-iced) The additionally expected waiting time in front of de-icing pads is calculated from de-icing capacity and demand by APM. This planning tool updates process times and performance predictions. It displays the possible delays. A forecast shows the effects in case of a “Do-nothing” to the agents in the APOC. Concerned systems: APM (calculation of capacity and demand) Concerned working positions: Airline Agent, Airport Agent
	Airlines identify flights, prioritised for departure (e.g. intercontinental flights) and which flights may be cancelled or rescheduled. [BUC: Demand Adjustment] Concerned systems: flight plan planner, airline systems Concerned working positions: Airline Agent
	With the airport as supporter/moderator, airlines negotiate among themselves and supported by the DMAN a preferred sequence of departures. This preferred sequence is passed to the Predeparture sequencing-system of the local ATC for implementation. [BUC: Pre-Departure Sequencing]

Workflow without TAMS	*Workflow with TAMS*
	Passengers of cancelled flights will be informed on the FIDS and directly by the airline (e.g. e-mail, sms). Concerned systems: DMAN, FIDS (informs passengers) Concerned working positions: Airline Agent, Airport Agent (terminal management), ATC Agent
There is no system support indicating possible delays of individual flights.	The preferred departure sequence is provided to all stakeholders in consideration of de-icing capacity. Each airline knows the off block time of the respective flight, therefore pilots will also be informed in due time. Concerned systems: Video Wall (situation awareness), Airport Operation Data Base (AODB) Concerned working positions: Airline Agent, Airport Agent, ATC Agent
	The airport analyses the stand and gate planning based on the updated system data. If the gate occupancy time is prolonged, stand and gate planning will be adjusted [BUC: Stand- and Gate Management]. Airlines, passengers and ground handler will be informed. Concerned systems: Stand and Gate Planning System, AODB Concerned working positions: Airport Agent (stand and gate management), Airline Agent, Ground Handling Agent
	Airlines decide about the time of boarding for each flight (assumption: there is a buffer and the start of boarding is not delayed beyond the maximum of the buffer – in this example the buffer will be set to 15min and the flight scheduled for 16:00 will get a TSAT at 16:30). Concerned systems: FIDS (informs passengers) Concerned working positions:

Workflow without TAMS	***Workflow with TAMS***
	Airline Agent, Ground Handling Agent, Airport Agent (stand and gate management)
(The ground handler does not yet know the resulting situation.)	The ground handler ensures the maintaining of the capacity after the peak according to the AOP, because a high utilisation after 17:00 is expected. Concerned systems: ground handler systems for coordination Concerned working positions: Ground Handling Agent
	The passengers will be informed about the new boarding times through FIDS. Concerned systems: FIDS (informs passengers) Concerned working positions: Airline Agent, Airport Agent
Cancelled or delayed flights can lead to crowds in the terminal area. Often adequate information is not available to the passengers. Consequently, delays cannot be predicted exactly.	Because the delay can be predicted better, the passenger can use this waiting time e.g. for shopping or dining. Passengers are spread throughout the terminal and do not wait in front of the gate.
Around 15:40: Pilot requests de-icing 20 – 30 min before EOBT (TOBT= 16:00). The de-icing sequence is transmitted every 30 minutes to the airlines and Ground Handler This sequence is an assumption. The airlines have no ability to influence the sequencing.	
The actual demand will be estimated due to the number of de-icing requests.	ATC confirms the start-up sequence using the pre-departure sequencer. Due to situation changes, the sequence or the predicted off-block time may vary to a small extent. Due to the boarding buffer, all passengers are at the gate on time when boarding starts. [BUC: Stand and Gate Management] Concerned systems: DMAN Concerned working positions: Airline Agent, ATC Agent, Airport Agent

Workflow without TAMS	*Workflow with TAMS*
Around 16:00: Pilot reports "ready for Start up".	
Around 16:01: ATC assorts the flight into the de-icing sequence. It specifies no time but only a position in the queue.	
The airport re-examines and adjusts the planning for stand and gate based on system data.	
	Around 16:10: The Pilot requests de-icing 20 – 30 min before TSAT (re-planned TOBT= 16:15). The TSAT is planned for 16:30. Concerned systems: DMAN Concerned Working Positions: Airport Agent, Airline Agent
	Around 16:15: Boarding is completed.
	Around 16:30 (TSAT): According to the sequence planning, the pilot reports „ready for start up"
Around 16:31: Pilot receives Start up clearance.	Around 16:31: Pilot receives Start up clearance.

Result without TAMS	*Result with TAMS*
Crowds might build within the terminal. Furthermore, queues of airplanes could form near the stands. Often there is no precise information about the delay situation. There is no situation awareness about the evolving situation of delay among the stakeholders Airlines do not have the opportunity to prioritise flights in the given de-icing sequence.	By the help of a pre tactical planning tool (APM) the predictability of departure times during de-icing conditions will increase. Due to provided data concerning planned departure times a better coordination between stakeholders can be developed. Due to better available data and an improved system support airlines get the opportunity to prioritise important flights in the planned de-icing sequence. Reliable information for passengers about the remaining time within the terminal could

Result without TAMS	***Result with TAMS***
Passenger discomfort due to lack of information. The pilot wants the flight to be accepted into the de-icing sequence as soon as possible, thus passengers will be boarded as soon as possible, as well.	imply better passenger comfort and higher revenue for the airport.

Winter service

Workflow without TAMS	***Workflow with TAMS***
Snowfall is forecasted for the day of operation.	Snowfall is forecasted for the day of operation.
	Possible intervals for snow removal will be included in the daily AOP updates. Under consideration of the weather-derived impact, the runway capacity will be adapted to its maximum possible capacity. [BUC: Planning of Capacity for Day of Operation] Concerned systems: airport systems Concerned working positions: Airport Agent
The winter service (snow removal of the individual runways) will be coordinated with the local ATC and the airport.	The winter service (snow removal of the individual runways) will be coordinated with the local ATC and the airport. [BUC: Adjustment of Traffic Procedures] Concerned systems: Airport systems for coordination, ATC systems for coordination, Ground Handler systems for coordination Concerned working positions: Airport Agent, ATC Agent, Ground Handling Agent (winter service)
(Around 16:00: Due to expected traffic load at 16:15 the airport could decide to anti-ice the runways in advance. The runways will be closed for the relevant	Around 16:00: Due to expected traffic load at 16:15 the airport could decide to anti-ice the runways in advance. The runways will be closed for the relevant

Workflow without TAMS	***Workflow with TAMS***
period (e.g. 15 min).) Nowadays preventive action is taken quite seldom.	period (e.g. 15 min). It is assumed that the airport considers the upcoming traffic in their planning. With a peak starting at 16:15, that means that if the interval is 16:00 - 16:30, the winter service would be carried out at 16:00. This will reduce delays for arrivals and departures. Concerned Working Positions: Airport Agent, Airline Agent, ATC Agent
Around 16:30: After the arrival of the snow front, the airport might inform airlines, ATC and ground handler when snow removal seems to be necessary and appropriate, according to the runways' condition and - as far as allowed by safety restrictions -also according to traffic load. It is expected the runway needs to be cleared between 16:45 and 17:15.	Around 16:30: After the arrival of the snow front, the airport indicates when snow removal seems to be necessary and appropriate, according to the runways' condition and - as far as allowed by safety restrictions -also according to traffic load. It is expected the runway needs to be cleared between 16:45 and 17:15. Based on this information a decision making process will be initiated determining the best time to clear the runways. In this process all stakeholders are involved. The decision is met to clear the runway at 17:00, if no safety restrictions force a clearance at an earlier point in time. The AOP will be updated. The airport does not have to wait until the runway definitely needs to be cleared. This could happen at an earlier point in time, if requested by other stakeholders in the APOC. [BUC: Adjustment of Traffic Procedures] Concerned Working Positions: all stakeholders
Delays of individual flights cannot be estimated, because the time of snow removal is still not decided. It depends on external triggering information (e.g. friction test, pilot request). Due to the uncertain time of the runway closure, the ground handler is often not able to align his resources optimally to the changed flight plan (e.g. rest periods).	Delays can better be predicted due to the knowledge of the expected time of the runway closure. Due to the known time of the runway closure, the ground handler is able to align his resources to the changed flight plan. Concerned working positions: Airline Agent, Ground Handling Agent

Workflow without TAMS	***Workflow with TAMS***
Around 16:45: The airport announces that snow removal will be carried out at 17:00. There is no system, which shows the development of delays.	Around 16:45: The system shows that snow removal will still be carried out at 17:00. The DMAN predicts the development of the traffic situation after reopening the runway (around 17:15). The airlines can provide accurate departure times to passengers. Concerned Systems: FIDS (information for passengers), DMAN (pre-departure sequence) Concerned Working Positions: Airline Agent, Airport Agent
Around 17:00: The winter clearance service on the runway starts.	Around 17:00: The winter clearance service on the runway starts. Concerned Working Position: Ground Handling Agent
Crowds could build within the gate areas due to flight cancellations and delays.	Passengers are distributed throughout the entire terminal area. Due to the better prediction of delays passengers use the time for shopping or dining.

Result without TAMS	***Result with TAMS***
Queues may arise within terminals and at stands. Today often there exists no transparent information about flight delays and flight cancellations. The situation awareness of all stakeholders is insufficient. Due to a lack of information resources might not be used optimally. The passenger comfort is not the best due to poor information availability and sharing.	Due to a pre-tactical and tactical planning tools (APM, DMAN) the predictability of departure times will be improved significantly. Due to better information about the development of the situation on the airport the stakeholders get the opportunity to optimise their coordination and the utilization of own resources. Reliable information for passengers about the remaining time within the terminal increases the comfort and maybe the airport retail.

Potential Business Use Cases

- 4.2 Planning of Capacity for Day of Operation
- 4.10 Stand- and Gate Management
- 4.11 Pre-Departure Sequencing
- 4.12 Adjustment of Traffic Procedures
- 4.13 Demand Adjustment

3.3. Capacity Demand Balancing

Event

This scenario is valid for a hub airport in a hub-and-spoke operation system. Due to weather events on a global level (powerful jet streams, no thunderstorms or turbulences that have to be avoided), the entire intercontinental fleet consisting mainly of heavy aircraft and coming from North America will arrive at GIA before schedule. Therefore, it is expected that the intercontinental flights arrive at the same time as a large number of smaller short-haul aircraft. They represent the feeding traffic for the long-haul aircraft after turnaround. During a time frame of approximately 30 minutes, the arrival demand will exceed the arrival capacity. Since the intercontinental fleets generally arrive concentrated at certain times of the day, this scenario is a common situation for hub airports that may occur regularly throughout the year.

Affected operation centres

- approach control
- tower control
- ground handling operation centre
- airline operation centre
- CFMU
- outstation
- terminal management
- stand and gate management
- customs authorities
- federal police
- security service provider (if existent)

Scenario

Workflow without TAMS	*Workflow with TAMS*
Individual stakeholders know the new ELDTs in advance (particularly the airlines) and transmit this information to other stakeholders. Possibly, the information is not instantaneously exchanged. There is no consistent set of information available for all stakeholders at the same time since no standardised procedures for information exchange and data management for flight delays and arrivals ahead of schedule exist.	The AMAN provides highly accurate ELDTs when the arrivals are within the range of the AMAN. The CAP (collaborative airport planning) approach implies that information known by one stakeholder will be distributed among the others via the information sharing platform (ACISP). Consequently, the information can be used for traffic prediction and planning by all stakeholders. Concerned systems: AMAN (calculation and update of arrival times), ACISP (distribution of information)

Workflow without TAMS	***Workflow with TAMS***
	Concerned working positions: all stakeholders
Centralised and continuously adapted traffic forecast considering the current traffic situation is not necessarily used at airports today. If there is no long-term prediction and planning, reliable information about arising capacity constraints are known well enough by all the stakeholders only a short time before they have to deal with it.	The APM uses the most accurate ELDT and EOBT data from the ACISP and generates a traffic prediction of the next 24 hours. Furthermore, the network of other assistance tools (AMAN, TMAN, DMAN, SMAN, PaxMan) analyses the development of the entire process chain from air to air. Concerned systems: APM (long term prediction of arrival and departure demand), AMAN, TMAN, DMAN, PaxMan (analysis of demand and capacity development for their respective resources) Concerned working positions: all stakeholders
	The results of the situation analysis are shown on the Video Wall (queues and expected performance).The expected demand capacity mismatches for the arrival capacity and other resources (e.g. stands, terminal) generate an alert on the Video Wall and are timely identified by the agents. The performance for the next 24 hours is predicted by the APM. The agents are triggered by the alerts to identify measures to reduce the impact of the arrival overdemand or even to prevent the bottleneck situation. All measures are aimed to comply with the QoSC and the SLA. Concerned systems: Video Wall (situation awareness inside the APOC, alert display), APM (prediction of performance for next 24h) Concerned working positions: all stakeholders
	The first two measures increase the usable portion of the maximum arrival capacity for the time when the intercontinental flights are expected. The first possibility is a change of the runway use strategy from mixed to single mode to increase the arrival capacity by decreasing the departure capacity. The ATC Agent

Workflow without TAMS	*Workflow with TAMS*
	checks the impact particularly of the decreased departure capacity in a single what-if with APM or in a joint what-if with AMAN and DMAN. The measure is particularly sensible if it does not cause a bottleneck situation for departing aircraft. If that is the case further investigations are required if the departure shortcomings can be prevented and the arrival capacity enlarged at the same time. The second possibility is a change of runway direction. This measure is only viable if the wind direction and strength allow a change of runway utilisation. One reason for such a change can be that one direction permits a higher capacity than the other due to crossing runways and a varying degree of runway dependency depending on the direction. Another reason can be the location and number of taxiways and runway exits. There may be a preferred direction for environmental reasons (e.g. noise over residential area) which can be changed for the time of the bottleneck situation to the less favourable direction with a higher capacity. During the change of the arrival direction, a higher number of take-offs may be possible. The ATC Agent tests in a single what-if of the APM and/or in a joint what-if of AMAN, SMAN, TMAN and DMAN the influence on the departure flow and the gain of arrival capacity. The ATC Agent has to consult all measures with tower control and approach control. The potential measures and their feasibility and benefit are negotiated between the concerned stakeholder agents (in particular ATC and airport). [BUC: Adjustment of Traffic Procedures] Concerned systems: APM (predicts impact of change of runway utilisation), AMAN/SMAN/TMAN/DMAN (predict influence of change of flight approach direction), AMAN/DMAN (predict impact of change of runway utilisation) Concerned working positions: Airport Agent, ATC Agent (tower control,

Workflow without TAMS	***Workflow with TAMS***
	approach control)
	If the predicted demand capacity mismatch for arrivals is higher than the capacity gain of the measures above, the ATC Agent checks by a single what-if of the ATWP if some short-haul flights can be restrained at the outstation and communicates with the CFMU if the network capacity allows this measure. This action does not entail additional delays compared to the delays the aircraft would suffer from in holding patterns at GIA if they departed as scheduled. The potential flights identified by the ATC Agent are communicated to the Airline Agent who consults with his OC taking aspects of fleet management and transfer passengers into account and ultimately decides about the flights that come into consideration. Outstations and CFMU have to be informed by the affected airlines about their intentions. The restraining of aircraft has to be implemented by the airlines and accordingly CFMU has to issue new slots. The communication with the respective outstation and the CFMU is realised by the Airport Agent and the ATC Agent, respectively, which represent these stakeholders in the TAMS APOC. Via ACISP, the information is shared with all other stakeholders in the APOC so that they can adapt their planning to the new arrival situation. [BUC: Demand Adjustment] Concerned systems: ATWP (analysis of potential flights for retarding at outstation), ACISP (distribution of information) Concerned working positions: ATC Agent (CFMU), Airport Agent (outstation), Airline Agent (airline operation centre)
An overdemand for arrivals arises that exceeds the capacity of the runway system because of the intercontinental flights arriving earlier than scheduled. The higher portion of aircraft in the wake vortex category "heavy"	Due to the adjustment of traffic procedures and the demand adjustment enabled by TAMS, only a small overdemand arises, or there is no demand capacity mismatch for arrivals at all.

Workflow without TAMS	***Workflow with TAMS***
causes larger separations in the arrival sequence and therefore enlarges additionally the demand capacity mismatch.	
The use of runway capacity is spontaneously shifted to an arrival prioritisation arrival capacity is spontaneously increased which entails a decrease of the usable departure capacity since the narrow staggering of arrivals does not allow departure slots. Departure flights stay on the ground and may miss their originally scheduled CFMU slots. This may cause an inefficient utilisation of network capacities. The enquired new departure time might not be possible since no CFMU slot for this time can be allocated due to limited network capacity. The alternative slot may cause additional delays. The departure punctuality is declined. Additionally a great number of arrivals have to fly holding patterns, early intercontinentals as well as scheduled short-haul flights. Therefore, the arrival punctuality of the short-haul flights is impacted.	The adjustment of traffic procedures ensures that the arrival capacity is increased if possible without decreasing the departure capacity below the required minimum. The demand adjustment reduces the arrival demand so that the number of holdings are minimised. At this point, there is only limited impact on the departure punctuality while short-haul flights restrained at their outstations will pass on their departure delays into arrival delays at GIA.
	The new EIBTs of all intercontinental flights are earlier than scheduled. In single what-ifs of the SGMAN, the Airport Agent in collaboration with the airport stand and gate management finds the optimal stand allocation for the new in-block sequence to avoid tows, bus transfers, and remote parking positions. The Airport Agent negotiates the new stand allocation with the Airline Agent while they may consider the preferences of the Ground Handling Agent. They consult with the ground handling operation centre and the airline operation centre, respectively. The Airport Agent analyses in a joint what-if of SGMAN and PaxMan the impact of the stand allocation on the terminal operations in consultation with the terminal management. The new stand and gate allocation is communicated to all stakeholders via the ACISP. [BUC: Stand- and Gate Management] Concerned systems: ACISP (distribution of information), SGMAN/PaxMan (optimal stand and gate

Workflow without TAMS	***Workflow with TAMS***
	allocation) Concerned working positions: Airport Agent (terminal management, stand and gate management), Ground Handling Agent (ground handling operation centre), Airline Agent (airline operation centre)
Since the intercontinental flights arrive before schedule, their parking positions might still be used by other aircraft. If a reallocation of stands is not possible, the turnaround of the aircraft will be handled at remote positions. Reallocation, towing, bus transfers etc. might be the consequence particularly if there are not enough non-schengen positions. Alternatively, the aircraft will wait for a limited time period at remote positions with running engines for the clearance of the original parking positions. In both cases, the service level for passengers will decrease.	Due to the early stand and gate management enabled by TAMS, only a small number of tows or bus transfers are required.
The environmental impact will augment due to waiting aircraft in the air in holding patterns and on the ground with running engines at remote positions.	Since the number of aircraft waiting in the air in holding patterns and on the ground with running engines is minimised, the environmental impact does not augment significantly.
	The Ground Handling Agent knows the new in-block time of the intercontinental flights and the eventually delayed short-haul flights in advance via AMAN and SMAN. The TMAN identifies critical flights. The Ground Handling Agent analyses in a single what-if of the TMAN which resources he needs to allocate and adapts processes in such a way that the early arrivals can be handled directly after in-block and the late arrivals can be handled in a quick turnaround process. He coordinates with the Airline Agent the preferences of the airline. The Ground Handling Agent consults all measures with the OC and organises the implementation. [BUC: Turnaround Management] Concerned systems: TMAN (identification of critical flights, resource allocation and process adaptation), AMAN/SMAN (prediction of new EIBT) Concerned working positions:

Workflow without TAMS	***Workflow with TAMS***
	Ground Handling Agent (ground handling operation centre)
The overdemand for ground handler resources causes departure delays for the short-haul flights. Due to holding patterns, the short-haul flights may have arrived later than the intercontinentals and the ground handler resources may already be occupied. The ground handler may potentially not be able to handle all short-haul and intercontinental flights at the same time. He prioritises the handling according to financial incentives and potentially interrupts the handling of intercont s. The originally scheduled stands of the short-haul flights may already be blocked by the intercontinental flights.	The departure times of the short-haul flights which were restrained at the outstation and which arrived late at GIA are mostly still met due to the early turnaround management and the implementation of quick turnarounds.
Deboarding and baggage handling of the intercontinental flights may not directly be realised subsequently to in-block since the ground handler may be overloaded with the overdemand and the aircraft may stand on remote parking positions. This leads to a decrease of the passenger service level. After the turnaround, departure delays for the intercontinental flights are likely despite their early arrival due to general complications at the airport caused by the arrival peak and due to transfer passengers from the delayed short-haul flights.	Due to the stand and gate management and the turnaround management enabled by TAMS, aircraft are handled directly after in-block and the passengers can immediately enter the gate. There is no decrease of the passenger service level.
	Since the Airport Agent inside the APOC has full situation awareness by means of the ACISP and the Video Wall, the necessary information can timely be passed on to the terminal management, the customs authorities, the federal police and the security service provider (if existent). The resources of baggage handling inside the terminal and of control stations for passport and customs particularly for non-schengen passengers are adapted to the early arrival of intercontinental passengers. This process is implemented by the OCs outside the APOC while the Airport Agent can identify and propose adequate measures utilising the PaxMan [BUC: Passenger Flow Management]. Concerned systems:

Workflow without TAMS	*Workflow with TAMS*
	ACISP (distribution of information), Video Wall (situation awareness), PaxMan (identification of resource adaptation for control stations) Concerned working positions: Airport Agent (terminal management, customs authorities, federal police, security service provider (if existent))
Control stations for passport and customs particularly for non-schengen passengers might be closed or not sufficiently staffed. The consequence will be the formation of queues and a further decrease of the passenger service level.	Due to the passenger flow management, the early intercontinental flights cause no additional queues. Since the passengers can enter the gate immediately after in-block and the queues are reduced to a minimum, more transfer passengers have a longer time period than scheduled in the terminal for shopping and eating.

Result without TAMS	*Result with TAMS*
Airport capacities are inefficiently used. Departure punctuality is decreased and CFMU slots are potentially unused. Noise, pollutants and greenhouse gases are emitted that could be avoided Stand capacities are sub optimally used. Additional coordination between all stakeholders involved in the turnaround process is necessary and leads to increased workload. The passenger service level is decreased.	The situation awareness is enhanced even in everyday situations. Resources are efficiently used (e.g. parking positions, runways, police, customs, ground handling). The operating ability can be preserved. Queues and general waiting time can be minimised leading to a customer-friendly airport and a high service level. Emission of noise, pollutants, and greenhouse gases can be reduced. Delays and costs can be reduced. The immediate handling of intercontinental aircraft and intercontinental passengers at control stations entails for more transfer passengers longer periods inside the terminal giving the opportunity for eating and shopping.

Potential Business Use Cases

- 4.8 Turnaround Management
- 4.9 Passenger Flow Management
- 4.10 Stand- and Gate Management
- 4.12 Adjustment of Traffic Procedures
- 4.13 Demand Adjustment

3.4. Closure of Neighbouring Airport

Event

As predicted by weather forecast, a neighbouring airport will be partly or totally closed due to bad weather conditions in the coming hours (e.g. severe thunderstorm or snowstorm, flood). Arriving flights will be diverted to Generic International Airport (GIA). This may result in an over-demand of various resources at GIA. First, this over-demand will affect the originally planned arriving flights due to the increasing arrival demand. However, departures may have also to be considered, even if they can be scheduled ahead of time. Usually, an airport's departure capacity is not independent of its arrival capacity, esp. if runways are used in mixed mode. Within the scope of this scenario it is assumed that the departure capacity of GIA is sufficient to handle the additional departure flights. However, the arrival- and turnaround operation will be affected by the additional flights.

Alternate airports are selected during flight preparation and they are filed with the ATC flight plan. However, out of this previous selection any alternate airport may be chosen during the flight, depending on the current circumstances. An airport has to accept a request to land particularly in case of an emergency and if the airport is not closed. It is assumed that all aircraft diverted to GIA can be parked on the apron. In exceptional cases, taxiways may be used as auxiliary stands, though this possibility will not be considered for this scenario. Handling capacities, however, may at times be limited at the airport. An extreme example would be the diversion of many long distance flights from a hub to a qualified smaller airport. This potential variant of the scenario would be similar to the preceding scenario Capacity Demand Balancing (cf. 3.3) and is not considered here.

Affected operation centres:

- tower control
- approach control
- apron control
- ground handling operation centre
- airport traffic centre
- terminal management
- airline operation centre
- (federal police, customs authorities, security service provider (if existent))

Scenario

Workflow without TAMS	*Workflow with TAMS*
Neighbouring airport will be closed or its inbound capacity drastically reduced. This event is communicated verbally by ATC up to 3 hours in advance.	Neighbouring airport will be closed or its inbound capacity drastically reduced. This event is communicated by ATC up to 3 hours in advance. A notification is displayed on the Video Wall. Concerned systems:

Workflow without TAMS	***Workflow with TAMS***
	ACISP (distribution of information), Video Wall (situation awareness) Concerned working positions: all stakeholders
Several pilots decide to divert to GIA instead of entering a holding at the original destination airport. For their decision, they take into account the advice of ATC and of their own airline operation centre.	Several pilots decide to divert to GIA instead of entering a holding at the original destination airport. For their decision, they take into account the advice of ATC and of their own airline operation centre. Concerned systems: airline systems, AMAN (planning of sequence) Concerned working positions: Airline Agent (airline operation centre), ATC Agent
The separate diversion landings will be announced by ATC, partly on short notice, and a new airport flight is created.	The separate diversion landings will be communicated by ATC to all stakeholders as soon as possible and a new AOP is created automatically. Airport traffic centre supplements flight- and master data for the added inbounds where needed. [BUC: Management of an additional arrival flight] Concerned systems: airline systems (decision about diversion), ACISP (distribution of information), flight plan planner (creation of new airport flight schedule), AMAN (planning update of arrival sequence) Concerned working positions: all stakeholders
Due to the diverted flights, the total number of arrivals at GIA will increase for a certain period of time resulting in an over-demand. In many cases, adequate measures will not be possible within the limited time frame and holdings as well as delays will arise.	Due to the diverted flights, the total number of arrivals at GIA will increase for a certain period of time resulting in an over-demand. Without appropriate measures, holdings as well as delays will arise for scheduled and diverted flights. Possible measures, like delaying some scheduled flights at their outstation, can be discussed in the APOC and examined with a single or joint what-if. [BUC: Handling of updated ELDT or EIBT; BUC: Demand Adjustment]

Workflow without TAMS	***Workflow with TAMS***
	Concerned systems: AMAN (planning update of sequence) Concerned working positions: Airline Agent, ATC Agent
Airport traffic centre looks for available stands to park diverted aircraft. Respectively, terminal management allocates gates for the additional aircraft. In some cases, both will only be possible on short notice due to delayed information about the diverted flight.	Airport traffic centre is looking for optimal stands with SGMAN to park diverted aircraft. Respectively, terminal management allocates optimal gates for the additional aircraft with PaxMan. If applicable a single what-if or joint what-if (e.g. SGMAN & PaxMan) can be made to support the decision. [BUC: Stand- and Gate Management] Concerned systems: SGMAN (planning update of stands), PaxMan (planning update of gate) Concerned working positions: Airport Agent (airport traffic centre, terminal management), Ground Handling Agent
Staff and equipment to handle aircraft are partly called on short notice. In some cases they will have to be taken from scheduled aircraft. The amount of handling activities are agreed-upon spontaneously between airline and ground handler.	Resources (staff and equipment) to handle aircraft will be provided according to the active AOP (containing scheduled and diverted flights). Required handling processes are well defined and planned ahead by the TMAN thus reducing delays, especially for the scheduled aircraft. The amount of handling activities corresponds to the service level agreements between airline and ground handler, if existent. Otherwise, the amount of handling activities are agreed-upon spontaneously between airline and ground handler. [BUC: Turnaround Management] Concerned systems: TMAN (planning update of turnaround) Concerned working positions: Ground Handling Agent
Preferably, passengers will stay on board and continue their journey to the original destination. Depending on the situation, decisions are partly taken on short notice regarding deboarding of passengers,	Preferably, passengers will stay on board and continue their journey to the original destination. If not, all stakeholders are informed as soon as possible if and when it is planned to have the passengers deboarded,

Workflow without TAMS	***Workflow with TAMS***
unloading of baggage, immigration and customs control, keeping passengers in transit area, bus transfer, fuelling, and catering etc. Often there is only uncoordinated provision of information among different stakeholders (telephone). Potentially immigration and customs control will be overloaded as the additional demand has originally not been anticipated.	baggage unloaded, immigration and customs control available (or if passengers stay in transit area), bus transfer arranged and so on. [BUC: Passenger Flow Management, BUC:Turnaround Management] The decision whether to deboard passengers or not can be discussed in the APOC in order to evaluate available resources (precondition: respective airline is represented in the APOC). Single what-ifs or a joint what-if can be used to determine the optimal handling and timing of the necessary processes (e.g. PaxMan prognoses necessary/available capacity at security check point). Concerned systems: TMAN (planning update of turnaround), PaxMan (e.g. calculation of pax-density or checkpoint capacity), airline systems (replacement crew), AMAN (planning update of arrival sequence) Concerned working positions: all stakeholders
Approach, landing, taxiing, and parking are carried out like regular flights.	Approach, landing, taxiing, parking are carried out like regular flights.
A new ATC flight plan has to be filed either for the continuation of the diverted flight to its original destination airport or for the transfer of the aircraft to a different airport.	A new ATC flight plan has to be filed either for the continuation of the diverted flight to its original destination airport or for the transfer of the aircraft to a different airport. Potentially the allocation of slots might be negotiated.[1] Due to the overall circulation of the aircraft, an affected airline will have interest to get its aircraft to the original destination. Concerned systems: airline systems (desired departure time) Concerned working positions: Airline Agent, ATC Agent (CFMU)
Airport traffic centre creates an updated airport flight schedule for the departure of the diverted flight. The new airport flight schedule	Airport traffic centre creates an updated AOP for the departure of the diverted flight using the flight plan planner and informs all

[1] The neighbouring airport will probably operate at its capacity limit after re-opening: holding patterns have to be emptied first, potentially on-going capacity constraints, especially during wintertime. That is, if the CMFU will provide slots to this airport. Because airlines are highly interested to bring their aircraft back into their originally planned rotations, negotiations of CTOTs could be very interesting (bonus-malus-system). This is not considered here, because slot negotiation is out-of-scope of TAMS.

Workflow without TAMS	***Workflow with TAMS***
is available to all stakeholders, though possibly with time delay.	stakeholders about it. The exact TSAT of the diverted flight can be discussed in the APOC supported by a single or joint what-if of the different tools. [BUC: Management of an additional departure flight] Concerned systems: SMAN/DMAN (planning update of departure sequence), flight plan planner (creation of new airport flight schedule), ACISP (distribution of information) Concerned working positions: all stakeholders
Regarding the particular situation, renewed changes in the flight schedule (for diverted as well as scheduled flights) may become necessary due to possible - flight delays (e.g. caused by passengers delayed due to long queues in the terminal) - the fact that flight crews of the diverted flights might possibly have to be replaced and a new crew might have to be flown in (duration uncertain) - stand and gate changes made necessary by the diverted flights as well as delayed scheduled flights	Regarding the particular situation, renewed changes in the flight schedule (for diverted as well as scheduled flights) may become necessary due to possible - flight delays (e.g. caused by passengers delayed due to long queues in the terminal) [BUC: Refine TOBT in case of updated ERDT, BUC: Handling of updated ELDT or EIBT] - the fact that flight crews of the diverted flights might possibly have to be replaced and a new crew might have to be flown in (duration uncertain) [BUC: Refine TOBT in case of updated ERDT, BUC: Handling of updated ELDT or EIBT] - stand and gate changes made necessary by the diverted flights as well as delayed scheduled flights [BUC: Stand- and Gate Management] In the APOC those changes can be managed as follows: - coordination between airline and ground handler about aircraft sequence and possible acceleration of aircraft handling [BUC: Turnaround Management] - in case replacement crews have to be sent via aircraft, the flights with the replacement crews on board may be prioritised (in order to accelerate the departure of the diverted flight)

Workflow without TAMS	***Workflow with TAMS***
	- the results of the different measures can be tested with the different tools by using a single what-If - automatic information distribution to all stakeholders Concerned systems: TMAN (planning update of turnaround), SGMAN (planning update of stands), SMAN/DMAN (planning update of sequence), PaxMan (updated EPGT calculation), ACISP (distribution of information) Concerned working positions: all stakeholders
Boarding of passengers, push-back, taxiing, and take-off are carried out like regular flights.	Boarding of passengers, push-back, taxiing, and take-off are carried out like regular flights.

Result without TAMS	***Result with TAMS***
Capacity of RWY will be exceeded. Arrivals must enter holdings. Capacity of aircraft stands is not sufficient (maybe only temporarily). Handling resources will be exceeded (e.g. baggage system, check points).	Situation awareness is fostered by prediction of waiting queues and provision of actual information. Spontaneous activities are avoided. Efficient operations are possible because current information is provided centrally. It has not to be acquired by telephone and entered manually into local systems. Increase in overall workload will be reduced. Time frame for planning will be increased. Better use of resources (e.g. parking stands, RWY, staff, and equipment) will be possible. Direct agreements between airport and airlines at the airport within APOC: due to expected delays the airlines may distribute their own flights to different alternates to avoid an over-demand at GIA (these details are out-of-scope of TAMS).

Potential Business Use Cases

- 4.3 Management of an additional arrival flight
- 4.4 Management of an additional departure flight
- 4.6 Handling of updated ELDT or EIBT
- 4.7 Refine TOBT in case of updated ERDT
- 4.8 Turnaround Management
- 4.9 Passenger Flow Management
- 4.10 Stand- and Gate Management
- 4.13 Demand Adjustment

3.5. Strike – (entry and execution phase of strike)

The recovery phase subsequent to the strike is described in “Recovery subsequent to strike”, chapter 3.6.

Event

In this scenario, the focus is on a pilots’ strike, which is announced early on and affects only the home carrier. A participation of about 80% of all of the home carrier’s pilots is assumed. The strike commences with start of operations at the airport (from 6am) and will at least last till 11am of the same day. Consequently, the strike takes place during the morning departure peak, which in turn is partly equalised and postponed. In addition, a number of flights will be cancelled. The home carrier has a lion’s share of the flights in the schedule, especially in the morning peak. Owing to the early announcement of the strike, the time of commencement as well as the duration is known the day before. With start of operation on strike day, the departure flights of the home carrier stay on the ground while initially the arrival flights still reach the airport.

Affected operation centres:

- airline operation centre
- ground handling operation centre
- terminal management
- tower control
- federal police
- security service provider (if existent)
- [stand and gate management (adjusted gate assignment)]
- [apron control (organization of towing)]

Scenario

Workflow without TAMS	*Workflow with TAMS*
The strike is announced.	The strike is announced.
The Airline (home carrier) prepares a special strike flight schedule (owing to the early strike announcement, preliminary planning is possible, no ad-hoc planning).	The Airline (home carrier) prepares a first version of a special strike flight schedule (owing to the early strike announcement, preliminary planning is possible, no ad-hoc planning). Concerned systems: airline systems Concerned working positions: Airline Agent
The Airport as well as ATC receives the	The stakeholders in the APOC may support the airline with the setting up of a special

Workflow without TAMS	***Workflow with TAMS***
special strike flight schedule from the airline. The newly issued strike flight schedule is, however, subject to some uncertainties caused by missing knowledge of flight crew appearance, available aircraft and passenger behaviour (arrival time at airport, rebooking, cancellations, transfer to train)	strike schedule and during the integration of the final draft of into the AOP (24h preliminary planning). Possible topics could be aircraft changes (bigger aircraft), stand & gate planning or the take-over of flights by different airlines/airline pilots. [BUC: Aircraft change, BUC: Stand- and Gate Management] Results of the different measures can be tested with the different tools by using a single What-If. The newly issued AOP with the special strike flight schedule is, however, subject to some uncertainties caused by missing knowledge of flight crew appearance, available aircraft and passenger behaviour (arrival time at airport, rebooking, cancellations, transfer to train) Concerned systems: TMAN (planning update of turnaround), SGMAN (planning update of stands), SMAN/DMAN (planning update of sequence), ACISP (distribution of information) Concerned working positions: all stakeholders
The commencement of the strike is announced with start of operations in the morning, Consequently the special strike flight schedule is generated the previous evening based on available information. The activation of the new schedule occurs with start of operations.	In the APOC, the stakeholders can debate the point in time at which the new strike flight schedule shall be incorporated into the AOP. For this scenario, the commencement of the strike is announced with start of operations in the morning. Consequently, the special strike flight schedule is generated the previous evening based on available information. The activation of the new schedule occurs as agreed with start of operations. Concerned systems: ACISP (distribution of information) Concerned working positions: all stakeholders
The activation of the special strike flight schedule is relevant to all existing systems entailing the distribution of the respective information (if present: FIDS, TMAN, SMAN,	The incorporation of the strike flight schedule into the AOP is relevant to all existing systems. The distribution of the respective Information is carried out automatically and

Workflow without TAMS	***Workflow with TAMS***
DMAN, SGMAN).	immediately. Concerned systems: ACISP (distribution of information), FIDS (update of monitors) TMAN (planning update of turnaround), SMAN/DMAN (planning update of sequence), SGMAN (planning update of stands) Concerned working positions: all stakeholders
The strike begins.	The strike begins.
In most cases, the coordinated planning among the different stakeholders is not sufficient in order to manage the occurrences during the strike phase optimally.	During the strike phase, the APOC coordinates the operational handling of the flights. Information about current operational changes is passed to all stakeholders. All changes are included in the AOP. Concerned systems: ACISP (distribution of information) Concerned working positions: all stakeholders
Terminal management informs the passengers. Large passenger crowds in some areas of the airport are possible. The airline ensures that enough personal is available at information desks and service points for e.g. rebooking/refunding of tickets or issuing transfer tickets for trains. If it becomes necessary, additional personal has to be deployed.	Terminal management informs the passengers. With the help of the PaxMan, the terminal management also monitors the filling level in waiting areas. If it becomes necessary, affected passengers might have to be guided back to the public area. [BUC: Passenger Flow Management] The airline ensures that enough personal is available at information desks and service points for e.g. rebooking/refunding of tickets or issuing transfer tickets for trains. If it becomes necessary, additional personal has to be deployed. Concerned systems: PaxMan (calculation of pax-density), FIDS (information for passengers) Concerned working positions: Airline Agent, Airport Agent
During operation, changes in the special strike flight schedule may become necessary	During operation changes in the AOP may

Workflow without TAMS	*Workflow with TAMS*
due to - Aircraft change (e.g. if the available pilots do not have the necessary licenses or bigger aircrafts are needed to enable the transport of more passengers) - Flight delays (e.g. caused by passengers rebooked on short notice) - Additional flight cancellations (e.g. if less pilots than previously expected are available or aircrafts are not available as planned) - Stand and gate changes, possibly including tows to remote parking positions (e.g. made necessary by strike-hit aircrafts blocking the gates or aircraft changes)	become necessary due to possible - Aircraft changes (e.g. if the available pilots do not have the necessary licenses or bigger aircrafts are needed to enable the transport of more passengers) [BUC: Aircraft change] - Flight delays (e.g. caused by passengers rebooked on short notice) [BUC: Refine TOBT in case of updated ERDT, BUC: Handling of updated ELDT or EIBT] - Additional flight cancellations (e.g. if less pilots than previously expected are available or aircrafts are not available as planned) [BUC: Demand Adjustment] - Stand and gate changes, possibly including tows to remote parking positions (e.g. made necessary by strike-hit aircrafts blocking the gates or aircraft changes) [BUC: Stand- and Gate Management] In the APOC those changes can be managed as follows: - Coordination between airline and ground handler about aircraft sequence and possible acceleration of aircraft handling (quick turnaround in case important connection flights shall be carried out even during the strike); all possible measures thereby depending on the availability of resources and aircraft type authorisation of the ground handler. [BUC: Turnaround Management] - The results of the different measures can be tested with the different tools by using a single what-If. - Automatic information distribution to all stakeholders Concerned systems: TMAN (planning update of turnaround), SGMAN (planning update of stands), SMAN/DMAN (planning update of sequence), PaxMan (updated EPGT

Workflow without TAMS	Workflow with TAMS
	calculation), ACISP (distribution of information) Concerned working positions: all Stakeholders

Result without TAMS	Result with TAMS
Each stakeholder has information only about the processes relevant for himself and about the respective status of those processes. Tool support for common planning of short-term changes is very limited today or does not exist at all. Automatic distribution of information is not available. Flight delays and cancellations as well as large passenger crowds are likely.	Potential strike flight schedule is shared with all stakeholders early on. Consequently, all stakeholders have the chance to reconsider their planning and if required adapt it. By using TAMS, the coordination of updated planning among the stakeholders is promoted. Information distribution occurs automatically. Thus, an ideal use of the remaining resources is ensured and delays as well as cancellations can be reduced to a minimum. Tool support enables improved assessment of results of possible measures and decisions. Systematic passenger guidance will reduce passenger crowds.

Potential Business Use Cases

- 4.5 Aircraft change
- 4.6 Handling of updated ELDT or EIBT
- 4.7 Refine TOBT in case of updated ERDT
- 4.8 Turnaround Management
- 4.9 Passenger Flow Management
- 4.10 Stand- and Gate Management
- 4.13 Demand Adjustment

3.6. Recovery subsequent to strike (recovery management)

Event

In this scenario, the focus is on a pilots' strike, which is announced early on and affects only the home carrier. A participation of 80% of all of the home carrier's pilots is assumed. The strike commences with start of operations at the airport (from 6am) and will at least last till 11am of the same day. Consequently, the strike takes place during the morning departure peak, which in turn is partly equalised and postponed (assumption: no flight cancellations). Owing to the early announcement of the strike, the time of commencement as well as the duration is known the day before. With start of operation on strike day, the departure flights of the home carrier stay on the ground while initially the arrival flights of the home carrier still reach the airport.

After the strike, the situation at the airport depends on the events and actions occurring during the strike phase. Thus, the number of aircrafts on the ground (not yet handled departures or delayed arrivals) and the number of passengers remaining in the terminal is directly correlated with the special strike flight schedule operated during the strike phase and necessary short-term adoptions of this schedule. However, due to the strike situation there is no exact knowledge about the available aircraft and crews or the number of passengers still waiting for their flights at the end of the strike phase. Necessary aircraft might still be grounded on other airports or passengers might have rebooked, cancelled or switched to train or car, respectively.

The aim of all stakeholders is to return to normal operation as fast as possible after the end of the strike. All planning activities seek to promptly establish respective conditions for all stakeholders. This particularly concerns all airlines with aircraft rotations and passenger processing. However, ground handling, airport operator, and ATC will have to update their planning in order to meet the demand, too.

Affected operation centres:

- tower control
- approach control
- ground handling operation centre
- airline operation centre
- terminal management
- airport traffic centre
- apron control (organisation of towing)
- federal police
- security service provider (if existent)

Scenario

Workflow without TAMS	*Workflow with TAMS*
Before the beginning of the strike, the airline prepares a special recovery flight schedule, which will be updated continuously during the strike phase.	Before the beginning of the strike, the airline prepares a special recovery flight schedule, which will be updated continuously during the strike phase. Concerned systems: airline systems Concerned working positions: Airline Agent
Possible combinations of flights (combination of different flights of the home carrier as well as a combination of a home carrier flight with one of a different airline) may be discussed in negotiations among different airlines. Results will be presented in an updated flight schedule.	Possible combinations of flights (combination of different flights of the home carrier as well as a combination of a home carrier flight with one of a different airline) may be discussed in negotiations among different airlines. (Negotiations solely among airlines are treated like a black box in TAMS) Results will be presented in an updated flight schedule. Concerned systems: airline systems Concerned working positions: Airlines Agent
The airport as well as ATC receives the updated recovery flight schedule from the airline on short notice. There is no coordinated cross-stakeholder planning.	The APOC allows for a revised recovery management where different measures may be tested and optimised with the different tools by using a single what-if. Based on information about the current situation (e.g. about delayed flights) including resources, the new recovery flight schedule can be negotiated in the APOC and included in the AOP. The updated AOP might comprise flight delays or changes, cancellations and aircraft changes.[BUC: Demand Adjustment, BUC: Management of an additional departure flight, BUC: Aircraft change, BUC: Stand- and Gate Management] Concerned systems: TMAN (planning update of turnaround), SGMAN (planning update of stands), SMAN/DMAN (planning update of sequence), ACISP (distribution of information)

Workflow without TAMS	*Workflow with TAMS*
	Concerned working positions: all Stakeholders
The expected end time of the strike is known (scenario description). The updated recovery flight schedule is generated based on available information and gets activated with end of strike.	In the APOC, the stakeholders can debate the point in time at which the recovery flight schedule shall be incorporated into the AOP. The expected end time of the strike is known (scenario description). The recovery flight schedule is generated based on available information and gets activated as agreed with end of strike (for this scenario description). Concerned systems: ACISP (distribution of information) Concerned working positions: all stakeholders
The strike ends.	The strike ends.
Each stakeholder resumes operation with the aim to return to the normal operation as fast as possible.	Recovery management starts and the APOC coordinates the operational handling of the flights according to the AOP, enabling each stakeholder to resume operation with the aim of returning to normal operation as fast as possible in a well-coordinated way. Concerned systems: ACISP (distribution of information) Concerned working positions: all stakeholders
Terminal management informs the passengers about the new recovery schedule. Large waiting queues and passenger crowds in some areas of the airport are possible. The airline as well as the police/security service provider ensures that enough personal is available at the different process stations. Only limited coordination and optimisation of the different measures take place.	Terminal management informs the passengers about the new recovery schedule. With the help of the PaxMan, the terminal management also monitors the filling level of the different process stations. Based on the results of what-if calculations conducted with the PaxMan, the APOC advises the stakeholders about necessary increase of personal at certain process stations. (airline: check-in and service counter; police/security service provider: immigration, security, and passport control) The goal therein is to prevent or at least reduce waiting queues. [BUC: Passenger Flow Management] Concerned systems:

Workflow without TAMS	***Workflow with TAMS***
	PaxMan (calculation of pax-density), ACISP (distribution of information), FIDS (information for passengers) Concerned working positions: Airline Agent, Airport Agent (police/security service provider (if existent))
During operation, changes in the flight schedule might become necessary due to - aircraft change (e.g. if aircraft scheduled according to the recovery flight schedule are not yet available) - Flight delays (e.g. caused by passengers rebooked on short notice or delayed arrivals) - Additional flight cancellations (e.g. if aircraft or crews scheduled according to the recovery flight schedule are not yet available) - Stand and gate changes, possibly including tows to remote positions (e.g. made necessary by aircrafts blocking the gate or aircraft changes) Limited coordination and optimisation of the separate measures, no automatic real-time distribution of information	During operation, changes in the AOP might become necessary due to - aircraft change (e.g. if aircraft scheduled according to the recovery flight schedule are not yet available) [BUC: Aircraft change] - Flight delays (e.g. caused by passengers rebooked on short notice or delayed arrivals) [BUC: Refine TOBT in case of updated ERDT, BUC: Handling of updated ELDT or EIBT] - Additional flight cancellations (e.g. if aircraft or crews scheduled according to the recovery flight schedule are not yet available) - Stand and gate changes, possibly including tows to remote positions (e.g. made necessary by aircrafts blocking the gate or aircraft changes) [BUC: Stand- and Gate Management] In the APOC those changes can be managed as follows: - Coordination between airline and ground handler about aircraft sequence and possible acceleration of aircraft handling (quick turnaround); all possible measures thereby depending on the availability of resources and aircraft type authorisation of the ground handler [BUC: Turnaround Management] - Results of the different measures can be tested with the different tools by using a single what-if. - Automatic information distribution to all stakeholders Concerned systems: TMAN (planning update of turnaround),

Workflow without TAMS	Workflow with TAMS
	SGMAN (planning update of stands), SMAN/DMAN (planning update of sequence), PaxMan (updated EPGT calculation), ACISP (distribution of information) Concerned working positions: all Stakeholders

Result without TAMS	Result with TAMS
Each stakeholder only has information about the processes relevant for himself and about the respective status of those processes. To return to normal operation as quickly as possible common planning is necessary. Today, tool support for common planning is very limited or does not exist at all. Automatic real-time information distribution is not available. Flight delays and cancellations as well as passenger crowds are likely.	Potential recovery flight schedule is shared with all stakeholders early on. Consequently, all stakeholders have the chance to reconsider their planning and if required adapt it. By using TAMS, the coordination of updated planning among the stakeholders is promoted. Information distribution occurs automatically. Thus, an improved foundation for planning can be gained. Tool support enables improved assessment of results of possible measures and decisions. Optimised passenger flow as well as optimised use of resources conduces to a reduction of waiting times for passengers and handling times of the aircrafts. Accordingly, delays and cancellations will be reduced.

Potential Business Use Cases

- 4.4 Management of an additional departure flight
- 4.5 Aircraft change
- 4.6 Handling of updated ELDT or EIBT
- 4.7 Refine TOBT in case of updated ERDT
- 4.8 Turnaround Management
- 4.9 Passenger Flow Management
- 4.10 Stand- and Gate Management
- 4.13 Demand Adjustment

3.7. Quality of Service

Corresponding to the vision of TAMS (cf. [5], section 2.3) the basis for realising a Total Airport Management is the enabling of performance based planning and monitoring at an airport. A precondition for performance based airport operations is the selection and implementation of KPIs. Therefore, the stakeholders in the GIA APOC need to agree upon defined performance goals and jointly set target values for the day-of-ops[2], according to the kind of traffic operations, which are managed. These jointly set targets are called Service Level Agreement and are based on the Quality of Service Contract (QoSC) defined on management level[3]. The Quality of Service Levels (QoSLs) define the target values for the individual KPIs according to the respective time and situation customised to the individual airport. The QoSLs are jointly determined by the APOC Agents and constitute the SLA. The measured and forecasted values of the KPIs are called actual and predicted performance and describe the status of the SLA. Additionally, the QoSC and SLA are made known to the air transport network so that the network planning can be aligned to the planned airport operations.

Typical KPIs for the QoSC and SLA belong to e.g. the Key Performance Areas (KPAs) Punctuality, Traffic Volume & Demand, Capacity, or Environment. In these areas, KPIs can be selected and applied according to the TAMS operational concept document (cf. [5], section 4.3). The specific selection of KPIs depends on the individual airport and can differ from airport to airport. However, at an airport the selected KPIs and defined metrics for the calculation of these KPIs are chosen for at least one season on a management level. The jointly set target values (QoSL values over time) can vary with the time of day and are negotiated variably based on special occurrences or traffic demand and defined in the Service Level Agreement.

If a system suite enabling Total Airport Management includes a planning tool for the optimisation of the Airport Operation Plan (AOP), the whole milestone planning can be managed based on the set of performance goals.

If preference and possibility windows are defined related to the performance goals of the QoSC and SLA, an alerting of some form is possible, which informs the stakeholders about the adherence to the SLA (cf. [5], section 4.4).

The SLA for a certain day is negotiated as soon as reliable predictions are available. At least, the SLA is set before operations start. If excessive capacity restrictions or over demands occur during operations, which cannot be handled by appropriate measures, the SLA is renegotiated.

As both, airlines and airports, advertise e.g. with their achieved daily operation punctualities, the setting of daily average values for the SLA could be sufficient as a first step. Likewise as a further step, it is also possible that variable values are negotiated, such as punctuality in the morning amounting to 90 % and in the evening to 80%. As described in the TAMS OCD [5], the KPIs of the different KPAs can influence each other, so that e.g. it could be a mutual decision that greater delays are accepted for a defined period to avoid flight cancellations during adverse conditions. Therefore, a weighting between different KPAs respectively KPIs shall be determined.

[2] The „day-of-ops“ means the day of operations and encompasses the whole 24h time horizon of the current day.

[3] For further information refer to TAMS operational concept document [5], chapter 4.

This scenario demonstrates how a SLA can be adapted to a certain situation within the APOC.

Event

This scenario is related to the Capacity Demand Balancing scenario, cf. chapter 3.3. A measure defined for a punctuality KPI within the QoSC is basis for this event. This is defined as a comparison between AIBT and SIBT for arrivals and AOBT to SOBT for departures. In addition, the QoSC states that the punctuality KPI is based on the IATA 15-min criterion, i.e. all flights with a maximal delay of +/- 15 min are considered as punctual. Regarding the KPI delay, it has been defined in the QoSC that a maximal delay in the vicinity of the airport (e.g. arrival sequencing and metering area, cf. [3]) for each aircraft is guaranteed. Based on the given QoSC a SLA has been accepted wherein the target for the punctuality indicator has been set so that at least 90% of all flights shall be punctual. The target for the delay KPI has been set to a maximal delay of +/- 20 min. At first, no problems occur and the targets are met. Then it becomes obvious that all trans-atlantic flights will arrive earlier as assumed, leading to an unexpected demand-peak. In contrast to the scenario Capacity Demand Balancing, in this event no adequate counteractions are possible so that the SLA needs to be negotiated within the APOC. The agents lower the target for the punctuality indicator to a target where at least 80% of all flights shall be punctual and adapt the target for the delay KPI to a maximal delay of 40 minutes for the time until the overdemand has been handled. The updated SLA is valid starting with the arrival of the trans-atlantic fleet and lasting about 2 hours. The negotiation includes that the formerly accepted SLA with the 90% punctuality criterion is again in effect when the demand-peak is processed.

For the purpose of this scenario the dependence of and from other KPIs is not considered.

Affected Operation Centres

As the QoSC and SLA shall be in focus of every stakeholders' planning and execution of airside and landside processes, every entity is affected, which is involved in operations or resource planning at an airport, especially in a pre-tactical time horizon.

- airline operation centres
- stand and gate management
- ground handling operation centre
- terminal management
- federal police
- security service provider (if existent)
- approach control
- tower control

Scenario

Workflow without TAMS	Workflow with TAMS
Nowadays airlines and airports are measured by their performance and obviously, stakeholders will organise their processes	With the implementation of TAMS, a QoSC has been agreed on a management level,

Workflow without TAMS	***Workflow with TAMS***
internally in such a way, that they can principally reach their performance goals. However, comprehensive management of airport operations according to set goals takes place only in terms of seasonal slot coordination.	including metrics for the calculation of KPIs.
At present, it is unusual that stakeholders at an airport jointly agree upon common performance goals.	Based on the QoSC, the agents within the APOC have negotiated a SLA with the target for the punctuality KPI so that at least 90% of all flights shall be punctual. The target for the KPI delay says that no flight shall have more than +/- 20 min delay. Part of the SLA in general is: - weighting of KPIs or KPAs - definition of preference and possibility windows - derivation of alerts (this means the setting of boundary values for the triggering of alerts) Concerned systems: APM, ACISP Concerned working positions: all stakeholders
Overdemand is detected through FUMs. Delay increases.	Overdemand is detected through FUMs, a punctuality alert is generated because the value is out of the preference window. Concerned systems: APM, ACISP Concerned working positions: all stakeholders
	During the negotiation of the SLA including the setting of new target values for the punctuality KPI and the delay KPI, both a single what-if and a joint what-if can be used in order to gain sensible target values. [BUC: Update Service Level Agreement] Concerned systems: APM, ACISP Concerned working positions: all stakeholders

Workflow without TAMS	*Workflow with TAMS*
An adjustment of performance goals only takes place stakeholder internal and is restricted to own optimisations.	New targets for the punctuality (80%) and delay (40 min maximal delay) KPIs are negotiated and new boundaries for the preference windows are set within the APOC. [BUC: Update Service Level Agreement] Concerned systems: APM, ACISP Concerned working positions: all stakeholders
	The new SLA is made public to the network. Concerned systems: ACISP Concerned working positions: Moderator

Result without TAMS	*Result with TAMS*
Between the different stakeholders conflicts of interest exist. Since they represent solely their own interests, considerable losses to other stakeholders can be the result and an airport-wide optimum may not be reached.	Depending on the situation at the respective airport, specific performance goals can be fostered through the setting of the SLA. The QoSC and SLA provide a basis for the optimisation of the whole airport system and therefore conduces to every stakeholder's aims in the long term. The expected situation is made known to the network through the SLA.

Potential Business Use Cases

- 4.1 Update Service Level Agreement

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4. Business Use Cases

This chapter introduces the TAMS Business Use Cases (BUCs). BUCs are a series of interactive steps between either humans (between the APOC Agents themselves or in conjunction with their operation centres - OCs) or between the agent and the corresponding TAMS APOC support systems. They describe the handling of specific tasks the APOC agents are confronted with, depending on the operational scenarios described in previous chapters of this document.

Several BUCs can be applied to the same scenario as the same BUC can be applied to several scenarios. In the individual BUC sub chapter, a reference to the operational scenarios the BUC applies to is stated. The compilation is not subject to completeness.

At the beginning of each sub chapter the *scope* in time and involvement of actors (APOC Agents, OCs) is listed, followed by the operational scenarios it applies to. A brief *summary* of the intention of the BUC is followed by *prerequisite conditions* that need to be satisfied before the BUC is or can be executed. The following *post conditions* present the situation that exists after successful termination of the BUC.

The *notes* describe additional information that is useful for getting a deeper understanding of the constraints of the BUC or of the general setup.

What will trigger the execution of the BUC is exemplified in the corresponding *trigger* sub section.

The structure of BUCs itself is straightforward. It compasses of a *main flow* that principally covers the majority of steps that are common to the described situations (within the operational scenarios). This is complemented by secondary branches (*alternative flows* based on decisions to be taken during the main or alternative course of action) and concluded by *failure flows* (where the original intention of the BUC can't be satisfied).

The individual steps are sequentially numbered, starting with the main flow steps, followed by alternative flow steps and concluded by the failure flow steps. References from one step to the other are given by referral to the step number.

Numbers in brackets (e.g. [2]) substitute the step with the same number in the original flow and therefore indicate alternative flow entry points, resulting in a deviation from the main flow based on decision variances of the former flow steps.

The BUCs apply to the TAMS planning phase and not to operational ad-hoc decision making. All BUCs end at last when the planning of the corresponding event or situation has been concluded. Therefore, it is obvious that the BUC processes are not safety critical and hence have no impact on operational safety of airport operations as a whole.

The flow during the BUC handling and the results of it will affect the AOP and change one or more planning details of an event or resource, potentially resulting in alerting of the agents and triggering additional BUCs.

For all BUCs it is true that a valid AOP exists at all times, as this is the already agreed upon plan of airport operations. Intermediate AOP samples or extracts may exist during the course of any BUC, it is up to the BUC and the decisions taken by the agents if this intermediate AOP extract will be re-inserted into the current AOP resulting in a new AOP.

When BUCs employ the TAM functionality What-If-Analysis, this analysis and the modification of planning data is achieved on a technical copy of the AOP data. It is obvious that during the course of the BUC the real world, and thus the valid AOP, may change. It is up to the agents to transform their (potential) decisions adequately back to the valid AOP once they came to a conclusion (end of BUC). If BUCs trigger other BUCs while they are in What-If-Analysis mode, these BUCs are processed in What-If-Analysis mode, as well.

The probing for benefits of various potential solutions during What-If-Analysis can either be conducted sequentially or in parallel, system support should enable both possibilities.

Some BUCs include events where airlines, that normally are not operating at GIA, divert to GIA. In these cases it is assumed:

- Either airline and GIA's ground handler have a service contract or the airline has initiated a handling request that has been accepted by GIA's ground handler.
- The airline OC can not add information to GIA's AOP. In this case, the Airport Agent consults the airline and replaces the Airline Agent within the APOC in the steps of applying BUCs.

The below listed table contains an overview of the association of the TAMS BUCs to the TAMS Operational Scenarios.

The turquoise coloured table rows indicate that a detailed description of the BUC is available. Detailed description of the other BUCs, which are referenced in the Operational Scenarios but either are not occurring often enough or are covered in other BUCs (e.g. Aircraft Change), have been omitted.

Scenario / ***BUC***	Closed Terminal Area	De-Icing & Winter Services	Capacity Demand Balancing	Closure of Neighbour-ing Airport	Strike – Entry and Execution	Strike – Recovery	Quality of Service
Update Service Level Agreement							X
Planning of Capacity for Delay of Operation		X					
Management of an additional Arrival Flight				X			
Management of an additional Departure Flight				X		X	
Aircraft Change					X	X	
Handling of Updated ELDT or EIBT	X			X	X	X	

Refine TOBT in Case of Updated ERDT	X			X	X	X	
Turnaround Management			X	X	X	X	
Passenger Flow Management	X		X	X	X	X	
Stand and Gate Management	X	X	X	X	X	X	
Pre-Departure Sequencing		X					
Adjustment of Traffic Procedures		X	X				
Demand Adjustment		X	X		X	X	

Table 4-1: Overview of TAMS BUC and Operational Scenarios

A more technical description related to the tools used within the TAMS project can be found in [1] and [7].

4.1. Update Service Level Agreement

This BUC is part of the TAMS scenarios. Due to the limited number of operational scenarios that necessitate the employment of this BUC it is not considered further within the TAMS project.

Summary

The pretactical planning of performance goals and strategies is content of this BUC.

4.2. Planning of Capacity for Day of Operation

This BUC is part of the TAMS scenarios. Due to the limited number of operational scenarios that necessitate the employment of this BUC it is not considered further within the TAMS project.

Summary

The aim of the planning of capacity is to define the capacity of runways for the day of operations taking events into account that can have a negative impact on capacity.

4.3. Management of an additional arrival flight

Scope

- Time horizon: announcement of diverted flight until landing
- Actors: ATC Agent, Airline Agent, Airport Agent
- Negotiation: Airport and Airline Agent
- Kind of what-if: BUC “Stand- and Gate Management” runs completely as what-if

Correlated operational scenarios

- Recovery subsequent to strike
- Closure of neighbouring airport

Summary

This BUC describes how an additional arrival that is actually not included in the flight schedule shall be handled. The flight has to be incorporated in the AOP in order to allow tactical tools a consideration of this flight. Thus, conflicts with other flights can be detected and times as well as resources can be assigned.

Precondition

A flight, which is airborne and not in the airport schedule, is expected to land. No maintenance of the aircraft is required.

Postcondition

A flight event, which was not in the airport schedule, is planned in the AOP.

Notes

The airport is of at least medium size so that enough stands are available. It makes no difference for the flow of an additional arrival whether this arrival goes to the original or any other destination later on.

Trigger

A new unplanned arrival has to be added to the AOP.

Main Flow

1. An additional arrival, which is not in the airport schedule, is announced to land by ATC to the APOC Agents. The flight information, including ELDT is communicated using ACISP. This updates also the AOP.
2. The Airline Agent communicates that the original destination will be closed for a couple of hours.
3. The Airline Agent communicates the OC decision that passengers shall be deboarded and baggage unloaded, pax will have to collect the baggage at the baggage reclaim.
4. Airline OC adds the number of pax and baggage to the AOP.
5. The Airport Agent triggers BUC “Stand- and Gate Management” in what-if mode

possibly assisted by the Airline Agent.

6. The Airport Agent updates AOP with stand and gate information resulting from what-if.
7. The Airport Agent triggers BUC "Passenger Flow Management" for the handling of the additionally arriving passengers. The result updates the AOP.
8. The Airline Agent triggers BUC "Turnaround Management". The result updates the AOP.
9. The Airline Agent communicates that the aircraft shall go without all original pax to the original resp. selected destination as soon as possible.
10. The Airline Agent communicates modes of further transportation and the likelihood of usage (e.g. bus, rebooking of transfer pax).
11. The Airport Agent triggers BUC "Passenger Flow Management" for the handling of the passengers who continue their trip by plane. The results update the AOP.
12. When the aircraft landed, the information for passengers defined in steps 7 and 11 is displayed with FIDS where applicable.
13. Airline Agent triggers BUC "Management of an additional departure flight". BUC is finished.

Alternative Flow

[2] The Airline Agent communicates, that the original destination will be closed only for a short period, i.e. less than one hour.

14. The Airline Agent communicates the OC decision that the pax shall not be deboarded and baggage not unloaded. The flight will shortly continue its flight to the original destination.
15. The Airport Agent triggers BUC "Stand- and Gate Management" in what-if mode possibly assisted by the Airline Agent.
16. The Airport Agent updates AOP with stand and gate information resulting from what-if. Next step 13.

[2] The Airline Agent communicates that an additional aircraft will arrive to transport additional passengers.

17. The Airline Agent communicates that the aircraft is empty.
18. The Airport Agent triggers BUC "Stand- and Gate Management" in what-if mode possibly assisted by the Airline Agent.
19. The Airport Agent updates AOP with stand and gate information resulting from what-if.
20. The Airline Agent communicates the planned time of departure and the destination of the aircraft.
21. The Airline Agent triggers BUC "Turnaround Management". The result updates the AOP. Next step: 13.

[3] The Airline Agent communicates the OC decision that passengers shall be deboarded until the flight can be continued but baggage shall stay on board.

22. The Airport Agent triggers BUC “Stand- and Gate Management” in what-if mode possibly assisted by the Airline Agent.
23. The Airport Agent updates AOP with stand and gate information resulting from what-if.
24. The Airline Agent triggers BUC “Turnaround Management”. The result updates the AOP.
25. The Airport Agent triggers BUC “Passenger Flow Management” for the handling of the passengers that have to wait in the transit area. The results update the AOP.
26. When the aircraft landed, the information for passengers defined in step 25 is displayed with FIDS where applicable. Next step: 13.

[3] The Airline Agent communicates the OC decision that passengers and baggage shall stay on board.

27. The Airport Agent triggers BUC “Stand- and Gate Management” in what-if mode possibly assisted by Airline Agent.
28. The Airport Agent updates AOP with stand and gate information resulting from what-if.
29. The Airline Agent triggers BUC “Turnaround Management”. The result updates AOP. Next step: 13.

[9] The Airline Agent communicates that the aircraft shall go to the original destination and carries passengers with this destination. These passengers may be rebooked from other flights or did arrive with the same aircraft earlier. Passengers that did arrive with this aircraft earlier also have the possibility to use other modes of transport.

30. The Airline Agent communicates modes of further transportation and the likelihood of usage (e.g. bus, rebooking of transfer pax, passengers using original aircraft).
31. The Airport Agent triggers BUC “Passenger Flow Management” for the handling of the diverted passengers. The results update the AOP.
32. When the aircraft landed, the information for passengers defined in step 7 and 31 is displayed with FIDS where applicable. Next step: 13.

[17] The Airline Agent communicates that the aircraft has passengers and baggage on board.

33. The Airline OC adds the number of pax and baggage to the AOP.
34. The Airport Agent triggers BUC “Stand- and Gate Management” in what-if mode.
35. The Airport Agent updates AOP with stand and gate information resulting from what-if.
36. The Airport Agent triggers BUC “Passenger Flow Management”. The result updates the AOP.
37. The Airline Agent triggers BUC “Turnaround Management”. The result updates the

AOP.

38. The Airline Agent communicates the planned time of departure and the destination of the aircraft. Next step: 13.

Failure Flow

There is no failure flow within this BUC.

4.4. Management of an additional departure flight

Scope

- Time horizon: announcement of a new departure flight until airborne
- Actors: Ground Handler Agent, Airline Agent, Airport Agent, ATC Agent
- Negotiation: Airport and Airline Agent
- Kind of what-if:
  - single what-if with TMAN,
  - single what-if with PaxMan.

Correlated operational scenarios

- Recovery subsequent to strike.
- Closure of neighbouring airport.

Summary

This BUC describes how an additional departure flight that is actually not included in the airport schedule shall be handled. The flight has to be incorporated into the AOP in order to allow tactical tools, the APOC Agents and other stakeholder to consider this flight. Thus, conflicts with other flights can be detected and times as well as resources can be assigned.

Precondition

A flight, which was diverted to GIA, or a new flight, which was not scheduled, is expected to depart.

Postcondition

A flight event, which was not in the airport schedule, is planned in the AOP.

Notes

The airport is of at least medium size so that enough stands are available. It makes no difference for the flow of an additional departure flight whether this departure goes to the original later on or any other destination.

The airport and the ground handling companies have enough resources to handle the additional flight to the requested time.

Trigger

A new unplanned departure has to be added to the AOP.

Main Flow

1. An additional departure is announced to depart at a requested time by airline OC to the Airline Agents, which is not in the airport schedule. The departure time could be dependent on a slot. Airline OC files an ATC-flight plan. The flight information, including requested EOBT is communicated using ACISP. This updates also the AOP.
2. The Airline Agent communicates to the APOC Agents that there is a new additional

departure flight and its requested EOBT.

3. The Airline Agent communicates that the aircraft is currently empty.
4. The airline OC adds the number of departing passengers and baggage to the AOP.
5. The Airport Agent triggers BUC “Stand- and Gate Management”. The assigned gate and stand update the AOP.
6. The Airport Agent triggers BUC “Passenger Flow Management”. The assigned service facilities update the AOP.
7. The departure information from [5, 6] for passengers and airport employees is displayed with FIDS.
8. AOP is updated. BUC is finished.

Alternative Flow

[3] The Airline Agent communicates that passengers and baggage are already in the aircraft.

9. The airline OC adds the number of departing passengers and baggage to the AOP. Next step: 7.

[3] The Airline Agent communicates that only the baggage of the passengers is in the aircraft and the passenger are in the transit area and have to board on a requested time.

10. The Airport Agent triggers BUC “Stand- and Gate Management”. The assigned gate and stand update the AOP.
11. The Airport Agent triggers BUC “Passenger Flow Management”. The assigned service facilities update the AOP.
12. The departure information from [10, 11] for passengers and airport employees is displayed with FIDS.
13. The airline OC adds the number of departing passengers to the AOP. Next step: 8.

Failure Flow

There is no failure flow within this BUC.

4.5. Aircraft change

This BUC is part of the TAMS scenarios. Due to the limited number of operational scenarios that necessitate the employment of this BUC it is not considered further within the TAMS project.

Summary

The actions resulting from an aircraft change that are related to stand and gate planning are covered by the BUC “Stand- and Gate Management”. To complete the flow associated with the BUC “Demand Adjustment”, ATC related issues resulting from an aircraft change are covered within the BUC “Demand Adjustment” that triggers the BUC “Stand- and Gate Management”.

4.6. Handling of updated ELDT or EIBT

Scope

- Time horizon: ELDT-3h up to MST 6 (ALDT), respectively MST 3 (ATOT outstation) up to - MST 7 (AIBT),
- Actors: all agents may be affected,
- Negotiation: no negotiation within this BUC,
- Kind of what-if: no what-if in this BUC.

Correlated operational scenarios

- Recovery subsequent to strike
- Closure of neighbouring airport

Summary

During the approach of an arriving flight, the ELDT is repetitive updated and the estimate is getting more and more precise. Since the combination of ELDT and calculated Taxi-In Time is the trigger point for the turnaround-process, the ELDT is propagated through the TAMS subsystems automatically by ACISP.

Flight update messages (FUM) are sent by the CFMU to the ADES (Aerodrome of destination, here GIA) in the following cases:

- At ELDT - 3 hours (this is 3 hours before the estimated landing time at the ADES)
- At modification of the ELDT of more than a given number of minutes (e.g. 5 min)
- At important flight status changes

The ELDT can be retrieved from a FUM sent by the CFMU or from calculation by the AMAN as soon as the flight is within its focus. A flight will be in focus of the AMAN as soon as radar data becomes available (FIR entry) or the ATC flight plan provides estimated time over the FIR entry point. An ELDT coming from the AMAN will be treated as to be more precise than the ELDT coming from the CFMU. A new ELDT will be forwarded to all stakeholders via the ACISP.

Precondition

- The flight where the FUM or EIBT relates to is already part of the flight schedule.
- The process planning by TMAN is connected with a resource management system, otherwise the Ground Handling Agent is responsible for the availability of turnaround resources.
- A new ELDT may affect more flights than the associated one. The systems highlight any EIBT and ERDT in graphical user interfaces (GUI), if deviations of more than a defined tolerance from SIBT or SOBT exist.

Postcondition

Discrepancies are known to all APOC Agents and are handled in such a way that the processes of all concerned stakeholders are optimised.

Notes

Independent of the ELDT the EIBT might be updated. If an arrival has actually landed, a change of EIBT is furthermore possible. In this case, all steps of the following main flow from step [2] and the alternative flows are the same. But, if the arrival has already landed, the reaction has to be conducted immediately, because the time for reaction is quite short.

Possible reasons for an updated EIBT after landing are:

- The traffic situation on airfield or apron causes a change of taxi route or extended taxi time (constraints of dependent parking position in complex apron layouts, taxiway congestion, winter service, sudden inhibition of taxiway).
- The pilot takes the false taxi route or taxis to fast or to slow.
- The taxi route is changed in case of a newly allocated parking position.

Trigger

ELDT or stand or taxiroute for a flight is updated.

Main Flow

1. ATC OC updates the arrival sequence possibly assisted by AMAN and this updates in turn the AOP.
2. SMAN (re-)calculates EIBT for this flight on basis of its new ELDT/stand/taxiroute automatically and updates the AOP.
3. PaxMan (re-)calculates EPGT for transfer passengers of this flight on basis of its new EIBT automatically.
4. TMAN (re-)calculates the turnaround process and therefore the ERDT for all flights, which are affected by the new EIBT automatically.
5. The Airport Agent checks the usability of the parking position between EIBT and ERDT using SGMAN.
6. No change of the parking position is necessary, for the flight with the new EIBT and the next flight on the same parking position.
7. AOP is updated.
8. The Airport Agent checks deviations between EIBT and SIBT resp. ERDT and SOBT for all affected flights i.e. linked departure and flights with transfer passengers from the flight with the changed EIBT.
9. All deviations are smaller than a defined tolerance.
10. BUC is finished.

Alternative Flow

[3] No transfer passengers are on this flight, therefore no update of EPGT for transfer passengers is necessary.

11. Next step: 4.

[6] The check of parking position fails.

12. The system sends an alert to the Airport Agent to inform about the discrepancy.
13. The Airport Agent initiates BUC “Stand- and Gate Management”. Next step: 7.

[9] The new ELDT (EIBT) causes a delay of the linked departure, i.e. the deviation ERDT/SOBT is above the defined tolerance.

14. The Airline Agent and the Ground Handling Agent receive an alert at the working position about the delay of the linked departure.
15. The Airline Agent initiates BUC “Turnaround Management”.
16. BUC “Turnaround Management” finds a solution so that the delay for the linked departure is below the defined tolerance. Next step 7.

[9] Another departure is delayed, because of transfer passengers on the flight with the new ELDT (EIBT). The deviation ERDT to SOBT for this departure is above the defined tolerance.

17. The Airline Agent and the Ground Handling Agent receive an alert at the working position about the delay of the departure.
18. The Airline Agent and/or the Ground Handling Agent check the reason for the delayed departure using TMAN and PaxMan.
19. The working position indicates an alert about the delayed transfer flight and the transfer time for passengers.
20. The Airline Agent initiates BUC “Passenger Flow Management”.
21. Result of BUC “Passenger Flow Management” leads to an acceleration of the transfer so that the deviation between ERDT and SOBT for the connecting flight is below the defined tolerance. Next step: 10.

[16] BUC “Turnaround Management” finds a solution where the delay for the linked departure is above the defined tolerance.

22. The Airline Agent decides after consulting airline OC to accept delay for linked flight and to update AOP. BUC “Refine TOBT in case of updated ERDT” is initiated for linked departure automatically. Next step: 10.

[21] Result of BUC “Passenger Flow Management” leads to a deviation between ERDT and SOBT for the connecting flight above the defined tolerance.

23. The Airline Agent decides after consulting airline OC to accept delay for connecting flight and update AOP. BUC “Refine TOBT in case of updated ERDT” is initiated for connection flight automatically. Next step: 10.

[23] The Airline OC decides to carry out the connection flight without waiting for transfer passengers.

24. AOP is updated. Next step: 10.

Failure Flow

[15] The Airline Agent does not react on alert. Delay of linked departure is accepted.

25. Next step: 10.

[16] BUC “Turnaround Management” finds no solution. No measures are possible.

26. Next step: 10.

[20] The Airline Agent does not initiate BUC “Passenger Flow Management”.

27. Next step: 23.

[22] The Airline Agent decides after consulting airline OC not to accept delay for linked departure.

28. The airline provides an alternative aircraft.
29. The Airline Agent initiates BUC “Stand- and Gate Management” for the alternative aircraft. AOP is updated.
30. The Airline OC decides about the next destination of the original aircraft and initiates BUC “Management of an additional departure flight”. Next step: 10.

4.7. Refine TOBT in case of updated ERDT

Scope

- Time horizon: MST 7 (AIBT) up to MST 12 (ARDT)[4]
- Actors: Airline Agent, Ground Handling Agent
- Negotiation: no negotiation
- Kind of what-if: no what-if in this BUC.

Correlated operational scenarios

- Closed Terminal Area
- Strike – entry and execution phase of strike
- Recovery subsequent to strike

Summary

The BUC describes how an airline OC can be assisted in the TAMS environment to refine the Target Off-Block Time (TOBT) of an outbound flight in order to improve the predictability and accuracy of off-blocks.

The BUC is triggered, if the Airline Agent wants to refine the TOBT or if a TOBT exists and an updated ERDT is available, which deviates more than a tolerance from the previous ERDT. Possible causes are:

- A significant inbound delay, which implies a delay of the linked departure, see also BUC "Handling of updated ELDT or EIBT".
- Late or not appearing passengers that cause a delay and consequently the unloading of their baggage.
- One of the turnaround processes takes more or less time than calculated.
- Turnaround delay recovery in case of late arrival, see also BUC "Turnaround Management"
- Transfer passengers of a delayed arrival, see also BUC "Passenger Flow Management"

Precondition

- The flight where the TOBT or ERDT relates to is already part of the flight schedule.
- The AOP includes the linkage of the inbound flight with the outbound flight and is available to all stakeholders.
- The new ERDT is later than the former ERDT.

Postcondition

Discrepancies are known to all APOC Agents and are handled in such a way that the processes of all stakeholders are optimised.

[4] The time horizon encompasses not only MST 9, Final update of TOBT, since the ERDT may be changed up to MST 12, when the turnaround is really completed.

Notes

This BUC clearly separates the role and responsibilities of the Airline Agent and those of the Ground Handling Agent. At some airports, there might be a delegation of responsibility for TOBT from the Airline Agent to the Ground Handling Agent. In this case, many steps of the BUC will not apply.

It is assumed that full coordination with the airline OC regarding operational decisions has already taken place once the Airline Agent wants to update a TOBT.

Trigger

An updated ERDT deviates more than a tolerance from the ERDT before.

Main Flow

1. The Airline Agent notices an updated ERDT that is displayed on his working position. A system notification shows, that this time deviates more than a tolerance from the ERDT before.
2. The Airline Agent decides to adapt TOBT after consulting airline OC.
3. The Airline Agent and the airline OC find a solution without any stand and gate conflicts for a TOBT update using TMAN.
4. The Airline Agent consults the Ground Handling Agent about planned change of TOBT.
5. The Ground Handling Agent agrees to the proposed TOBT.
6. The Airline Agent updates the AOP. BUC is finished.

Alternative Flow

[2] The Airline Agent decides after consulting airline OC to try to compensate delay.

7. The Airline Agent initiates BUC “Turnaround Management” and BUC “Turnaround Management” allows compensation. Next step: 6.

[3] The Airline Agent and airline OC find a solution for a TOBT update using TMAN that has a conflict with the following arrival on the same position.

8. The Airline Agent initiates BUC “Stand- and Gate Management”. Next step: 6.

[4] The Airline Agent changes TOBT without consulting Ground Handling Agent.

9. Next step: 6.

[5] The Ground Handling Agent does not agree to the proposed TOBT.

10. The Ground Handling Agent informs the Airline Agent that he cannot comply with the proposed TOBT.
11. The Ground Handling Agent proposes an alternative TOBT using TMAN to the Airline Agent.

12. The Airline Agent accepts proposal of the Ground Handling Agent. Next step: 6.

[7] The Airline Agent initiates BUC “Turnaround Management” and BUC “Turnaround Management” does not allow compensation.

13. The Airline Agent decides to adapt TOBT. Next step: 3.

[12] The Airline Agent does not accept proposal of the Ground Handling Agent.

14. Next step: 7.

Failure Flow

[2] The Airline Agent does not update the TOBT in time.

15. The system sets TOBT automatically to ERDT and updates the AOP. BUC finished.

4.8. Turnaround Management

Scope

- Time horizon: update of EIBT (ELDT) up to ASRT.
- Actors: Ground Handling Agent, Airline Agent, Airport Agent
- Negotiation: negotiation between Airport Agent, Airline Agent, Ground Handling Agent
- Kind of what-if: single what-if with TMAN

Correlated operational scenarios

- Closure of Neighbouring Airport
- Strike – entry and execution phase of strike
- Recovery subsequent to strike

Summary

The BUC describes a general planning of ground handling resources (personnel and equipment) during or before an overdemand to ensure a smooth ground handling process.

After an outbound delay has been identified in the TMAN, an airline or ground handling operator shortens (in regard of his possibilities) some turnaround processes in order to recover this delay (so-called “quick turnaround or short turnaround”). The ERDT and all dependent timestamps are updated in the AOP.

Precondition

Current turnaround information is available as part of the AOP to all stakeholders, especially ground handlers, so that they can make changes to their resource planning as early as possible. The flight information, which has to be updated, is contained in the AOP and a turnaround has been planned for the flight.

The airline operation centre or ground handling operation centre must have some additional personnel on standby and unused equipment to shorten the turnaround handling.

The ground delay results in a departure delay (for the corresponding departure flight).

Postcondition

Turnaround Management has been updated without conflicts according to the requirements. The updates are included in the AOP and are available for all stakeholders.

Notes

Short turnaround:

Services will be reduced, e.g. instead of a planned deep cleaning only a transit cleaning will be carried out. The benefit is timesavings.

Quick turnaround:

The ground handler increases the number of its resources. That means, e.g. the catering process will be performed with two vehicles instead by only one vehicle. The benefit is timesavings.

Trigger

Additional or changed flight requires new or updated turnaround process:

- new ELDT/EIBT
- new TSAT
- additional flight

Main Flow

1. The Ground Handling Agent notices that the deviation between EOBT and TOBT exceeds a predefined tolerance. This deviation is displayed as an agent notification alert in the HMI of the Airline and Ground Handling working position.
2. The Ground Handling Agent executes a single what-if with TMAN with the aim of finding out what kind of turnaround process (short or quick turnaround) is applicable to comply with the requested off-block time or to mitigate a delay.
3. TMAN calculates as proposal a quick turnaround.
4. Ground Handling Agent and ground handling OC assess the consequences of the proposal “quick turnaround” for ground handling resources (e.g. more personnel or more equipment).
5. The Ground Handling Agent and ground handling OC decide to do a quick turnaround.
6. AOP is updated with a new TOBT. BUC is finished.

Alternative Flow

[1] Ground Handling Agent notices an additional departure flight.

7. The Airline OC communicates EIBT and EOBT of this additional flight to the Ground Handling Agent.
8. The Ground Handling Agent and Airline Agent check through single what-if by TMAN if the handling of this flight is possible in time for the requested off-block time.
9. TMAN calculates that it is possible to handle the additional flight within the requested time and usual turnaround procedures. Next Step: 6.

[1] The Ground Handling Agent notices that a specific flight gets a new TSAT.

10. The Ground Handling Agent checks ground handling resources for new TSAT with TMAN.
11. The Ground handling resources are sufficient to handle the flight according the TOBT. Next step 6.

[3] TMAN calculates as alternative proposal a short turnaround.

12. The Ground Handling Agent, Airline Agent and airline OC assess the consequences of the proposal “short turnaround” for airline (e.g. no catering for this flight).
13. The Airline OC accepts a short turnaround. Next step: 6.

[5] The Ground Handling Agent and ground handling OC do not decide to do a quick turnaround.

14. The Ground Handling Agent executes single what-if to check whether short turnaround will adhered with the requested off-block time or mitigate a delay.
15. The solution of this what-if probing is that with a short turnaround, the requested off-block time will be adhered or a delay could be mitigated. Next step: 12.

[9] TMAN calculates that it is not possible to handle the additional flight at the requested time and usual turnaround procedures.

16. Next step: 2.

[11] The Ground Handling resources are insufficient to handle the flight according the new TOBT.

17. The Ground Handling Agent negotiates with Airline Agent and airline OC about a new TOBT.
18. The Airline accepts the new TOBT in certain circumstances the TSAT will be changed again. Next step: 6.

[13] The Airline Agent does not accept a short turnaround.

19. Airline accepts delay. Airline Agent communicates delay of a specific flight to the Airport Agent triggers the BUC “Stand- and Gate Management”. Next step: 6.

[18] The Airline does not accept the new TOBT.

20. Next step: 2.

[19] The Airline executes an aircraft change to minimise the delay. The Airline Agent triggers the BUC “Stand- and Gate Management”.

21. The Ground Handling Agents verifies if re-planning e.g. number of personnel is needed.
22. A re-planning of equipment and/or personnel is not necessary.
23. Ground Handling OC coordinates its resources to the stand of the new aircraft. Next step: 6

[19] Airline cancels the flight, the reason could be that the delay is too large for the airline.

24. The airline books passengers on other flights.
25. Airline Agent informs Airport Agent about the cancellation. Airport Agent triggers BUC “Stand and Gate Management”. Next step: 6.

[22] A re-planning of equipment and/or personnel is necessary.

26. Ground Handling OC makes a re-planning of equipment and/or personnel and coordinates its resources to the stand of the new aircraft. Next step: 6

Failure Flow

[3] TMAN calculation shows, that neither short turnaround nor quick turnaround are possible.

27. Next step: 19.

[15] The solution of this what-if probing is that with a short turnaround, the requested off-block time will not be adhered or a delay could not be mitigated.

28. The Ground Handling Agent decides to do neither quick turnaround nor short turnaround. AOP is updated with a new TOBT, BUC is finished.

4.9. Passenger Flow Management

Scope

- Time horizon: day of operations
- Actors: Airport Agent, Airline Agent
- Negotiation: Airport and Airline Agent
- Kind of what-if:
  - BUC “Refine TOBT in case of updated ERDT” runs completely as what-if
  - single what-if with PaxMan

Correlated operational scenarios

- Closed Terminal Area
- Capacity Demand Balancing
- Closure of Neighbouring Airport
- Strike – entry and execution phase of strike
- Recovery subsequent to strike

Summary

This BUC describes how all the processes related to the handling of passengers inside the terminal building shall be handled. This includes monitoring as well as allocation of terminal resources (service facilities) and monitoring as well as management of passenger flows through the terminal building. After the identification of a bottleneck in landside airport processes or after a request of another agent to open additional service facilities, possible solutions are calculated, discussed and agreed upon as well as the AOP is updated accordingly.

Precondition

Current information related to the airport situation (information about flights, passengers) is available as part of the AOP to all stakeholders, especially Airport Agent. A bottleneck in landside airport processes is identified or the opening / relocation of a service facility is requested or needed.

Postcondition

Passenger related information has been updated in the AOP. This also includes updates related to the allocation of terminal service facilities. Included information in the AOP is available to all stakeholders.

Notes

The planning and allocation of the terminal facility „gate“ where the passengers are ready to board the aircraft is not considered in this BUC but in the BUC „Stand and Gate Management“. Check-in counters, security check points, passport control and immigration control are summarised under the term “service facilities”. The flows described in this BUC are valid for all service facilities and differ only in the responsible operation centres (except marked differently):

- check-in → physical resource Airport Agent and personnel resource Airline Agent respectively airline OC
- security → OC of federal police or security service provider
- passport control → federal police
- immigration control → federal police

The acceptable length of waiting queues or waiting times as well as the maximum acceptable number of passengers for a certain procedure is defined specifically at every airport according to pre-defined service levels. In the following description of the operational flows, only the terms “long queue”, “long waiting time” and “high number” are used due to simplification.

Trigger

Adjustment of Passenger flow becomes necessary due to

- Long queues or waiting times at terminal service facilities
- High number of passengers delayed for their flight
- Airline desires additional or different check-in counter
- Closure of service facilities

Main Flow

1. The Airport Agent gets automatically informed about long queues and/or waiting times at service facilities by an agent notification alert displayed on the HMI of the Airport Working Position.
2. The Airport Agent identifies the concerned service facility(ies) (check-in, security, passport control) with PaxMan.
3. The Airport Agent checks the availability of additional infrastructure (immobile) resources with PaxMan.
4. PaxMan determines at least one solution to increase the capacity of the concerned service facility(ies).
5. The Airport Agent checks with respective operation centre the availability of additional personal (mobile resources) which is needed for the proposed solution(s).
6. Respective operation centre ensures the Airport Agent that enough personal is available for at least one of the proposed solutions.
7. The Airport Agent together with the responsible Agent or operation centre selects one of the proposed solutions.
8. The Airport Agent triggers the distribution of information about the modifications for the passengers (if applicable Terminal Management uses FIDS to display information).
9. AOP is updated. BUC is finished.

Alternative Flow

[1] The Airport Agent gets manually (e.g. telephone, mail, monitoring camera) informed about long queues and/or waiting times at service facilities.

10. Next step: 2.

[1] The Airport Agent gets automatically informed about a significant number of passengers delayed for their flight(s) by an agent notification alert displayed on the HMI of the Airport Working Position. The Airport Agent determines with PaxMan that respective passengers (including transfer passengers) have already arrived at the airport. The service facility the passengers have passed last is identified.

11. PaxMan (re-)calculates EPGT of respective passengers.
12. Updated EPGT shows that passengers will not be able to reach the gate in time.
13. AOP is updated with new EPGT and the Airline Agent gets informed about delayed passengers.
14. The Airline Agent assesses the consequences of the delayed passengers by triggering the BUC “Refine TOBT in case of updated ERDT” in what-if mode.
15. The Airline Agent together with the airline OC decides to wait for delayed passengers and arranges for passengers to be informed.
16. The results of BUC “Refine TOBT in case of updated ERDT” update the AOP. Next step: 8.

[1] The Airport Agent gets manually (e.g. telephone, mail) informed about a significant number of passengers delayed for their flight(s).

17. Next step: 11.

[1] The Airline Agents request change of one or more check-in counters.

18. The Airport Agent checks the availability of one or more different check-in counters with PaxMan.
19. PaxMan determines at least one solution to meet the Airline Agent’s request of a change of check-in counter.
20. The Airport Agent together with the Airline Agent assesses the solution(s) proposed by PaxMan.
21. The Airport Agent and the Airline Agent agree on one common solution. Next step: 8.

[1] The Airline Agents desires one or more additional check-in counter(s).

22. Next step: 19.

[1] The Airport Agent gets automatically informed about the closure of one or more significant service facilities by an agent notification alert displayed on the HMI of the Airport Working Position., e.g. due to technical problems or the closure of a certain terminal area.

23. The Airport Agent generates notification for all agents about the closure of significant service facility(ies).
24. The Airport Agent enters closure information into PaxMan.
25. According to the closure information, PaxMan calculates all resulting changes for the

AOP.

26. AOP is updated.
27. The Airport Agent identifies that passengers will be delayed. Next step: 12.

[1] The Airport Agent gets manually (e.g. telephone, mail, monitoring camera) informed about the closure of one or more significant service facilities, e.g. due to technical problems or the closure of a certain terminal area.

28. Next step: 24.

[1] The Airport Agent notices an updated EPGT that is later than the former EPGT. This deviation is displayed as an agent notification alert on the HMI of the Airport Working Position.

29. Next step: 13.

[3] The Airport Agent checks the feasibility and benefit of a separate line for concerned passengers.

30. Next step: 4.

[12] Updated EPGT shows that passengers will be able to reach the gate in time.

31. The Airport Agent has no necessity to initiate any action. No update of AOP is necessary. BUC is finished.

[14] The Airport Agent identifies long queues or waiting times at service facility as reason for delayed passengers.

32. Next step: 3.

[14] The Airport Agent identifies closure of service facility as reason for delayed passengers.

33. Next step: 24.

[27] The Airport Agent identifies that passengers will still be able to reach the gate on time.

34. The Airport Agent has no necessity to initiate any action. No update of AOP is necessary. BUC is finished.

Failure Flow

[4] PaxMan cannot detect a solution. No update of AOP is necessary. BUC is finished.

[6] Respective operation centre informs the Airport Agent that no personal is available for any of the proposed solutions.

35. The Airport Agent does not initiate any changes. No update of AOP is necessary; BUC is finished.

[7] The Airport Agent and further responsible agent or OC are unable to agree on common solution. No update of AOP is necessary. BUC is finished.

[11] The Airport Agent cannot assuredly determine if respective passengers have already arrived at the airport.

36. Due to lack of information about the passengers' location, the Airport Agent cannot initiate any measures to handle the delay. No update of AOP is necessary. BUC is finished.

[15] The Airline Agent together with the airline OC decides not to wait for the delayed passengers but rather to have the flight depart on time. They arrange for passengers to be informed.

37. The Airport Agent has no immediate necessity to initiate any action. No update of AOP is necessary. BUC is finished.

[18] The Airport Agent refuses the Airline Agent's request without further inquiry. No measures to handle the delay are taken, no update of AOP is necessary. BUC is finished.

[19] PaxMan cannot determine any solution to meet the Airline Agent's request of change of check-in counter.

38. The Airport Agent informs Airline Agent that a change of check-in counter is not possible. No update of AOP is necessary. BUC is finished.

[21] The Airport Agent and Airline Agent cannot agree on one common solution.

39. The Airport Agent does not initiate any changes. No update of AOP is necessary. BUC is finished.

4.10. Stand- and Gate Management

Scope

- Time horizon: updated or new ELDT until Off-block
- Actors: Airport Agent, Airline Agent, Ground Handling Agent, in severe cases possibly ATC Agent
- Negotiation: negotiation between Airport Agent, Airline Agent, Ground Handling Agent, and possibly ATC Agent
- Kind of what-if:
  - joint what-if with SGMAN, TMAN, SMAN
  - single what-if with SGMAN or PaxMan

Correlated operational scenarios

- Capacity demand balancing
- Closed terminal area
- Strike – entry and execution phase of strike
- Recovery subsequent to strike
- Closure of neighbouring airport

Summary

The BUC describes how an existing allocation of a parking position and/or gate is changed caused by one flight.

The change of an allocated parking position respectively gate may be necessary or useful in the following cases:

- A delayed departure occupies a parking position for an on-time arrival (delayed ERDT).
- An aircraft has to be changed due to damage or strike and is substituted by another aircraft type that does not suit to the original position.
- An updated ELDT indicates that one flight arrives early and its parking position is still occupied.
- An unexpected additional flight is planned and needs a parking position and gate.
- An airline desires a stand and/or gate change.
- Possible other reasons that avoid the use of the original planned parking position and/or gate, e.g. noticed damages at the parking position, the passenger bridge or the gate inside the terminal building.
- A parking position directly connected to the terminal building by a passenger bridge is changed, is occupied for a longer time due to a delayed departure, or in case of a flight arriving early is still occupied by the previous departure.

Precondition

Current stand and gate plan information is available as part of the AOP flight schedule to all stakeholders (especially ground handlers) to make changes to their resource planning as early as possible. The concerned flight is contained in the AOP flight schedule with or without an assigned stand. It is assumed that if a stand is available the appropriate gate is available as well.

Postcondition

Stand and gate plan has been updated without conflicts according to the requirements. The updates are included in the AOP and are available for all stakeholders.

Notes

The result of this BUC is usually an update of the AOP. These updates can be stand and/or gate allocation times as well as stand and/or gate changes. Therefore, the end of this BUC may trigger the use cases BUC "Turnaround Management" and/or BUC "Passenger Flow Management".

Trigger

Additional or changed flight requires new or updated stand and/or gate:

- Aircraft blocks stand longer than planned (delayed ERDT)
- Aircraft change
- Early arrival
- Additional flight
- Airline desires stand and/or gate change
- Parking position or gate unplanned out of order

Main Flow

1. The Airport Agent notices that a specific flight is late.
2. The Airport Agent determines that the stand occupation time for a specific flight is not sufficient.
3. The Airport Agent checks the availability of the stand for the changed stand occupation time using SGMAN.
4. SGMAN identifies conflict for stand occupation and calculates an alternative proposal, which has only influences on other flights below a predefined tolerance.
5. In cooperation with the Airline Agent, the Airport Agent assesses the consequences of the alternative proposal for passengers and landside infrastructure (especially gate) with the help of PaxMan as well as for airside operations.
6. The Airport Agent identifies a suitable gate related to the appropriate stand using PaxMan.
7. The Airport Agent accepts the proposal of the SGMAN and PaxMan.
8. AOP is updated. BUC is finished.

Alternative Flow

[1] The Airline Agent communicates that the airline will change the aircraft type.

9. The Airport Agent detects that the stand is not suited using SGMAN.

10. The Airport Agent triggers the calculation of a stand planning proposal using SGMAN.
11. SGMAN proposes a new stand directly connected to the terminal building by a passenger bridge.
12. The Airport Agent triggers the calculation of a gate planning proposal using PaxMan.
13. The Airport Agent presents proposed changes of stand and gate planning to the effected Airline Agents.
14. The Airline Agents together with the Ground Handling Agents assess the consequences of the proposal for turnaround management using TMAN by triggering BUC “Turnaround Management”.
15. The Airline Agent together with the Ground Handling Agent informs the Airport Agent of their approval to the proposed changes. Next step: 7.

[1] The Airport Agent notes that a specific flight arrives earlier and that the scheduled position is not available at this time.

16. The Airport Agent triggers the calculation of a stand planning proposal using SGMAN. Next step: 11.

[1] The Airport Agent notices an additional arrival flight.

17. The Airport Agent identifies an available and suitable stand using SGMAN and an appropriate gate using PaxMan. Next step: 7.

[1] The Airline Agent requests stand change to a specific stand.

18. The Airport Agent does not identify conflicts using SGMAN by probing the new stand and the appropriate gate using the PaxMan. Next step: 7.

[1] The Airline Agent requests gate change to a specific gate directly connected to the terminal building by a passenger bridge.

19. Next step: 18.

[1] The Airline Agent requests gate change to a specific gate not directly connected to the terminal building by a passenger bridge (remote parking position).

20. The Airport Agent does not identify conflicts using PaxMan for probing the new gate. A stand change is not necessary due to the remote parking position. Next step: 8.

[2] The Airport Agent determines that the stand occupation time for a specific flight is sufficient.

21. Next step: 8.

[4] The necessary extended stand occupation time does not lead to a conflict. The Airport Agent accepts the proposed stand occupation time.

22. Next step: 8.

[4] SGMAN identifies conflict for stand occupation time and calculates an alternative proposal, which implies influences on other flights above a predefined tolerance.

23. The Airport Agent tests in a single what-if possible solutions with SGMAN as well as PaxMan and assesses the consequences of the alternative proposals for passengers, landside infrastructure (especially gate) and airside operations.
24. After consulting Airline Agent and Ground Handling Agent, the Airport Agent accepts a suitable solution. Next step: 8.

[7] The Airport Agent does not accept proposal of SGMAN.

25. Next step: 23.

[9] The Airport Agent detects that the stand is suited for the new aircraft type using SGMAN and that the aircraft change leads to an extended stand occupation time.

26. Next step: 3.

[9] The Airport Agent detects that the stand is suited using SGMAN and that the aircraft change does not lead to an extended stand occupation time.

27. Next step: 8.

[11] SGMAN proposes a new stand at the apron not directly connected to terminal building by a passenger bridge. PaxMan keeps the original planned gate.

28. Next step: 13.

[15] The Airline Agent together with the Ground Handling Agent do not agree to the proposed changes.

29. The Airport Agent, the Airline Agent, and the Ground Handling Agent determine in a joint what-if a common proposal for the stand and gate planning using SGMAN, PaxMan, TMAN, SMAN in BUC “Turnaround Management” and BUC “Passenger Flow Management”.
30. The Airport Agent accepts the common proposal. Next step: 8.

[17] The Airport Agent does not identify an available and suitable stand using SGMAN and an appropriate gate using PaxMan.

31. Next step: 37.

[18] The Airport Agent does identify conflicts resulting from the requested stand change.

32. The Airport Agent triggers the calculation of a stand and gate planning proposal using SGMAN as well as PaxMan and taking the requested stand change into account.

Next step: 14.

[20] The Airport Agent determines that the requested gate is not possible.

33. The Airport Agent identifies a suitable gate related to the appropriate stand using PaxMan.
34. The Airport Agent presents the alternative proposal to Airline Agent.
35. The Airline Agent accepts alternative proposal. Next step: 7.

[24] After consulting Airline Agent and Ground Handling Agent, the Airport Agent does not yet accept a solution and informs the Airline Agent and the Ground Handling Agent about possible solutions.

36. Next step: 29.

Failure Flow

[4] SGMAN is not able to detect a conflict free solution.

37. The Airport Agent, Airline Agent, the Ground Handling Agent, and possibly ATC Agent determine in a joint what-if a common proposal for the stand and gate planning using SGMAN, PaxMan, TMAN, SMAN, and possibly DMAN by BUC "Turnaround Management". They can decide on other areas to park an aircraft than usual parking positions (e.g. part of a taxiway), if not enough positions are available.
38. The Airport Agent accepts the common proposal. Next step: 8.

[6] PaxMan is not able to detect automatically a conflict free solution.

39. Next step: 33.

[29] The Airport Agent, the Airline Agent, and the Ground Handling Agent are unable to find a common stand and gate solution.

40. The Airport Agent decides about the new stand and gate planning selecting a suitable stand and gate solution. Next step: 8.

[30] The Airport Agent does not accept common proposal.

41. Next step: 40.

[32] The Airport Agent refuses the Airline Agents request naming the conflicts that would result from the stand change. No update necessary, BUC finished.

[32] The Airport Agent cannot identify a suitable gate related to the appropriate stand using PaxMan.

42. The Airport Agent refuses the Airline Agent's request naming the conflicts that would

result from the gate change. No update necessary, BUC finished.

[35] The Airline Agent does not accept alternative proposal. No update necessary, BUC finished.

[37] The Airport Agent, the Airline Agent, the Ground Handling Agent, and the ATC Agent are unable to find a common stand and gate solution. No update necessary, BUC finished.

4.11. Pre-Departure Sequencing

This BUC is part of the TAMS scenarios. Due to the limited number of operational scenarios that necessitate the employment of this BUC it is not considered further within the TAMS project.

Summary

The content of this BUC is an airline internal prioritisation of flights as well as a trade-off of priorities and departure sequences among airlines themselves and airport and airline(s). The implementation of this pre-departure sequencing by ATC is also part of this BUC.

4.12. Adjustment of Traffic Procedures

Scope

- Time horizon: Indication of future capacity shortfall until resolution or reduction of overdemand situation
- Actors: All agents
- Negotiation:
  - negotiation between all agents
- Kind of what-if:
  - single what-if with APM
  - single what-if with ATWP
  - joint what-if with ATWP, APM and TMAN

Correlated operational scenarios

- Capacity Demand Balancing
- De-Icing and Winter Services

Summary

The BUC examines several actions, which change the employment of the runways and which change therefore the available portion of the maximum arrival and/or departure capacity. These actions are:

- the scheduled runway inhibition e.g. for winter service,
- the change of the runway use strategy from mixed to single or from single to mixed mode, and
- the change of runway operational direction.

Precondition

It is predicted for a certain period that the demand will exceed the available departure/arrival capacities of the runways.

The airport under consideration has at least two runways whereof at least one is operable. At least one runway is scheduled for inhibition. At least one of the operable runways can either be used in single and mixed mode or in both directions.

If a runway is scheduled for inhibition, the actual timeperiod of the inhibition is variable to a certain degree.

Post condition

It is predicted that the newly scheduled employment of the runways is going to cause less or no shortfall of the arrival and/or departure capacity.

Notes

There are no notes in this BUC.

Trigger

The ATWP and/or the APM generate an alert, which indicates to the APOC Agents that in the near future the demand is going to exceed the arrival/departure capacity. Reasons could be e.g.:

- Weather phenomena,
- Carried out work on the runway (e. g. snow removal, construction works),
- Additional unexpected traffic

Main Flow

1. The Airport Agent notices that a specific runway has to be closed for a certain period of time and announces the information to the other agents.
2. Each agent determines in collaboration with his/her respective OC the best point in time for the runway inhibition from each stakeholder's point of view.
3. All agents together carry out joint what-ifs with APM, ATWP and TMAN to determine the best point in time for the inhibition from an overall airport perspective.
4. The agents negotiate the possible periods for the inhibition and agree on a solution. Each Agent communicates the solution to his/her OC.
5. Each OC agrees to the solution.
6. AOP is updated. BUC is finished.

Alternative Flow

[1] The ATC Agent wants to change the runway use strategy.

7. The ATC Agent consults the ATC OC if it is possible to change the runway use strategy for the time frame of the predicted capacity overdemand.
8. The ATC OC confirms that a change of the runway use strategy is possible and that the acceptance depends on the benefit of the specific solution.
9. The ATC Agent tests the impact of the change to a specific runway use strategy using APM or ATWP in single what-ifs.
10. The systems predict a benefit for the intended change of runway use strategy.
11. The ATC Agent communicates the benefit to the ATC OC.
12. The ATC OC agrees to the change of runway use strategy. Next step: 6.

[1] The ATC Agent wants to change runway operational direction.

13. The ATC Agent consults the ATC OC if it is possible to change the runway operational direction.
14. The ATC OC confirms that a change of the runway operational direction is possible.
15. The ATC Agent tests the impact of a change of the runway operational direction using APM or ATWP in single what-ifs.
16. The systems predict a benefit for the intended change of runway operational direction.

17. The ATC Agent communicates the benefit to the ATC OC.
18. The ATC OC agrees to the change of the runway operational direction. Next step: 6.

[1] The ATC OC announces that at some point in the future the runway operational direction should be changed.

19. Next step: 15.

[12] The ATC OC does not agree to the change of runway use strategy. ATC Agent and OC agree that the Agent will propose an alternative solution.

20. The ATC Agent identifies an alternative solution and tests its impact using APM or ATWP in single what-ifs. Next step: 10.

Failure Flow

[4] The agents do not agree on a solution.

21. The Airport Agent sets the point of inhibition of runway and updates the AOP. BUC is finished.

[5] At least one of the OCs does not agree to the solution.

22. The Airport Agent sets the point of inhibition of runway and updates the AOP. BUC is finished.

[8] The ATC OC does not confirm that a change of the runway use strategy is possible. BUC is finished.

[10] The systems calculate no significant benefit for the intended change of runway use strategy.

23. The ATC Agent does not change the strategy of runway use. AOP is not updated. BUC is finished.

[12] The ATC OC does not agree to the change of runway use strategy. AOP is not updated. BUC is finished.

[14] The ATC OC does not confirm that a change of the runway operational direction is possible. BUC is finished.

[16] The systems calculate no significant benefit for the intended change of runway operational direction.

24. The ATC Agent does not change the runway operational direction. AOP is not updated. BUC is finished.

[18] The ATC OC does not agree to the change of the runway operational direction. AOP is not updated. BUC is finished.

4.13. Demand Adjustment

Scope

- Time horizon: Indication of future capacity shortfall (which is used in this BUC as reason to some kind of overdemand) until resolution of overdemand situation
- Actors: All agents
- Negotiation:
  - between all Airline Agents in the APOC if the shortfall concerns commonly used resources
  - between all Airline Agents and the ATC Agent about positions in the new arrival/departure sequence
  - between all Airline Agents, the ATC Agent and the Airport Agent about solutions for the new de-icing sequence
- Kind of what-if:
  - single what-if with APM
  - single what-if with ATWP
  - single what-if with AMAN
  - single what-if with DMAN
  - joint what-if with SMAN and TMAN

Correlated operational scenarios

- De-Icing and Winter Services
- Capacity Demand Balancing
- Closure of Neighbouring Airport
- Strike – (entry and execution phase of strike)
- Recovery subsequent to strike (recovery management): Cancelled flights will be covered by this BUC, new flights are part of BUC “Management of an additional departure flight”.

Summary

The BUC describes the collaborative handling of a predicted overdemand situation by the APOC Agents. This includes a capacity shortfall of the runways, of the de-icing pads or of airline resources (e.g. pilots who do not fly due to strike) that has not yet occurred. Potential ways to adjust the demand of departures are delaying or cancelling flights and of arrivals restraining aircraft at outstation. Before the runway demand will be adjusted the potential to enlarge the capacity will be analysed by the adjustment of traffic procedures. The BUC demand adjustment is only successfully completed if the solution is collaboratively achieved and agreed on by all involved APOC Agents and their OCs.

Precondition

There is a significant overdemand for at least one resource that is related to airport operations. The APOC Agents can influence the respective resource.

The capacity shortfall of this resource can be indicated by support systems to the responsible agents in advance so that there is enough time to find a solution before the actual situation arises.

The CFMU has the possibility to analyse if the network capacity allows the slot allocation as requested by the airline without actually assigning the slot (what-if functionality).

Postcondition

A collaborative solution of the respective capacity shortfall is realised. All changes of the flight schedule are integrated in the AOP.

Notes

Although only a demand capacity mismatch for runways, de-icing pads, and airline resources is described in this BUC the following description could eventually be adapted to shortfalls of other resources.

The deviation of flights to their alternate airports to adjust the arrival demand is not part of this BUC.

If flights are restrained at outstation the respective airline should get appropriate new slots from the CFMU after the collaborative decision so that the flight can depart from outstation at the new EOBT without further delay. Furthermore, the airline should get the assurance from the ATC OC at GIA that the flight can land at the new ELDT without further delay. This process is not part of the BUC demand adjustment.

Trigger

- Arrival demand for runway system is higher than arrival capacity.
- Departure demand for runway system is higher than departure capacity.
- Aircraft is not available e.g. due to strike or technical failure.
- Pilot is not available e.g. due to strike.
- De-Icing capacity is lower than de-icing demand.

Main Flow

1. The ATWP and/or the APM generate an alert for the ATC Agent that a capacity shortfall for the runways will occur.
2. The ATC Agent identifies which runway at which time and for which period will be effected and if it concerns arrivals, departures, or both.
3. The shortfall concerns only departures.
4. The ATC Agent checks whether the change of runway use strategy and/or the change of runway operational direction can resolve the departure capacity shortfall by triggering the BUC “Adjustment of Traffic Procedures”.
5. The shortfall cannot be resolved completely.
6. The ATC Agent identifies with the APM the number of flights that need to be deprioritised to solve the capacity shortfall (which means he identifies the total amount of flights that need to be delayed or cancelled in a particular period in order to decrease the demand to the level of the available capacity).
7. All Airline Agents in collaboration with their airline OCs analyse possible solutions and

negotiate which particular flights could be deprioritised.

8. The ATC Agent analyses in single what-ifs with the ATWP and in collaboration with the Airline Agents which alternative positions in the departure sequence can be allocated to these flights.
9. The Airline Agents and the ATC Agent agree on a solution that solves the predicted capacity shortfall and that all airline OCs have accepted.
10. Each airline OC together with the Airline Agent decides if deprioritised flights shall take place at the new position in the departure sequence, if flights shall be combined (codesharing) and/or if flights shall be cancelled and passengers rebooked to other flights.
11. The Airline Agent(s) integrate(s) the new airline flight schedule in the AOP.
12. The ATC OC is informed about the changes in the flight plan and about the agreed sequence either automatically by the ACISP or by the ATC Agent.
13. The Airport Agent triggers the BUC “Stand- and Gate Management” and the BUC “Passenger Flow Management”.
14. The Ground Handling Agent triggers the BUC “Turnaround Management”.
15. The results of the BUCs from 13. and 14. update the AOP. A collaborative solution is realised. BUC is finished.

Alternative Flow

[1] The TAMS systems generate an alert for the Airport Agent that a capacity shortfall will occur on the de-icing pads.

16. The Airport Agent identifies at which time and for which period the shortfall will occur.
17. The Airport Agent identifies in a joint what-if with SMAN and TMAN the number of flights that need to be deprioritised to solve the capacity shortfall.
18. All Airline Agents in collaboration with their airline OCs analyse possible solutions and negotiate which flights could be deprioritised.
19. The ATC Agent analyses in single what-ifs with the ATWP which alternative positions in the departure sequence can be allocated to these flights and negotiates the results with the Airline Agents and the Airport Agent. Next step: 9.

[1] The airline OC identifies that one or several flights cannot take place as scheduled due to lacking aircraft or crew resources.

20. The airline OC determines in collaboration with the Airline Agent the prioritised flights and organises the required resources.
21. The airline OC determines that changes of scheduled aircraft are necessary.
22. The Airline Agent informs the ATC Agent about the changes of aircraft and updates the AOP.
23. The Airline Agent triggers the BUC “Stand- and Gate Management”.
24. The airline OC in collaboration with the Airline Agent determines, which deprioritised flights will be delayed and which will be cancelled. Next step: 11.

[3] The shortfall concerns only arrivals.

25. The ATC Agent checks whether the change of runway use strategy and/or the change of runway operational direction can resolve the arrival capacity shortfall without compromising the required departure capacity by triggering the BUC “Adjustment of Traffic Procedures”.
26. The shortfall cannot be completely resolved.
27. The ATC Agent identifies by single what-ifs with ATWP that a number of flights that are not yet airborne and can possibly be restrained at the outstation.
28. The ATC Agent identifies with the CFMU the flights for which the network capacity allows the measure of restraining.
29. The ATC Agent communicates the potential flights to the Airline Agents.
30. The Airline Agents in collaboration with their airline OCs analyse which flights could be restrained from the perspective of each airline.
31. The Airline Agents and the ATC Agent negotiate which flights shall be restrained and which position these flights shall have in the new arrival sequence by using single what-ifs with the AMAN.
32. The Airline Agents and the ATC Agent agree on a solution, that solves the predicted capacity shortfall and that all airline OCs have accepted.
33. The Airline Agents or airline OCs or the Airport Agent inform the respective outstations about the flights that are going to be restrained.
34. The ATC Agent informs CFMU about the flights that are going to be restrained.
35. The CFMU issues new slots for the departure at outstation for the respective flights corresponding to the collaborative agreement.
36. The airline OCs inform their pilots about the collaborative decision of restraining their aircraft.
37. The Airline Agents integrate the new airline flight schedule in the AOP.
38. The BUC “Handling of updated ELDT or EIBT” is triggered either automatically or by the ATC Agent. Next step: 12.

[3] The shortfall concerns arrivals and departures at the same time.

39. The ATC Agent checks whether the change of runway operational direction can resolve the overall capacity shortfall by triggering the BUC “Adjustment of Traffic Procedures”.
40. The shortfall cannot be completely resolved.
41. The ATC Agent identifies in single what-ifs with the ATWP and/or APM if there is the possibility that all arrivals land as scheduled by only deprioritising departure flights.
42. The ATC Agent finds a solution and identifies the number of departure flights that need to be deprioritised to solve the arrival and the departure capacity shortfall.
43. All Airline Agents in collaboration with their airline OCs analyse possible solutions and negotiate which departure flights could be deprioritised.

44. The ATC Agent analyses in single what-ifs with the ATWP in cooperation with the Airline Agents which alternative positions in the departure sequence can be allocated to theses flights.
45. The Airline Agents and the ATC Agent agree on a solution, that solves the predicted arrival and departure capacity shortfall and that all airline OCs have accepted. Next step: 10.

[5] The shortfall can collaboratively be resolved by the adjustment of traffic procedures.

46. There is no further need for demand adjustment.
47. Results from the BUC in 4. update the AOP. A collaborative solution is realised. BUC is finished.

[21] No changes of scheduled aircraft are necessary.

48. Next step: 24.

[26] The shortfall can collaboratively be resolved by the adjustment of traffic procedures.

49. Next step: 46.

[32] The agents agree on a collaborative solution that does not solve the entire arrival capacity shortfall.

50. The Airline Agents or airline OCs or the Airport Agent inform the respective outstations about the flights that are going to be restrained.
51. The ATC Agent informs the CFMU about the flights that are going to be restrained.
52. The CFMU issues new slots for the departure at outstation for the respective flights corresponding to the collaborative agreement.
53. The airline OCs inform their pilots about the collaborative decision of restraining their aircraft.
54. The Airline Agents integrate the new airline flight schedule in the AOP.
55. The BUC “Handling of updated ELDT or EIBT” is triggered either automatically or by the ATC Agent.
56. The agents integrate the results in the AOP.
57. The ATC Agent initiates the conventional generation of an arrival sequence taking into account the agreed solution for restrained aircraft using the AMAN. Next step: 12.

[40] The shortfall can be resolved collaboratively by the adjustment of traffic procedures.

58. Next step: 46.

[42] The ATC Agent finds out that the arrival capacity shortfall cannot be solved by exclusively deprioritising departures.

59. The ATC Agent identifies a number of departure flights that need to be deprioritised to

solve the departure capacity shortfall and to support a later solution for the arrival shortfall as best as possible.

60. All Airline Agents in collaboration with their airline OCs analyse possible solutions and negotiate which departure flights could be deprioritised.
61. The ATC Agent analyses in single what-ifs with the DMAN which alternative positions in the departure sequence can be allocated to these flights and informs the Airline Agents.
62. The Airline Agents and the ATC Agent agree on a solution, that solves the departure capacity shortfall, that supports a solution for the arrivals as best as possible, and that all airline OCs have accepted.
63. Each airline OC together with the Airline Agent decides if deprioritised flights shall take place at the new position in the departure sequence, if flights shall be combined (codesharing) and/or if flights shall be cancelled and passengers rebooked to other flights.
64. The Airline Agents integrate the new airline flight schedule in the AOP.
65. The ATC OC is informed about the changes in the flight plan either automatically by the ACISP or by the ATC Agent.
66. The Airport Agent triggers the BUC “Stand- and Gate Management” and the BUC “Passenger Flow Management”.
67. The Ground Handling Agent triggers the BUC “Turnaround Management”. Next step: 26.

Failure Flow

[9] The Airline Agents and the ATC Agent do not agree on a solution that solves the entire capacity shortfall.

68. The ATC Agent initiates the conventional generation of a departure sequence using DMAN or the ATWP.
69. The ATC OC decides about the solution and updates the AOP. BUC is finished.

[27] The ATC Agent identifies by single what-ifs with ATWP that no flights can be restrained at outstation since all potential flights are already airborne.

70. The ATC Agent initiates the conventional generation of an arrival sequence including holding patterns using AMAN when the flights are in radar range and captured by the AMAN.
71. The ATC OC decides about the solution and updates the AOP. BUC is finished.

[28] The ATC Agent identifies with the CFMU no flights for which the network capacity allows the measure of restraining.

72. Next step: 70.

[32] The agents do not agree on a solution at all.

73. Next step: 70.

[45] The Airline Agents and the ATC Agent do not agree on a solution that solves the entire capacity shortfall.

74. The ATC Agent initiates the conventional generation of a departure sequence using DMAN.
75. The ATC OC decides about the solution and updates the AOP.
76. No collaborative solution by deprioritising departures is realised. The arrival overdemand has still to be fixed. Next step: 25.

[62] The Airline Agents and the ATC Agent do not agree on a solution that solves the departure capacity shortfall and supports a later solution for the arrival shortfall.

77. Next step: 74.

References

The following documents are referenced in this document:

[1] Barco, ATRiCS, Inform
Total Airport Management – Integrated Tactical Systems [TAM-ITS 2.0a]
December 2009

[2] DLR & EEC
TAM-OCD: Total Airport Management – Operational Concept Document
October 2006

[3] PRC
ATM Airport Performance (ATMAP) Framework
Measuring Airport Airside and Nearby Airspace Performance
Brussels 2009

[4] TAMS Verbund/Barco
TAMS Glossary V-1-0-0
to be published

[5] TAMS Verbund/DLR
TAMS OCD – Operational Concept Document V-1-0-0
to be published

[6] TAMS Verbund/DLR
TAMS OCD – Operational Concept Document Iteration 2 V-1-0-0
April 2011

[7] TAMS Verbund/Siemens
TAMS SYRD – System Requirements Description
to be published

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Abbreviations

For a glossary please refer to the global TAMS glossary [4]. All abbreviations used in this document are listed below:

Acronym	Definition	Source
A-CDM	Airport Collaborative Decision Making	EUROCONTROL
ACARS	Aircraft Communication and Addressing and Reporting System	
ACISP	Airport CDM Information Sharing Platform	EUROCONTROL
ADES	Aerodrome of Destination	EUROCONTROL
AIBT	Actual In-Block Time (equivalent to Airline/Handler ATA Actual Time of Arrival, ACARS=IN)	EUROCONTROL
ALDT	Actual Landing Time	EUROCONTROL
AMAN	Arrival Manager	
AOBT	Actual Off-Block Time (Equivalent to Airline/Handlers ATD – Actual Time of Departure, ACARS=OUT)	EUROCONTROL
AODB	Airport operational Data Base	
AOP	Airport Operations Plan	[2]
APM	Airport Performance Management	Siemens
APOC	Airport Operation Centre	[2]
ARDT	Actual Ready Time (for Movement)	EUROCONTROL
A-SMGCS	Advanced Surface Movement Guidance and Control System	
ATA	Actual Time of Arrival (obsolete abbreviation)	
ATC	Air Traffic Control	
ATD	Actual Time of Arrival (obsolete abbreviation)	
ATM	Air Traffic Management	
ATMAP	ATM Airport Performance	EUROCONTROL
ATOT	Actual Take-Off Time	
ATRiCS	TAMS Partner	
ATWP	Airside Tactical Working Position	
BUC	Business Use Case	TAMS
CAP	Collaborative Airport Planning	EUROCONTROL
CDM	Collaborative Decision Making	EUROCONTROL

Acronym	Definition	Source
CFMU	Central Flow Management Unit	EUROCONTROL
CND	Cooperative Network Design	EUROCONTROL
DLR	Deutsches Zentrum für Luft- und Raumfahrt e.V.	
DMAN	Departure Manager	
EC	European Commission	
EEC	EUROCONTROL Experimental Center, Brétigny, France	EUROCONTROL
EIBT	Estimated In-Block Time (equivalent to Airline/Handler ETA Estimated Time of Arrival)	EUROCONTROL
ELDT	Estimated Landing Time (equivalent to ATC ETA – Estimated Time of Arrival = landing)	EUROCONTROL
EN	European Norm	
EOBT	Estimated Off-Block Time (extracted from the filled ATC flight plan and ATC flight plan modification messages)	ATC
EPGT	Estimated Time of Passengers at Gate	
Episode3	EC framework FP 6 project	
ERDT	Estimated (Aircraft) Ready Time	
ETA	Estimated Time of Arrival (earliest time to land based an radar track-data), ATC	
ETSI	European Telecommunications Standards Institute	
EUROCAE	European Organization for Civil Aviation Equipment	
EUROCONTROL	The European Organisation for the Safety of Air Navigation	
FAMOUS	Future Airport Management Operational Utility System, DLR internal project	
FG	Functional Group (see A-CDM Standards)	
FIDS	Flight Information Display System	
FIR	Flight Information Region	
FSG	Flughafen Stuttgart Gesellschaft	
FUM	Flight Update Messages	
GIA	Generic International Airport	
GUI	Graphical User Interface	

Acronym	Definition	Source
HMI	Human Machine Interface	
IATA	International Air Transport Association	
ICAO	International Civil Aviation Organisation	
KPI	Key Performance Indicator	
min	Minutes	
MST	A-CDM Milestone	A-CDM
OC	operation centre	
OCD	Operational Concept Document	
ops	operations (day-of-operations)	
OS	Operational Scenario	
pax / PAX	Passenger	
PaxMan	Passenger Manager	
PDS	Pre-Departure Sequencing	
QoSC	Quality of Service Contract	
QoSL	Quality of Service Level	
RWY	Runway	
SGMAN	Stand and Gate Manager	
SIBT	Scheduled In-Block Time	
SLA	Service Level Agreement	
SMAN	Surface Manager	
SOBT	Scheduled Off-Block Time	
T1	GIA Terminal 1	
T2	GIA Terminal 2	
TAM	Total Airport Management	
TAMS	Total Airport Management Suite	
TMAN	Turnaround Manager	
TOBT	Target Off-Block Time	
TSAT	Target Start Up Approval Time	EUROCONTROL
TTOT	Target Take Off Time	EUROCONTROL

Acronym	***Definition***	***Source***
UC	Use Case	
xMAN	all kinds of tactical airport systems e.g. AMAN, SMAN, TMAN, DMAN, PaxMan	