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Turnaround Integration in Trajectory And Network		
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EXECUTIVE SUMMARY

This document reports the scope, the planning and the results of the Gaming Sessions that were carried out as part of the validation activities in TITAN.

The objective of the Gaming Sessions was twofold:

1. to define and refine the information available in TITAN services;
2. to validate the usability of the subscribed information and services.

Over a time period of three days, one training session and three different gaming sessions (based on three different scenarios) were performed with the following actors: Airline Operation Centre, Passenger Agent, Flight Dispatcher, Cockpit Crew, Ramp Agent, Tower Controller, Ground Controller, CFMU and Airport Operator.

The main conclusions of the gaming exercise are the following:

- List of TITAN gaming information (information level 0) is sufficiently complete to support the turnaround processes. Some slight modifications were done concerning the wording and the providers of this information.
- The additional information identified during the gaming sessions refers mostly to unexpected events and the information levels 1, 2 and 3.
- The current definition and the number of information levels are accepted by experts.
- The definition of TITAN services is considered useful and complete. However depending on the actors who performed the subscriptions some modifications were done.
- There are some activities (like de-icing, ambulift, and RMP) which might be provided by external companies which could therefore also be TIS users.

The main recommendations compiled from the results of the gaming exercise are the following:

- The completeness of TITAN information could be improved by assessing more unexpected or abnormal situations. Based on this, the information levels 1, 2 and 3 should be further completed, provided that it meets the applicable standards.
- Presentation of the information levels must be carefully designed to facilitate the identification of problems or unexpected events and plan the solutions with enough time in advance.
- It must be evaluated how to present the information most clearly and efficiently.
- CDM times and milestones and ICAO times (included in the FPs) is valuable information which should be included in the TIS.



1. INTRODUCTION

1.1 Purpose of the document

TITAN is charged with the analysis and improvement of the aircraft turnaround process [1]. The improved turnaround concept relies heavily on Information sharing; augmenting the situational awareness of all partners involved. This concept, of which a first description is given in ref. [2], will be modelled and validated after which it will be updated and used as input for the development of a decision support tool.

The Gaming Sessions, of whose results are presented in this document, were aimed at the validation of the feasibility and usability of the information exchange in the TITAN concept. They were carried out according to the plan described in the Validation Exercise Planning document [4].

1.2 Intended audience

This public document, which may be distributed freely, is intended to present the Gaming Session results to all partners involved in TITAN, to the stakeholders that are supporting the project from the beginning (airlines, ground handling, airport, ANSP) and to those outside TITAN who are engaged in the SJU validation process.

1.3 Document structure

The document consists of two volumes.

Volume 1 is the present report and forms the body of the document, containing six chapters. Chapter 1 is the general introduction and Chapter 2 details the scope and justification of the Gaming Sessions, by summarizing the stakeholder expectations, the TITAN concept, the gaming objectives and the relevant assumptions. Chapter 3 describes the preparative activities that were carried out before the Gaming Sessions. Chapter 4 provides the Gaming planning and describes the dynamics and results of the actual Gaming Sessions. These results are discussed in chapter 5 by comparing them with the initial gaming objective, resulting in on the one hand feedback to the concept itself and on the other hand feedback to the Gaming technique and tool. Chapter 6 ends this report with conclusions and recommendations.

Volume 2 contains the Annexes [6].

1.4 Partners involvement

The Gaming Sessions were only possible thanks to the collaboration of several partners during the different phases of the Gaming Sessions:

- During the preparative phase Ineco, BluSky and Isdefe were together involved in further detailing of the TITAN service information and the scenario definition;
- During the execution phase Isdefe provided the Game Management Team in collaboration with Ineco and SLOT Consulting provided most of the actors (completed by an actor of Boeing, BluSky and RWTH Aachen University)
- Analysis of the results and reporting was done by Isdefe, while all partners reviewed the document for obtaining consensus about the implications for the TITAN concept.



1.5 References

- [1] TITAN Annex 1 “Description of Work”, Version 0.4, 31 August 2009.
- [2] TITAN D1.4 “Operational Concept Document (Issue 1)”, INECO, Version 1.0, October 2010.
- [3] TITAN D3.1 “Validation Strategy”, Isdefe, Version 1.0, February 2011.
- [4] TITAN D3.2 “Validation Exercise Planning”, Isdefe, Version 0.7, November 2011.
- [5] TITAN D7.8 “Report on 2nd Workshop”, INECO, Version 0.7, May 2011.
- [6] TITAN D3.3A – Vol2 “Gaming Exercise Report Annexes”, Isdefe, Version 0.2, March 2012

1.6 Glossary of terms

AENA	Aeropuertos Españoles y Navegación Aérea
AIBT	Actual In-block Time
AIRS	Airport Information Report Service
ALDT	Actual Landing Time
ANSP	Air Navigation Service Provider
AOBT	Actual Off-Block Time
AOC	Airline Operation Centre
AOP	Airport Operator
APIS	Advance Passenger Information System
APU	Auxiliary Power Unit
A-SMGCS	Advanced Surface Movement Guidance & Control System
ASRS	Aircraft Status Report Service
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATM	Air Traffic Management
ATOT	Actual Take-Off Time
AXIT	Actual taXi-In Time
BFIS	Baggage Flow Information System
CDM	Collaborative Decision Making
CFMU	Central Flow Management Unit
CHILL	Collaborative Human In the Loop Laboratory
CMFIS	Cargo/Mail Flow Information Service
CPC	Cockpit Crew
DLA	Delay message
DPI	Departure Planning Information
EC	European Commission
EOBT	Estimated Off Block Time



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E-OCVM	European Operational Concept Validation Methodology
ETTT	Estimated Target Turnaround Time
EXIT	Estimated taxi-In Time
EXOT	Estimated taxi-Out Time
FC	Flight Crew
FIR	Flight Information Region
FP	Flight Plan
GH	Ground Handler
GND	Ground
GPU	Ground Power Unit
GSE	Ground Support Equipment
HMI	Human-Machine Interface
ICAO	International Civil Aviation Organization
KPA	Key Performance Area
KPI	Key Performance Indicator
PC	Passport Control
PFIS	Passenger Flow Information System
PNL	Passenger Name List
PNR	Passenger Name Record
PRM	Passengers with Reduced Mobility
RAMS	Reorganized ATC Mathematical Simulator
RMP	Reduced Mobility Person
SESAR	Single European Sky ATM Research
SIBT	Scheduled In-Block Time
SJU	SESAR Joint Undertaking
SOBT	Scheduled Off-Block Time
SSR	Special Service Request
STA	Scheduled Time of Arrival
STD	Scheduled Time of Departure
SW	Software
TBO	Trajectory Based Operations
TIS	TITAN Information System
TITAN	Turnaround Integration in Trajectory and Network
TOBT	Target Off Block Time
TSAT	Target Start-up Approval Time
TTOT	Target Take-Off Time
TTTT	Target Turnaround Time
TWR	Tower



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UM Unaccompanied Minor
VIP Very Important Person
WP Work Package



2. EXERCISE SCOPE AND JUSTIFICATION

2.1 Stakeholder Expectations

The principal stakeholder groups involved in the current turnaround process are Airline, Ground handler (GH), Air Navigation Service Provider (ANSP) and Airport operator. In addition, there are a number of indirect stakeholder groups (like regulation authorities, CFMU, security and immigration staff, fuel companies, meteorological services) whose performance has an impact on the turnaround process execution.

The stakeholders' needs can be summarized by the conclusion that there is an urgent need for turnaround related Information Sharing [2]. The validation exercise expectations from the stakeholder's point of view can therefore be easily deduced [4]:

- Assess the feasibility and usability of the information exchange in the TITAN concept;
- Demonstrate that the information exchange in the TITAN concept improves the efficiency, predictability and cost effectiveness of the turnaround process.

The first expectation was assessed by the Gaming Sessions described in this report, which is part A of deliverable D3.3. The second expectation is assessed by means of model simulations and will be reported in part B of deliverable D3.3.

2.2 Concept overview

The proposed TITAN solution is described in the ConOps document [2] which develops the new advanced operational concept for the turnaround process aimed to improve predictability, flexibility, efficiency, cost effectiveness and to provide a common situational awareness to those actors involved in the process. The scope is limited to the sequence of ground operations required to service the aircraft in the turnaround between the in-block and the off-block time as well as those external services which have a direct influence on it.

The Concept of Operations is expressed in a process-based, service-oriented way based on principles like net-centricity, information management or collaborative decision making. It describes how the turnaround process will be performed from different perspectives by identifying functions and processes, and their corresponding interactions and information flows; concerned actors, their roles and responsibilities.

Regarding processes, main focus is on landside processes and their link with airside ones, a description of how to track passenger and baggage flow is addressed among others. Also common (landside and airside) and off-airport processes are considered to ensure an extended handling view by including processes hitherto not, or not fully, considered in the Collaborative Decision Making view.

In order to be executed, those processes require various services which, in turn, support end-user applications that are the operational interface to the outside world (for humans) or to external environments without human intervention. Services in the TITAN concept of operation context include both operational and supporting services but exclude technical/IT services. Table 1 gives the so-called TITAN Information Services, which are described in terms of the type of information they provide. As an application of those services, TITAN collects technical performance data as well as data on planned and actually performed trajectories, warnings (time issued and time in advance), actions, etc. The aim is to provide sufficient data to end-user applications that generate performance information for the different partners, including trends and problem source analyses.



TITAN Information Services	
BFIS	Baggage Flow Information Service
PFIS	Passenger Flow Information Service
CMFIS	Cargo/Mail Flow Information Service
AIRS	Airport Information Report Service
ASRS	Aircraft Status Report Service

Table 1: TITAN Services

2.3 Gaming objectives

The main objective of the gaming sessions in TITAN is therefore the following:

Assessment of the information usability and the quantity of information required by the decision making associated to events of normal operation according to the scenarios already identified in Validation Exercise Plan [4]. This objective is linked to the fact that the actors/roles in the turnaround process can access all the information within the TIS, but they will only be subscribed to a part of the information by services. However, this information can still be too much for displaying it at the same time. By exploring the information that each actor/role really uses in each scenario, we could validate or update the initial categorization of information.

This objective is linked to the validation strategy objective: *“Assess the feasibility and usability of the information exchange in the TITAN concept”*

This objective can be subdivided into two tasks:

1. **Definition/Proposal of the information available in TITAN services.** As a first step it is an essential requisite to identify the information that is to be exchanged. TITAN Concept [2] identifies the information produced by each stakeholder to be dumped into the TIS (TITAN Information Sharing). This information will be completed with other missed data to support the validation scenarios and the gaming performance. Finally, the classification of the information by services must also be done in the context of the gaming scenarios.
2. **Validation of the TITAN information and TITAN services.** The usability of the subscribed information and services will be validated to ensure that this information will be useful to improve and solve some specific issues and current problems in turnaround (these situations are the ones described in the scenarios [4]).

2.4 Assumptions

The main assumptions taken into account during the gaming exercises were:

- The turnaround process contains different sub-processes which are defined in the section 3.1. Duration of each sub-process and consequently of the turnaround process was obtained through expert judgement and this was used as starting point to define a realistic turnaround process.
- The definition of the TITAN information and also the TITAN services was performed using the first version of the TITAN operational concept [2] and completed through an expert judgement. This initial definition was validated and assessed by other experts.
- A-CDM is fully implemented in the different scenarios.



3. GAMING PREPARATION

The activities carried out to prepare the gaming sessions are the following:

1. **Definition of the turnaround process flow:** using a story board, turnaround process has been pictured in a time line including all the sub-processes and their corresponding duration.
2. **Selection of the gaming roles and players:** starting from the list of actors defined in the TITAN Operational Concept, a selection of the roles to be involved in the gaming sessions and the persons who are going to play was performed.
3. **Definition of the TITAN information and the TITAN services:** starting from the description of the scenarios [4] and the information in TIS, a complete list of the TITAN information and its structuring in different services was performed.
4. **Definition of the gaming scenarios:** using as reference the scenarios described in Validation Plan document [4].
5. **Initial subscriptions to the TITAN services and information:** once the TITAN information and the services are defined, a preliminary task was performed sending to players who are going to participate in the gaming information all this information and asking them about their requests for subscription.
6. **Definition of general performance of gaming exercise:** The general dynamic of a gaming exercise and the particularities for each game are defined and the material to be used is developed and tested.
7. **Description of the results collection methods:** the Gaming sessions provide qualitative data which are collected with different methods for their subsequent analysis.

More details of these activities are given in the following sub-sections.

3.1 Definition of turnaround process flow

The development of a flow diagram of the turnaround process will aim at putting the turnaround process in a time-line to guide the actors during the game performance and give an idea about the expected turnaround sub-process that should be active at each time, thus monitoring the delays accountable to each process. This will be the baseline to define the storyboard for each specific scenario. Each gaming validation scenario differs in the inclusion of specific unplanned events that differentiate sub-processes from the planned operation and that have an impact on the information produced related to those sub-processes performance.

The general turnaround flow diagram also includes time buffers accounting for the acceptable delay in planned execution of turnaround process.

The definition of the story-board was done in two steps based on experts' knowledge:

1. Definition of the **turnaround sub-processes** included in a generic turnaround and their **interrelations** and;
2. the definition of typical sub-processes' **duration** taking into account that turnaround sub-process is performed in a medium aircraft type B737 or A320 and also that aircraft makes a short-haul leg (around one hour).

Figure 1 shows the full turnaround flow diagram.

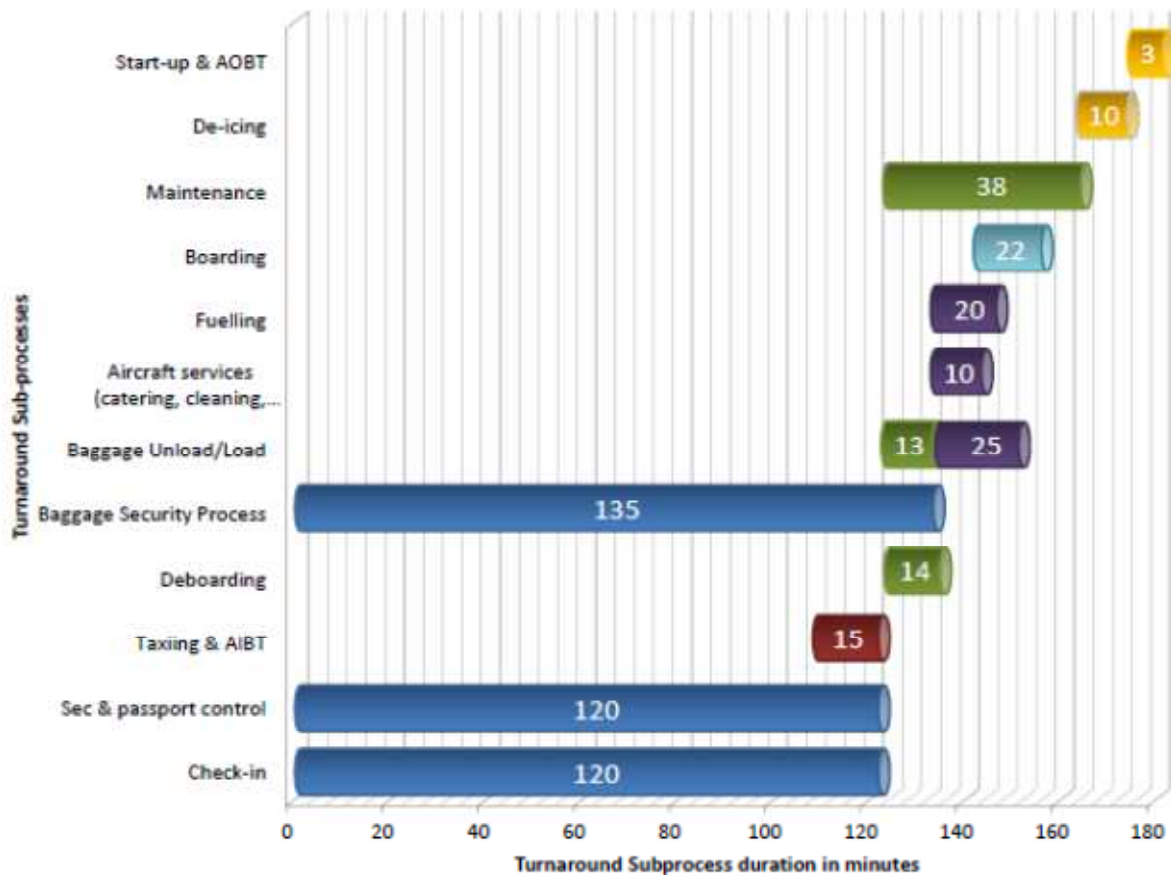


Figure 1: Turnaround flow diagram and sub-processes' duration

3.2 Selection of the gaming roles and players

During the performance and design of a gaming exercise two types of different human involvement can be distinguished:

- Gaming participants team:
 - **Actors:** The players who participate in the games. They are experts in the concept to be validated.
 - **Observant:** They are the people who do not play the game but they deeply know the concept to clarify it. Usually, they would have the skills and expertise necessary to play the game, but they will act as public of the game to supervise operational issues about the concepts and the processes and they will participate in the game if it is required.
- Gaming management team:
 - **Game Master:** This person directs and supervises the performance of the gaming sessions. He/she participates in the different design phases.
 - **Assistant:** These participants do not play the game but they participated and know the design and implementation of the game. Their mission is to support the Game Master in the execution of the game.



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The most important preparation activity about the selection of roles is the choice and selection of the participants: Who and which role is going to play.

As mentioned in section 3.1.2 of the Validation Exercise Plan document [4], a selection of the roles to play in the gaming exercises had to be done due to the high number of roles defined in the Operational Concept Document [2] and the limited recourses to be included in the gaming exercise.

Based on the scenarios defined in Annex 2 of the Validation Exercise Plan [4] a selection of the actors was done. Table 2 shows an initial list of players to participate in the gaming exercise. Each player will also assume the responsibilities of the collaborators and will have access to the information produced by them:

Organisation Unit	Player ¹	Collaborator ²
Aircraft operator	AOC (Airline Operation Centre) – Flight Dispatcher	Maintenance staff
		Passenger agent
	Cockpit crew	Cabin crew
Ground handling	Operation controller	--
	Ramp Agent	Cleaning agent
		Catering agent
		Baggage agent
		Cargo agent
		Mail agent
		Fuel provider
		Electric supply provider
		Load control
		Unaccompanied minors
		Ambulance
		Equipment Operator
ANSP	Local/Tower controller	--
	Ground controller	--
	CFMU	--

¹ Player is the person who will really play in the gaming session taking decisions about the turnaround process. He/she will be responsible for all the sub-processes in which associated collaborators are involved

² Collaborator is a role linked to certain specific player and various turnaround sub-processes. They do not play directly in the game, but their responsibilities and produced information are assumed by the associated player. In the real life this role would also be responsible of updating information in TITAN tool.

Organisation Unit	Player ¹	Collaborator ²
Airport Operator	Airport Operator	Marshalls and follow-me drivers
		De-icing staff
		Reduced Mobility assistance
		Automatic system/Load flow on terminal personnel
		Met office
		Security personnel

Table 2: List of TITAN gaming players

The following aspects must be considered as modifications in the list of actors defined in TITAN Operational concept document [2] and in the table above:

- Flight Dispatcher from Ground Handling was changed to Ramp Agent. This change was suggested by different experts and this was one of the comments suggested by the experts in the TITAN 2nd Workshop.
- Flight Dispatcher will be a role belonging to Aircraft Operator Unit and will share some of the responsibilities associated to AOC.
- Only one actor will play as Local/Tower Ground controller and CFMU due to the limited participation during the turnaround process.

The minimum requirements for the list of expertise were:

- 2 experts on airlines procedures(knowledge about passenger agent and cockpit crew)
- 2 experts on ground handling
- 1 expert on air traffic control
- 1 expert on airport operations

3.3 TITAN services information definition

This activity was the core of the preparation tasks. TIS definition was already done in the TITAN operational concept document [2], but after the 2nd TITAN workshop and the assessment of the scenarios, a more complete and detailed list of TITAN information was prepared supported by expert's knowledge.

After that, a web application to support the gaming exercises was developed to simulate the real-time sharing of information between the actors in real time and so, validate the TITAN information and the different services. During the development of this web application some re-adjustments in the information and overalls in the information levels were done to facilitate the performance of the exercises.

Summarizing, this activity was done in several steps:

1. Update of the TIS information and its different information levels (using the results obtained in the 2nd TITAN workshop).
2. Definition of TITAN Services and updating of the TITAN information (based on the scenarios assessment and on the expert's judgement)



3. Development of the TITAN web application to support the gaming exercises

These steps are explained in the following sub-sections.

3.3.1 TIS information and information levels

After the 2nd TITAN workshop, the list of TIS information was updated. As a new concept element it is proposed to categorize the provided information in terms of possible urgency in one of the following four levels [4]:

- Level 0 is simply a (re)-confirmation that a given process is running on time.
- Level 1 indicates that there is a problem with a process causing it to run late but the turnaround itself will not be affected even though part of the built in buffer will get used up.
- Level 2 indicates that immediate intervention is necessary to mitigate the effects of the process concerned otherwise the final turnaround target cannot be met.
- Level 3 indicates that urgent re-planning is necessary because it is no longer possible to meet the turnaround target with the original planning.

This approach implies that the core functionality of the services will not make judgements about the nature of the information in terms of how it has to be displayed at a given client HMI. Obviously information that may be of just passing interest for one client is a matter of the utmost urgency for another and the decision on this can only be usefully made in the End User Application (EUA) itself. Therefore the reaction to the different levels of information published by the core functionality and the consequent presentation on the HMI will depend on how the EUA itself has been set up. This is an important customization aspect and one of the means that reduces information overload.

This step was the starting point to define the TITAN services and the list of information to be included in the gaming exercises. The level 0 information was the “plain” information defined in the TIS to monitor the turnaround process (in normal conditions) and the level 1, 2 and 3 information was the information arisen when unexpected events happen or when turnaround process is not running as it was planned due to different causes.

This list of information classified by levels in the context of gaming scenarios can be found in Annex 1.

3.3.2 Definition of the TITAN Services

This step defines the TITAN services (CMFIS, AIRS, ASRS, PFIS and BFIS) in terms of the type of information they must provide.

This activity was done under the support of experts in Airport processes and Airport CDM together with the assessment of the scenarios which provided additional information to take into account in the performance of the gaming exercises.

The following approach was performed:

- Initial definition of the TITAN services describing the TIS information (from TITAN operational concept document [2]) that each service should provide.
- Updating the list of TIS information with supplementary information included in the scenarios description [4] and also with the CDM milestones and some important times considered as missing in the TITAN milestones.



- Classifying the information of each of the TITAN services per turnaround sub-process. This was done because of the amount of information included in some of the services and is intended to facilitate the identification of each piece of information.

The final result was a table/database with the information available for each of the TITAN services (see Annex 2). This information will be organized by turnaround sub-process.

3.3.3 Development of the TITAN web application

Due to the amount of information that some of the services contain, it was a challenge to find a way to present all this information for each role and at the same time simulate the sharing of information only using paper material. Eventually, it was decided to develop a web-based tool that would present the TITAN services and all the information to the roles and with the use of a single PC would facilitate a lot the performance of the game.

The web application would be basically a database containing the following functionalities:

- The web application presents all the TITAN level 0 information organized by TITAN services and structured by turnaround sub-process (see also 3.3.2)
- Access to this information (only view mode) is configurable by role. This means:
 - Implementation of a control access by role is needed (until six different roles can be configured).
 - The subscription to each item of information is allowed and modified in real time.
 - Each role will be able to see only the information which is subscribed to.
- Updating of the information is only allowed for the web application administrator.
- The web application will contain a chat function to allow communication between roles (one-to-one).
- The different levels of information are displayed for each TITAN service level and per role as described in the scenarios (see more in the Validation Exercise Plan document [4]). This implementation allows defining new data for the information levels which were not defined yet. Each information level contains two types of information:
 - Code colour: Green (level 0), Blue (level 1), Yellow (level 2), Red (level 3)
 - Text: additional data about the level of information (e.g. "change of the stand 3 to stand 7)

3.4 Gaming Scenario Specification

The different gaming exercises were defined using as reference the three scenarios included in Annex 2 of the Validation Exercise Plan [4], which are summarized below:

- **Scenario 1 – Missing passenger disrupts the end of the turnaround:** This scenario starts with the landing of one Schengen flight. The turnaround sub-processes runs in a proper way until the system detects that some passengers are lost in the boarding gate. Using the TITAN information and services this disruption in the process will be solved in the minimum time and the impact of the operation is minimized.
- **Scenario 2 – Aircraft change due to late incoming aircraft:** This scenario starts with the planning to execute one of the rotations of the day of one specific flight with the aircraft in connection coming from the other airport. This flight in connection has not still departed and



two delays happen: the first one is a short-delay which impact on the aircraft planning can be mitigated using the turnaround buffer time. The second one is a long delay and it causes the need of re-planning, re-scheduling another aircraft. The use of TITAN services and the TITAN information sharing will facilitate this process minimizing the impact in the schedule and in the passengers.

- **Scenario 3 - Waiting for connecting passengers at hub airport and slot problem and engine problem.** This scenario is about one flight to Budapest that is in connection with another international flight. Six of the passengers travelling in the international flight are business passengers. This connecting flight will arrive late and there will be no sufficient transfer time. The rest of the flights to Budapest are totally booked, finally the decision to wait for the passengers is taken and a new slot must be obtained. Once the new slot is obtained and the passengers in transfer are on-board, an engine problem arises during the taxi-out. Finally the problem is solved and the final delay is about 45 minutes.

In addition to these scenarios, a **training game** was defined to familiarize the actors with the Gaming technique and the material used in the games (mainly with the TITAN web application). The training game covered a complete turnaround process.

A more detailed version of each scenario was developed in order to prepare the performance of each game. More information can be found in Annex 4.

3.5 Preliminary information subscription

The access to the TITAN information will be done through the subscription to the TITAN services.

As the definition of these services and the contained information was carried out by means of an initial exercise, a validation by external experts was needed.

According to the TITAN services definition (see section 3.3.2) the experts who participate as players in the gaming session had to perform a preliminary subscription to the TITAN information and services.

The subscription was not only done at the level of piece of information. The most important information for each role was identified and the definition of the TITAN services was validated or updated if needed.

To carry out this activity an excel file with the definition of TITAN services (see Annex 2) was sent to the participants. One excel file per role was developed which included a default subscription which was considered as the minimum information to be subscribed. In summary, the default subscription was the TITAN milestones and the information which is provided by this role to the TIS.

The results of this preliminary subscription per role were consolidated and are given in Annex 5. They were used as a starting point for the gaming exercises and they were assessed in order to see if any modification is requested from the players during the performance of the gaming sessions.

3.6 Definition of the general performance of gaming exercise

The design of the gaming exercise aimed at ensuring that players would be able to monitor and manage the turnaround process only by sharing and assessing the information included in the TITAN services which is the information within TIS.

To do that, two different topics were addressed:



- Definition and development of material
- Definition of rules

3.6.1 Gaming exercise material

The support material to play the different games was the following:

- PC with internet for accessing the TITAN web-tool which displayed the services and all their information. This tool also contained a chat to allow communication between players (one-to-one). Figure 2 shows the view that an actor has about the BFIS information.



Figure 2: Snapshot of the TITAN webtool

- Time table: This excel sheet (Figure 3) was developed to guide the users through time. It showed the current and the estimated time and calculated times for each turnaround sub-process in order to support the decisions of the players when needed.



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2:35		ACTUAL TIME				
		Start	Duration	End		
	Start-up & AOBT	2:56	0:03	2:59		
0	De-icing	2:56	0:00	2:56		
	Maintenance	2:00	0:38	2:38		
	Boarding	2:34	0:22	2:56		
0	Remote boarding	2:34	0:00	2:34		
0	Fuelling	2:14	0:20	2:34		
	Aircraft services	2:14	0:10	2:24		
	Baggage Load	2:13	0:24	2:37		
	Baggage Unload	2:00	0:13	2:13		
	Baggage Security	0:00	2:15	2:15		
	Deboarding	2:00	0:14	2:14		
	Taxiing & AIBT	1:45	0:15	2:00		
	Sec & Pass control	0:00	2:15	2:15		
	Check-in	0:00	2:00	2:00		
ALDT	1:45	ELDT	1:45	0:00:00	Time to open door (aircraft and cargo)	
AIBT	0:00	EIBT	2:00	0:00:00	Time between end of unload and start of load	
AOBT	0:00	EOBT	2:59	0:10:00	De-icing	
ATOT	0:00	ETTT	0:59	0:01:00		
				0:10:00	Remote boarding extra-time	
Buffer	0:15	TOBT	2:59			
		TTOT	3:09	0:15	Estimated taxi-in duration	
		TSAT	2:59	0:10	Estimated taxi-out duration	
			Maximum time to find	0:30	0:06	Time for remote boarding in a hurry

Figure 3: Snapshot of the time table

- Guides for each player: These paper guides included a list of the tasks to be completed by the player at a specific timestamp. Generally, the task leads to the update of an item of TITAN information clustered in one or more TITAN services. Figure 4 shows an example:

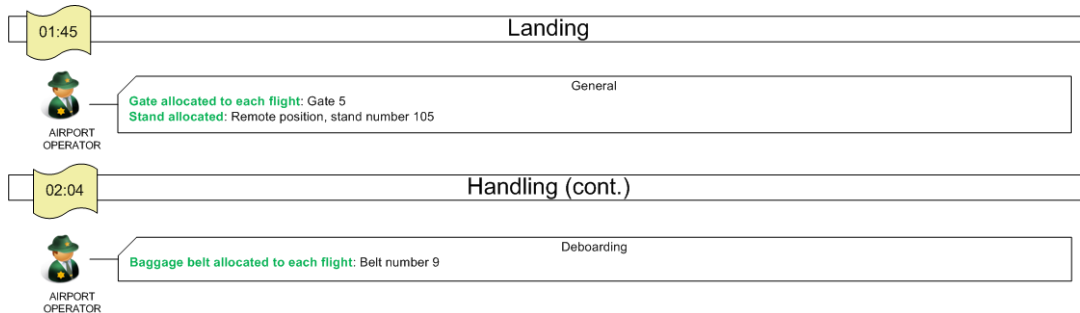


Figure 4: Snapshot of the guide of one of the actors/players

- List of all TITAN information presented in the TITAN web-tool: This sheet contained all pieces of information. Each player could add remarks or modify the sheets.
- Questionnaires: Two types of questionnaires were used; one at the first day of the gaming sessions in order to assess the experience of the actor with the gaming technique and another one for general de-briefing in order to collect the feedback from the players and participants after the performance of all gaming sessions. Two different de-briefing questionnaires were developed; one was filled in by the players by hand and the other questionnaire was adapted to be electronically filled in. The questionnaires structure can be found in the Annex 3.



3.6.2 Definition of rules

The general flow of each gaming session will be as following:

1. Firstly the initial conditions of the scenario to be played are presented.
2. The game starts when actual time is given (by Game Master and in the time table). For each updating of the timestamp, one or more actors will have to perform some actions if they are included in their own guide (e.g. In Figure 4, the airport operator had to update the item "baggage belt allocated to each flight" when timestamp was 02:04).
3. Players must be sure that they can execute the task described in the guide using only the TITAN web-tool. The actions that one player can perform through that tool are:
 - Information assessing: each actor can only see the content of the information to which he/she is subscribed within each TITAN service.
 - Information updating: Players can not directly update the information using the web-tool but they will have to communicate via chat with the administrator (playing the role of the "system") for indicating him the information and the content that he/she wants to update.
 - Communicating via chat: Players can communicate via chat with the rest of the roles subscribed to the tool and also with the "system" (admin role in the TITAN web tool).
4. Game master will announce the end of the game.

Furthermore the following rules are applicable to all gaming sessions:

- Each player can change or modify the information that he/she must share/update or request any information from the "system" or any other role if needed. Because of the limitations in the webtool functionalities, any change must be reported via writing the change in its own guide or requesting it from the "system" via chat.
- Although conversations between different actors are not allowed between participants, any actor and the game master can request a break time to open a discussion.
- All chat conversations must be recorded in text files.
- The actors can change the subscription to the information during the gaming. He/she can ask for subscription to the "system" via chat.

3.7 Results collection

The methods to collect the outputs for the result analysis are the following:

- Notes from the people involved in the gaming sessions:
 - Remarks made by the players in their guides and TITAN information sheet;
 - Notes taken by the gaming management team, reflecting the main discussions during the games and during de-briefing.
- Chat conversations
- Questionnaires



4. CONDUCTION OF GAMING EXERCISE

4.1 Gaming exercise planning and initial activities

4.1.1 Planning

Three different gaming sessions were planned according to the scenarios defined in [4]. Besides, a training session was performed before the execution of the different gaming exercises and an extra-time was booked to perform a general debriefing or to play an additional scenario to be suggested by the players depending on the performance of the first gaming sessions (especially on their duration).

Table 3 shows the proposed time schedule:

	05/10/2011	06/10/2011	07/10/2011
Morning	Gaming presentation and Training session	2 nd Gaming Session	3 rd Gaming Session
Afternoon	1 st Gaming Session+ Debriefing	Debriefing	General Debriefing/ Additional scenario

Table 3: TITAN Gaming Exercise planning

4.1.2 Gaming team

The game participants are the following:

Gaming management team:

- One Game Master (Rosana Casar – Isdefe)
- Three Assistants: One to support the actors (Izaro Etxebarria – Isdefe) and two acting as “the system”, managing the updating of the information in the TITAN web tool and managing the administrator’s chat (Ana Sáez – Ineco and Marta Sanchez – Isdefe).

Actors:

No actor or expert acted as observer. Some of the experts played together as a unique actor. This is the list of experts and the roles played.

Roles	Experts	Attendance
AOC Passenger Agent – Flight Dispatcher	Javier García (Boeing) Balázs Kerülő (SLOT)	Full sessions 2 nd and 3 rd session
Cockpit Crew	László Dabasi (SLOT)	1 st session
GH Ramp Agent	Noémi Král (SLOT) Steve Zerkowitz (BLUSKY)	Full sessions 1 st and 2 nd sessions
ANSP TWR/GND controller/CFMU	Ákos Kovács (SLOT) Zoltán Bilác (SLOT)	Full sessions 1 st session
Airport Operator	Andrej Kocsis (SLOT) Sebastian Kellner (RWTH Aachen)	Full sessions 1 st session

Table 4: TITAN gaming sessions experts/actors



4.1.3 Initial activities

Previous to game performance, the following activities were done to introduce the technique and the dynamic of each game:

- General presentation of gaming technique, TITAN concept and the objective of the gaming session.
- Filling in a pre-gaming questionnaire (see Annex 3) to collect the actors' feedback about the technique. The results are presented in section 5.3.1.
- Performance of a training session: As mentioned in section 3.4 a scenario was designed in which a general and complete turnaround process had to be performed.

Training session

The guides for the actors and the scenarios were designed with all the processes running on time and without any unexpected event.

There were 2 experts acting as AOC and pilot (cockpit crew), 2 experts acting as one airport operator, 2 experts acting as one ground handling and 2 experts acting as one air traffic controller.

This game was designed to train participants on the web-tool and the general dynamic for next gaming sessions. They had access to the information that they were subscribed for during the preparatory activity detailed in section 3.5.

The result was good and no particular issue was reported about the run of the game and the technique. At the end of the training, the actors were asked about their subscriptions and whether they felt the need to change them. No player modified its initial subscription.

4.2 Gaming sessions

4.2.1 Gaming Session 1: Missing passengers disrupts the end of the turnaround

The game was performed following the rules and using the material detailed in 3.6. Players were allowed to change or update additional piece of information or their content if they considered that some information was missing or was incorrect.

4.2.1.1 Dynamics

Table 5 shows the sequence of tasks for the different actors as proposed to be validated.

Task Id	Time	Role	Action
1	00:00	N/A	Initial conditions: flight in connection took off, check-in opened
2	01:30	N/A	Baggage Security Process, Security and passport control access opened, Final approach of the flight in connection
3	01:45	AOP	Inform about gate and stand
4	01:45	GH	Perform the stand check before arrival of the flight
5	01:45	ATC	Direct communication to Cockpit about the stand and the taxi instructions
6	01:45	FC	Confirmation of the stand and taxi instructions
7	01:47	ATC	Flight in connection touches down



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8	01:47	AUTO	Landing of the flight in connection (2 minutes late). CDM to confirm the new times launched Times updating (estimated and target)
9	01:50	All	Confirmation of the times (decision to assimilate the delay maintaining the times or state a delay of 2 minutes)
10	02:00	AUTO	Decision taken by all partners, the information levels are updated (level info 0)
11	02:00	GH	The aircraft arrived at the stand
12	02:00	AUTO	Update the times (AXIT and AIBT) Check in closes Stairs and bridge are located to start boarding
13	02:02	FC	All ready to start de-boarding
14	02:02	GH	Start to de-board passengers
15	02:02	AUTO	Start of baggage unloading
16	02:02	AUTO	Warning about the need of agreement to start fuelling while de-boarding
17	02:03	AUTO	Warning to all players about the need of agreement to start fuelling while de-boarding
18	02:04	AUTO	Decision about fuelling is taken and ASRS/AIRS warnings are deleted
19	02:04	AOC	Request of fuel (quantity)
20	02:04	GH	Fuelling can start
21	02:15	AUTO	End of unloading and start of loading Last passenger crossed the security control
22	02:15	AOP	The baggage belt is associated to the incoming flight
23	02:16	AOC	De-boarding ends
24	02:16	AUTO	Cleaning, catering and electrical provision starts
25	02:26	AOC	Boarding can starts
26	02:26	AUTO	Cleaning and catering and electrical supply is finished
27	02:26	AOC	Result of the safety and security procedures are reported
28	02:26	GH	Report of the status of the resources to board by bus
29	02:30	AUTO	Status of boarding is reported: ambulift is located and the first bus with passengers has arrived at time. All baggage is loading to the aircraft and the last piece of the unloading baggage has arrived to the hold baggage area
30	02:31	GH	Fuelling ends
31	02:31	AUTO	First bus has arrived to the remote stand
32	02:35	AUTO	Warning arises about three passenger missing
33	02:35	AOP	Report about the location of one of the lost passengers buying in a shop
34	02:37	AOC	The boarding goes on and the second bus drives to the remote stand.
35	02:37	GH	One of the buses will continue as occupied waiting the lost passengers
36	02:40	AUTO	Warning about passengers have been found out is launched
37	02:40	AOP	Actions are taken to find the passengers and confirmation of acceptance in the boarding gate is requested to AOC
38	02:41	AOC	Acceptance of the lost passengers
39	02:42	AUTO	Warning to all actors is launched because passenger have been found out and



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			they will board at time Loading baggage ends
40	02:45	AOC	Last passenger has arrived to the boarding gate
41	02:45	GH	Cargo doors are closed
42	02:47	AOC	End of boarding is reported
43	02:48	AOC	Total number of passengers is reported
44	02:48	GH	Ready to push-back
45	02:48	AOC	Request to push back and for start-up clearance
46	02:49	ATC	Approval for starting-up
47	02:50	GH	Off-block
48	02:50	AUTO	Update of AOBT
49	02:50	ATC	Give taxi instructions to cockpit crew
50	02:51	AOC	Confirmation of the taxi instructions
51	03:10	ATC	Take off is reported
52	03:10	AUTO	Update of time to take-off

Table 5: Sequence of tasks for Gaming Session 1

Main findings

Task 1 – Definition of *CTOT* is wrong. The right one is *CTOT* time (-5 mins, +10 mins)

Task 5 & 6 – No specific piece of information for *taxi-in instructions* neither their confirmation. Direct communication was done (via chat)

Task 7 – *Aircraft touch down* information is redundant with *ALDT* or *Landing*. But *ATC* sends updates of the following information: *EXOT* (duration of the taxi-out) and *TSAT* (Target time to start-up). *TSAT* is the result of $CTOT+10-EXOT$ then it can automatically be calculated. Finally a new time parameter was presented *STU*.

Task 12 – *AXIT* time is missing

Task 13 – Information as *Cross-check* and *aircraft door opened* is missing (communicated directly via chat)

Task 16, 17&18 – There is a discussion about the conditions under which fuelling is performed (while people inside the aircraft) and the possible information needed to support this action. See more in de-briefing section.

Task 26 – *End of electrical supply* should not be updated yet. The provision of electrical supply must last until the *a/c* pushes back.

Task 27 – The information about “*end of passenger cabin security check*” is not updated by the partners. A discussion is opened about the safety and security procedures because it is thought that this information should not be updated during this task. See more in de-briefing section.

Task 28, 29, 31 & 35 – Information about the *resources* (buses and boarding status) is missing in the *TITAN* services and this information was not used during the gaming. Discussion about the need to include information about resources (mainly *Ground Handling* resources) was held. See more in de-briefing section.

Tasks 32-39 – These tasks are related to the event “*lost passenger*”. No specific information level in *TITAN* services has been defined and so information needed to address the situation was also missing. In de-briefing section more details about the information needed is given and also about



the possible actions to address and solve this specific event. ATC could share the *latest STU/TSAT time according to the SLOT/CTOT*. See more in the de-briefing section.

Tasks 45 & 46 – These tasks related to the push-back and start-up requests and approvals were joined. Only the request and the approval for push-back were needed to be used as information: when push-back is requested, the start-up is also automatically requested and the same for the approval. Consequently, *start-up clearance request_M13* and *start-up approved_M14* can be substituted by the push back clearance request and push back approved (missing piece of information) previous one. *EXOT* time is already updated by TOBT after which *CTOT* is automatically updated.

Task 49 & 50 – No specific piece of information exist for *taxi-out* instructions and confirmation.

4.2.1.2 Main discussions/debriefing/communications assessment

This section presents the main agreed conclusions from the discussions held during game's performance:

AOP and AOC information

AOP and AOC do not have many interactions during the game. In summary, it was stated that the main information needed by them is the following:

- AOP needs to be aware of check-in process and resources used (in the airport), then having the information about airport resources (mainly gates and stands and their status) would be useful. This information is already defined in the TIS, but the availability and status of all gates and the stands in the airport should be considered.
- Controller (ATC) only needs to be aware of certain times: Taxi times (EXIT and EXOT), CTOT, and overall TOBT and any change on it. De-icing times and information is also requested. Even if something in the turnaround goes wrong, they only need this information to know when the times mentioned above might be impacted.

Taxi-in & Taxi-out

Taxi-in and *taxi-out times* are manually managed during the game but in airports with A-SMGCS implemented, these times are calculated automatically.

Other interesting information to be included is the *time to reach the stand* which is more precise for predicting the turnaround times.

Fuelling

(related to tasks 16&17&18)

This discussion arose from the question about how to perform the fuelling during the game. It was stated that there are no European or national standards to fuel within the airports, only local procedures.

The way to work is through the agreements between airline and airport regarding the conditions under which fuelling has to be performed. Airline has the final decision and if there is no impact on stands and gate allocation the procedures are allowed (for example, fuelling while de-boarding).

One example of local procedures is that all seat belts must be unfastened to carry out the refuelling with passengers on board.

The important data to support the decisions about this sub-process is the *airport policy* and *the information message to fireman* to check their availability (from AOC to fireman). Also the declared *safety level of airport* is important information.



Information about security and safety procedures

(related to task 27)

There was a discussion about the data *end of security check* because experts understood that this piece of information must not be updated at this point of the turnaround process. They commented that there are two types of safety procedures:

- Cabin safety procedure which is done by the Flight Crew and it is done for each flight
- Security check which is done only the first time in the morning.

According to this definition the piece of information can be related to the cabin safety procedures and not to security check. A re-definition of types of information such as “end of security check” related to security or safety should be done.

Need for information about resources

(related to tasks 28&29&31&35)

There was a discussion about the interest of the actors in the information about the resources. The example addressed was GH resources such as buses.

AOP is not interested in all information about the resources but only in information about service provision, delay cause and whether any delay is foreseen.

GH has tools to monitor its own resources and the rest of the actors were interested in the cause of delay and the expected times if any problem occurred. The discussion was about the need to have all this sensitive information and their applicability within TITAN. The summary of the discussion was that although the raw information is not going to be interesting for the users, some processed information using this data can be useful for knowing the expected delays and their causes.

The main issue about these raw data is the confidentiality and the availability of this information (from the information provider perspective). It was agreed that this last point is out of the scope of this part of TITAN project.

Boarding – Lost passengers

(related to tasks 32-29)

The discussion about lost passengers was opened due to the lack of pieces of information defined within TIS and within the services. Actors were also asked about the current procedures launched to solve this unexpected event. These are:

- Use of Voice systems to call for them
- Send an SMS (in case of having the Mobile number)
- GH sends an agent to look for them
- Detect the boarding pass in the places that they are presented (shops, other gates, ...)

The GH is responsible for collecting and looking for the lost passengers as being the main role impacted by this event, in terms of need of information. If luggage containers are previously identified, GH can unload baggage in 20 minutes.

The AOP role can be impacted by the following aspects:

- Expand the use of gate and stand
- Need to unload the baggage



- Identify/know a delay in the flight (in case of passengers are high-priority and delay in the flight is decided)
- Lost passenger can be a security issue for airport if they are not identified/found and the baggage remains in the airport (in case of unloading the luggage).

4.2.2 Gaming Session 2: Waiting for connecting passengers at hub airport and slot problem and engine problem

The second scenario presents two unexpected events that will provoke discussion and coordination among the players: delay for waiting for passengers in connection and an engine problem during taxi-out.

This scenario was the second one to be played because the performance of the game was similar to that of scenario 1. The main difference was that the guides contained only some paragraphs about the tasks to be completed, but not the information to be updated neither its content. Consequently, more freedom was allowed during this game. Figure 5 shows an extract of one of the guides provided in this game:

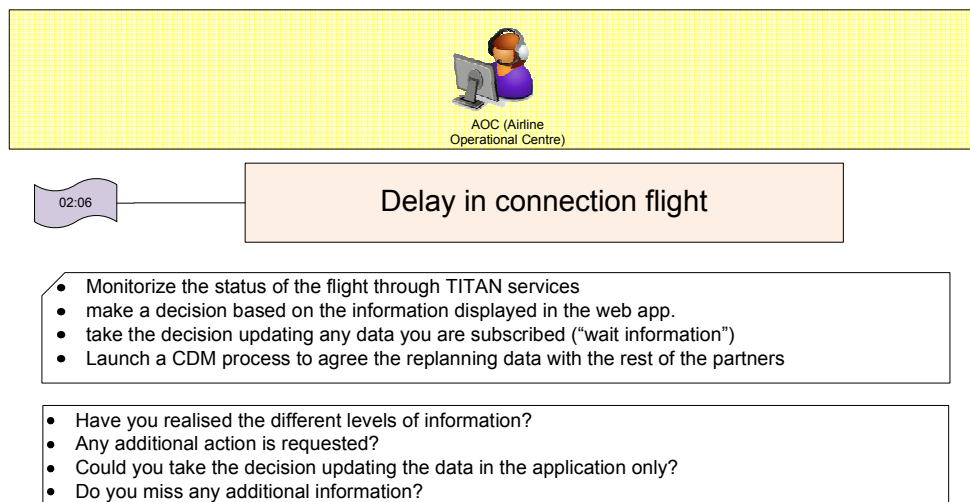


Figure 5: Snapshot of 2nd gaming session's guide

The rules and the rest of the material used during the game were similar to those given in section 3.6. Players were allowed to change or update additional piece of information or their content if they considered that some information was missing or incorrect.

4.2.2.1 Dynamics

Table 6 shows the sequence of tasks to be completed by the different actors proposed to be validated.

Task Id	Time	Role	Action
1	02:05	N/A	Initial condition: Incoming aircraft information, aircraft configuration, passenger list, estimated times, stand allocation, gate allocation. Aircraft touch down, apron/stand check finished. Check-in opened; security baggage, security and passport control, deboarding



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Task Id	Time	Role	Action
			and baggage unloading processes on-going. TITAN services alert: level 0.
2	02:06	AUTO	Warning about late business class passengers; baggage information, time to transfer provided. TITAN services alerts. Waiting for late passengers requires replanning of flight BW120.
3	02:06	AOC	It is decided to wait for passengers in connection.
4	02:10	AUTO	Warning to all actors. Assessment on delay and replanning of flight is required. New time slot is needed to replan all services impacted.
5	02:10	AOC	Check-in finished.
6	02:13	GH	Unloading finished/ start of baggage loading.
7	02:14	FC	Deboarding finished.
8	02:15	AUTO	Cleaning and catering activities start.
9	02:16	AUTO	Replanning of flight BW120.
10	02:16	ATC	New time slot requested via CFMU, 45 mins after the STD.
11	02:16	AUTO	EOBT and Target times updating. Collaboration request. All actors should reach an agreement on replanning.
12	02:22	AUTO	Confirmation of replanning. Services alerts removed. Target times publication.
13	02:22	AOC	Delay of boarding start published in the boarding gate.
14	02:22	AUTO	Last passenger crossing security control identified.
15	02:25	AUTO	End of cleaning and catering. Last baggage delivered to hold baggage bay. End of fuelling.
16	02:57	AUTO	CO060 arrives in time. Collaborative decision making among the actors: agreement on confirmation time and use of priority lane.
17	02:57	AOC	Start of boarding.
18	02:15	GH	Request to send tug and a cart to the area of containers from CO060.
19	02:26	AOC	End of boarding.
20	03:17	GH	Close cargo doors.
21	03:30	GH	Push back connection, aircraft ready.
22	03:31	FC	Push back and start up clearance request.
23	03:32	ATC	Start-up approved.
24	03:34	GH	Off-block performed.
25	03:34	GH	Taxi out instructions.



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Task Id	Time	Role	Action
26	03:34	FC	Direct communication from ATC with taxi instructions request.
27	03:37	FC	Warning about Engine problem when taxi out and take off. Ask to ATC to wait.
28	03:37	GH	Agree to wait for 10 mins. Information service level 1 'ground delay taxi'.
29	03:42	FC	Request to go on with the taxi-out.
30	03:42	GH	Agree on FC request.
31	03:46	AUTO	ATOT publication. Information service level 0.

Table 6: Sequence of tasks for gaming session 2

Main findings

Task 1 – There are two information data with the same meaning: *ALDT and Aircraft touch down*. It is suggested to maintain ALDT.

Task 2 – There is a piece of information corresponding to the level alerts of this situation which was provided to the actors but was not included within TIS. This is *time to transfer* (baggage). PNL list should also include the information about the lost passengers and their status as it is not clear whether such information is given in the PNR provided by the airline at the end of the check-in. The baggage information of the passengers in connection should be available together with its location in the aircraft in order to be able to predict better the time to transfer.

Tasks 3&4 – The CDM processes launched to agree times do not occur as they are designed in the game. The data of the flights in connection are needed to assess the need of re-planning and the possible solutions. More details are given in section 4.2.2.2.

Task 5 – The milestone “end of check-in” is very important to:

- Ensure adherence to the allocated slot. Any delay in the check-in process could lead to a delay resulting in slot loss.
- Have the final list of passengers.

Tasks 9-12 – The tasks of re-planning definition and agreement are different from the ones proposed in this flow. The procedure of calculating a delay when a re-planning is done and the slot modification to CFMU are addressed in section 4.2.2.2.

Task 13 – The delay at the boarding gate is published by the Ground handler instead of the airline.

Task 16 – There is no information in the TIS to report the arrival time of connected flights. As mentioned in tasks 3&4 there is no negotiation and confirmation about times, only airline and ground handler agree on the times. The decision to use priority lines is also decided by the airline and it is communicated to the Airport. Only information about the waiting times in security and passport controls exist within TIS, but not about the available airport resources.

Task 18 – No information about the ground handling resources for luggage unloading is given.

Task 24 – The order to update the information is different: Firstly the off-block time is reported and then, the push back is removed.



Tasks 25-26 – There are no specific items of information to support the taxi-out in the TIS. The communications were done via voice (in this game, via chat).

Tasks 27-31 – There are no pieces of information to support this unexpected event between airline and ground handling or ATC. These pieces of information could not be needed because the only information is the malfunctioning of any resource and the possible delays if needed to allocate enough resources. The *TTOT* is updated by the ground controller when the airline communicates the decision to wait 15 minutes. No negotiation is performed about this time, the decision is taken by the airline. See more in 4.2.2.2.

4.2.2.2 Main discussions/debriefing/communications assessment

This section presents the main conclusions from the discussions held during the game's performance, as obtained by the de-briefing.

The new times when there is a delay are agreed by Ground Handler and Airline. The rest of the turnaround actors are informed and they adapt their resources to the new request.

Delay and decision to re-plan a flight

(related to tasks 3 and 4)

When a delay is produced by knock-on effects and a re-planning must be done, the *connection flight data* is needed in real time to make the re-planning in the most efficient way avoiding continuous delays over time. Predictability and punctuality will result improved.

About the CDM processes to agree the re-planning of a flight, the ATC does not participate in CDM process of the negotiation of a new slot with CFMU. The new time (TOBT) is only agreed by the airline and ground handling. No confirmation about times is needed.

TOBT is not under the responsibility of ATC; the time to be managed is the TSAT.

AOP is just informed about the changes and re-arranges the resources according to the decisions of the airline. Only in extreme cases the airport will intervene in this CDM process.

Re-planning and new slot request

(related to tasks 9-12)

The **re-planning** process is managed by the airline and ground handling. They will agree on the final delay for the flight and the need to request the new slot is assessed.

The final delay will be calculated taking into account the connection/transfer times. Nowadays there are default connection times but some refinements can be done taking into account different conditions as number of seats, aircraft configuration, and stand location. Also, the ground handler could modify this time to take into account the use of new resources to support this transfer.

In this scenario, a **new slot** is needed and this task is totally managed by the airline with CFMU. The rest of the turnaround partners will adapt their resources to the new situation when a new slot is received. They will have to be aware of the final decision on TOBT to manage the impact on their job (if any). When the decision of the requested delay is taken by airline and ground handling, CFMU is informed and a new slot is required.

The process can be illustrated by the following example:

- Initial conditions are: EOBT 10:00 TOBT 10:00
- According to the delay agreed (20 minutes), TOBT is updated (10:20)
- Airline sends a DLA message to CFMU waiting for the new CTOT according to TOBT.



- A DPI message (only for airports with CDM implemented) is already sent to the CFMU to support the assessment of the new slot
- CFMU sends the new CTOT including the taxi-times (+10, -5 mins) to the airline and the TSAT is also updated.

There could be an issue when AOC estimates a delay and a new TOBT and CFMU cannot provide a slot according to it. Then the decision taken by the airline could change. One possible solution could be to know the Δ TOBT to see the calculated time by the system and to take the buffer time into account as well.

Another comment was about the priority that one late flight has when it arrives to the airport. It seems that there is no specific information to give it the priority to land. The aim of the controller is to comply with the planning. Maybe a message of the type "Special attention" could be stated to inform the controller about the particular situation of this flight which is a connection flight with one flight already delayed in order to avoid new delays.

Problems with the engine during taxi-out

(related to tasks 27-31)

GH has direct communication with AOC asking for de-boarding and maintenance. When problem arises immediate communication is performed.

At the time the engine problem arises, when AOC reports this problem to ATC, the system should send a warning message to all stakeholders. The only information needed is whether there is any malfunctioning of any resource.

4.2.3 Gaming Session 3: Aircraft change due to late incoming aircraft.

The last scenario performed was the less guided one. Although there is a guide for each partner, due to the lack of data regarding the connected flights in the web application it was preferred to launch different discussions about the data of flights in connection needed.

4.2.3.1 Dynamics

Table 7 shows the planned sequence of tasks to be completed by the different actors proposed to be validated.

Id	Time	Role	Action
1	00:00	N/A	Initial conditions: aircraft configuration, estimated times, security and passport control times data. Check-in opened.
2	00:05	AUTO	Delay published in the rotation 1 destination airport (10 mins) Warning: information service level 1 'delay on 10mins, no impact in arrival estimated times'.
3	00:10	AUTO	2 nd delay published in the rotation 1 destination airport (120min) Warning, information service level 3. Need of rescheduling for departure BW201 and arrival BW200. Aircraft change'.
4	00:10	AUTO	Waiting for new target times' confirmation.
5	00:10	AOC	Assessment of the list of the aircrafts to perform the change.
6	00:10	AO	Assessment of the possible changes in Gates and Stands allocation.



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Id	Time	Role	Action
7	00:10	ATC	Assess impact on scheduling flights
8	00:20	AOC	There is an aircraft available (BW101) to perform aircraft change without changes in the flight. Warning to all players: Collaborative Decision Making on scheduling request
9	00:20	AOP	Assessment of the Gates of BW101 and BW201 and their allocation.
10	00:20	ATC	Assess the impact on subsequent flights of BW101 and BW201.
11	00:20	GH	There is a need to decide which team (BW101, BW201) will perform Turnaround.
12	00:20	GH	Impact of the scheduled plan.
13	00:30	AOC	Aircraft information BW101/BW201
14	00:30	AUTO	Warning service level 3' Aircraft change BW101/BW201' Service level 2' Aircraft change, new gate and stand'
15	00:30	AUTO	New calculated Target times pending to be confirmed.
16	00:30	GH	Assessment of rescheduled resources.
17	00:30	AOC	Re-adaptation of arrival sequence when BW101 arrives.

Table 7: Sequence of tasks for gaming session 3

The main findings for this scenario are addressed in the following section.

4.2.3.2 Main discussions/debriefing/communications assessment

The main discussion was focused on the knock-on effects of the delays in the planning phase.


In general the different players playing the different roles need to be aware of the following information:

- Airline needs to know the impact of the delay although it has its own system;
- Airport operator needs information about the new arrival and departure, the stand and the gate to be allocated. This information is currently (no A-CDM) not available for this actor;
- Ground handling needs to know the cause of the delay, the new stand times (for passenger and baggage) and the information about the passengers to be transferred;
- Air Traffic controller only needs information about updated and agreed times.

In this scenario two different delays happened; one short delay which could be accommodated by the turnaround without any delay in the departure flight, and one long-delay which implies a re-planning of the flight. Two possibilities were widely explored in terms of needs of information: flight cancellation and aircraft change.

Flight cancellation

The airport operator needs information about the gate and the stand and the baggage belt because they will be occupied for an additional period of time. Also the information about the passengers of the cancelled flight is needed, mainly for the passengers and baggage that will stay in the airport (this is an important security issue). The information about their re-assignment to

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other flights should be available. All this information about passengers should be in the Passenger Name List (PNL).

Ground handler needs the information about other flights to re-route the passengers and the baggage and passenger's information. To re-route the passenger two times must be taken into account:

- *Passengers transfer time* (this time will also be used by the airliner to decide whether the flight will wait for the passenger)
- *Baggage transfer time* (currently only average time available).

Aircraft change

The airline needs the flight crew availability, *the type of aircraft, the tail number and the flight number and the weather*. The decision to change the gates and the stands is also taken by the airline and not by the airport.

Ground handler needs the information about *tail number, new aircraft configuration, current and new stand*, the updated times and the *registration aircraft*.

4.2.4 General debriefing session

After the performance of all exercises related to the scenarios a general debriefing was done to address the open issues that had arisen during the gaming sessions: definition of passenger data and PNL, and review of the full list of TITAN information filling in the source of each piece of information (when needed) and defining which information is interesting for which role (organization unit).

Passenger data and PNL

The PNR (Passenger Name Record) provided by the airline does not contain enough data to support the turnaround. Moreover, the information of this list is confidential and some kind of processing is needed. Experts defined the needed information allocated to each passenger:

- Passenger ID (no complete name to avoid confidentiality problems, maybe some kind of unique identifier)
- Baggage ID associated to the passenger (a link to the baggage information could be a tool to link both data)
- Incoming flight (reference to flight number and possible link to its information)
- Incoming gate
- Origin
- Destination
- Transfer Time
- Nature: Business, VIP, etc.
- Status: Boarded, checked in, cancelled, rejected, etc. The type of status must be defined.
- Last seen at (crossing points)
- Contact information
- Time to board

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Review of TITAN information/Services

The full list of TITAN information was reviewed by the experts, assessing the following aspects:

- Understanding and wording of the information
- Source of the information
- Interest of each organization unit in this information. The interest of the roles was identified by unit organization instead of roles. These are airport operator (AOP), airline (AOC), air traffic controller (ATC), ground handler (GH).
- Additional comments regarding services of the piece of information

The complete review of the TITAN information is included in annex 6. The main findings are:

- Some new pieces of information were suggested by the actors, see Table 8.
- Some turnaround sub-processes can be provided by third parties (apart from GH, AOC, Airport or ANSP) who could also be customers of TITAN. Some examples are Ambulift service provider, RMP provider and de-icing providers. The added times (TSAT, EXIT, EXOT, etc) are useful to calculate other measures needed for TITAN concept. Those times are provided by A-CDM which is assumed to be implemented at the airport.
- It is assumed that the providers of the information (source column) are interested in the information they provide.
- AOP is interested mainly in the information related to gates and stands and the security processes and ANSP is interested in the information related to times, taxi-in, taxi-out, start-up and de-icing turnaround sub-processes. GH and airline are the users of the most of information available in TITAN.



5. ANALYSIS OF THE OUTCOMES

5.1 Analysis of de-briefing questionnaires

This section compiles the answers of the experts to the de-briefing questionnaires (4 completed forms).

Opinion about the usefulness and completeness of TITAN concept and TITAN information

All experts considered that the information provided by TITAN was useful for their daily work and it was sufficiently complete. Only some information was specifically named such as the information regarding the flights in connection and other more business-specific information about resources.

It was commented that the ground handler has currently most of the information that he/she needs (because it is provided by him/herself). The most relevant external information that he could obtain from TITAN is the exact time when an aircraft arrives and what happens when the aircraft leaves the stand.

The interface and presentation of the information in the TITAN web application could be improved so that the information can be easily found and managed.

Opinion about the TITAN services definition

All experts consider that information clustering into services supports the turnaround process and provides needed information to the stakeholders. No new service is required and no need for changes in the services was identified.

The assessment on TITAN services was that all services were useful. The best valued services are (ordered by usefulness, from most to less):

- ASRS: One of the experts (acting as ground handler) values this services with a 100% of usefulness
- PFIS and AIRS
- BFIS

Half of the experts found that the information clustered by turnaround sub-processes is useful.

All experts supported the approach of accessing TITAN information through the subscription to the TITAN services. The main advantage identified was that subscription reduces the overload of information but on the other side, some information could be missed depending on the scenario.

Opinion about the TITAN information levels

The information levels defined within TITAN were considered useful and no change or modification was suggested.

Strength of TITAN concept

The following strengths were identified:

- The concept of sharing information is consistent with CDM concept



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- All the information could be found in one integrated system (and not several non-interconnected systems)
- Knowing all the information in time allows anticipating of the problems to re-arrange the resources

Weakness of TITAN concept

The following weaknesses were identified:

- Visualization of the information is difficult because it is difficult to harmonize the information needed to support the decision making in each turnaround phase
- Provision of the information: There is some doubt about how some of the information listed in the TIS is going to be provided to the system. Some of this information is only visual information and it is currently not included in any system (for example “end of safety check”, done by the cabin crew before boarding or “cargo door open” seen by the ground handler but not reported to any system). However, those questions are out of the scope of the TITAN Concept of Operations.

Other comments/suggestions

The following suggestions were detailed in the de-briefing questionnaires:

- Make the sequencing of the turnaround process visible
- Make the status of the flights visible
- Take into account that passenger list and crew and fleet availability provided by airline is sensitive information
- Time stamp in chat window is recommended to improve the TITAN web application.

5.2 Assessment of TITAN information and TITAN services

This section provides the analysis of the full set of information compiled during the gaming sessions to reach the main objective of this gaming exercise: **Assessment on TITAN information usability.**

This objective is addressed assessing two important aspects of TITAN information:

- usefulness and completeness of the list of TITAN information (“stored” in TIS) to be shared during turnaround process;
- definition of the TITAN services and the information clustered within it.

5.2.1 Assessment on usability and completeness of TITAN information (TIS)

The main result is the consensus that for the validated scenarios the available TITAN information was sufficiently complete and useful to carry out the turnaround process.

Apart from this general result, a work of detailing the concept and the information to be integrated in the TIS (Titan Information Sharing) was done. The following types of results were obtained:



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Identification of new information to be integrated within TIS:

Table 8 shows the new information items to be integrated within TIS, as identified during the performance of the gaming exercise.

Information Item	Remark
<i>taxi-in instructions</i>	
<i>Confirmation of taxi-in instructions</i>	
<i>AXIT (Actual taxi-in time)</i>	
<i>Cross check</i>	To inform that cross check was already done
<i>Aircraft door opened</i>	
<i>Resources information</i>	Need of definition of the requested information about resources
<i>push back approved</i>	
<i>taxi-out instructions</i>	
<i>Confirmation of taxi-out instructions</i>	
<i>Gates Availability</i>	
<i>De-icing holdover time</i>	To know and calculate the take-off times or off-block times. Suggested by the ANSP
<i>Time to reach the gate</i>	To improve the predictability because this is different from taxi-in time
<i>Airline free text</i>	Information coming from the airline e.g. the quantity of catering.
<i>Total amount of fuel in the airport</i>	For security and also for provision issues.
<i>Airport policy</i>	To support the fuelling sub-process
<i>Information message to fireman</i>	To support the fuelling sub-process
<i>Airport safety level</i>	To support the fuelling sub-process
<i>Missing passenger</i>	To inform about this unexpected event which was not identified in the information levels during the preparation phase.
<i>Connected flights information</i>	
<i>Availability of airport resources</i>	These resources are security controls, passport controls.
<i>Engine problem</i>	There is no information to report this event, time to solve is an associated data important for this item.
<i>Passengers transfer time</i>	Associated with passengers in connection
<i>Baggage transfer time</i>	Associated with baggage in connection
<i>Tail number</i>	
<i>Passenger information (new definition of PNL list)</i>	See section 4.2.4 of this document
<i>Aircraft container out of service</i>	Important for GH and AOC. This information corresponds to a part of the aircraft
<i>Number of people boarded/non-boarded</i>	

Table 8: New TITAN information identified



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Most of this new information is related to the unexpected events arisen during the progress of a normal turnaround. Some of this information cannot be information level 0 but information corresponding to higher levels of information (1, 2 or 3). This is illustrated by the following two examples:

Example 1: "Lost passenger" event. It was not identified as any information level but in this case some pieces of information were identified as necessary to support this task.

Example 2: "Aircraft change". This item was already identified in the list of TITAN information. New information was identified to support the decision-making process for this abnormal situation (e.g. the information about the flights in connection), without classifying it to information levels.

It was concluded that the classification of the new information into different information levels could not be done yet. A first step could be to identify more information related to information levels 1, 2 and 3 and then, assess these abnormal situations and identify the information required to support the decision making processes arisen to solve this situation in the most efficient way and with the minimum impact on the turnaround processes and on the general air traffic flow.

Detailing of the information defined in the TIS:

The starting point of the gaming exercise was the definition of the information to be integrated within the TIS. This definition was done taking into account the information listed within TITAN concept definition document [2] and the information identified after the 2nd TITAN workshop [5] in which information levels were defined and their corresponding information identified.

Next, during the gaming preparation activities, new pieces of information were added, which were related to:

- the description of the scenarios given in the Exercise Plan [4];
- the CDM milestones;
- the times corresponding to CDM process or flight plan (e.g. CTOT, TOBT, ...)

During the performance of the games additional data for the list of TITAN information was obtained, can be classified as follows:

- Wording of the TITAN piece of information
- Meaning/Interpretation of the TITAN information
- Interest of the actors (AOP, AOC, ATC and GH) in this information
- Identification of the provider of the specific piece of information

The full list of TITAN information with the additional details previously mentioned is available in Annex 6, where changes with respect to the first list of information are highlighted in blue. In general, no major changes were identified but due to the discussions held about the meaning of some pieces of information, a description of each TITAN information item could be beneficial to avoid misunderstandings in their interpretation.

Detailing of the performance of turnaround sub-processes and tasks:

During the gaming sessions the flow of the tasks defined for the scenarios was assessed. Some clarifications about the performance of these specific tasks were obtained. The main findings are:



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- Taxi-in and taxi-out tasks are out of the turnaround process. However, experts agreed on the need to have some information related to these tasks to improve the predictability of times and then the predictability on the turnaround process.
- The list of TITAN information did not include information about resources as for example the resources of ground handler. It is needed to define whether this information is going to be available or integrated in the TIS or whether this information is too specific to be included and its availability is only needed by each role in its own tools. On the other hand, AOP has interest to have the information about their resources (stands, gates, check-in desks) available in TIS in order to have all the interested information accessible from one single application.
- Some unexpected events of the scenarios were not included in the list of TITAN information. These are “missing passenger” and “problems with the aircraft’s engine” which are related to the information levels 1, 2 and 3. A wider assessment on this kind of information must be done to complete the list of TITAN information.
- Fuelling sub-process was detailed in order to identify the information needed to perform the fuelling according to the different airport policies.
- The negotiation processes regarding the different decisions to be taken (changes in times, changes in stands and gates, etc.) are not agreed by all partners. The main players are the AOC and the GH. They take the decisions and the rest of the partners adapt to them.
- The request of a new slot when a flight re-planning must be done was detailed in 4.2.2.2. The main finding is that TOBT is changed and agreed between airline and ground handler and the request of a new slot is managed directly by the airline with CFMU. There could be an issue within this process if CTOT given to the airline is not according to the TOBT agreed previously. Then airline could change their initial decision and new requests and modifications will have to be done.
- The re-planning decision when an important delay happens was explained in 4.2.3.2. Two possible solutions are given: aircraft change or flight cancellation. To support this decision the players expected to find information of the impacted flights in the list of TITAN information but it was not available during the gaming sessions. It was not clear that Flight Plans information is going to be available within TIS. It is therefore important to clarify which information can be found in TIS and which not.

General considerations about TITAN information:

- It is important for the experts to find all information in one integrated system.
- It is crucial for the experts to find the real information with enough time in advance to address unexpected situations in the best way.
- The presentation of the information and the interface for subscription and access to the information is really important for the experts. Experts stated the difficulty to find some of the information presented in the web application. Most of the suggestions given for the web application can also be applied to the HMI to develop a tool which implements the TITAN concept. These comments are listed in section 5.3.2.
- There is some concern about how some information is going to be integrated in TITAN because it was not included in any system, it is manually obtained.



5.2.2 Assessment on TITAN services definition

The general idea of the experts is that for the validated scenarios the TITAN services provide sufficient information to support the turnaround process and no changes were suggested.

The CFMIS services were not assessed because no scenario takes into account the specific information provided by it.

This assessment is focused on two milestones of the services subscriptions:

- Preliminary subscriptions performed by the experts before the execution of the gaming exercise and;
- Review of TITAN information activity in which experts show their interest in each piece of information available in the gaming exercise.

Assessment on preliminary subscriptions:

Each expert performed its preliminary subscription to the TITAN services including:

- a minimum set of information for each service independent of the role;
- the information that the actor already provided to TIS

After this, the players could extend their subscription identifying the extra pieces of information needed for each TITAN service.

The preliminary subscription showed that all actors (AOC, ATC, GH and AOP) were subscribed to all services, but they were interested in different information within each service. Complete information about their preliminary subscription is available in Annex 5. The main findings from the preliminary subscriptions are:

- Airline (AOC) was subscribed to all pieces of information: Two experts send their subscriptions. One of them requested subscription to all pieces of information and the other one extended their subscription in BFIS and AIRS services with some extra pieces of information. Both outcomes were merged and the result was that the AOC subscription included all information available in TIS (full list of TITAN information).
- Airport operator (AOP) maintained its subscription also as the preliminary one. Two experts sent their subscriptions, one of them maintaining the preliminary subscription and the other one extended their subscription with some specific items (some milestones and boarding information) in AIRS and ASRS services.
- Ground handling (GH) extended the minimum subscription with extra data in all TITAN services.
- Air traffic controller (ATC) extended the minimum subscription with some extra pieces of information related to boarding and de-boarding process in PFIS and with some specific pieces of information as stand availability and the meteorological forecast in AIRS and ASRS.

Final review of TITAN information:

After the performance of the gaming sessions and during the final debriefing, one of the activities was to review the list of TITAN information to get the feedback about each item and their interest on it (by role). The complete review can be consulted in Annex 6

The tables below list the most valued information per role. After each table the most interesting services are analysed taking into account this information and the TITAN services which include



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this information (see columns CMFIS, BFIS, PFIS, AIRS and ASRS). Text in red colour identifies the differences between the preliminary list of TITAN information and the TITAN services definition.

AOP information analysis:

Check-in					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
		1	1		Check in time for each passenger including RMPs and UMs
			1		Close check in_M17
	1	1	1		Open check in
Security and Passport Control					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
		1	1		Queue waiting time at passport control
		1	1		Queue waiting time at security control
Deboarding					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
			1		Baggage belt allocated to each flight
1	1		1		End of baggage delivered at baggage belt (incoming baggage into the airport)
		1	1	1	End of deboarding_M20
Baggage Security Process					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
	1				Baggage checked in and its information
	1		1		Baggage crossing check points *
Baggage load					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
1	1		1		Last baggage delivered to baggage holding area_M21
Aircraft Services (catering, cleaning, water and electricity supply, ...)					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
			1	1	End of electrical power supply
			1	1	Start of electrical power supply
			1	1	Type of electrical supply procedure (APU or external power supply)
Fuelling					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
			1	1	End of fuelling
			1	1	Start of fuelling_M24
Boarding					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
		1	1	1	Ambulift located
		1	1	1	End of boarding
		1	1	1	Start of boarding_M11
De-icing					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
			1	1	End of de-icing_M26
			1	1	Sequence of de-icing
			1	1	Start of de-icing
			1	1	Type of de-icing
Start-up					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
				1	Aircraft ready_M12
				1	Push back clearance request
				1	Start-up approved_M14
General information					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
				1	Aircraft information (for each turnaround process)
		1		1	Aircraft touch down
			1	1	Apron/Stand check finished
			1		ATC issues TSAT_M10
		1			Availability of RMP facilities
	1	1	1		Declaration and liability release form
		1	1		Gate allocated to each flight
1	1	1	1	1	Landing_M6 (ALDT)
			1	1	Meteo forecast including De-icing



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		1			PNL (Passenger name list) including SSR (Special Service Request)
				1	STA (scheduled time of arrival)
			1	1	Stand allocated
			1	1	Stand availability
				1	STD (scheduled time of departure)
1	1	1	1	1	Take off M16 (ATOT)

Table 9: AOP valuable information

The analysis of the TITAN services for AOP showed that:

- The most important service for AOP is the AIRS service. He/she is interested in 31 items of information.
- The next service in importance is the ASRS service. Although most of the information in ASRS is already included in AIRS, some specific items related to start-up and push-back sub-tasks and concrete information such as STD and STA times and the aircraft information are valuable information for this actor.
- The BFIS and PFIS services only include one piece of information which is not included in the AIRS and ASRS services: Baggage information for BFIS and PNL for PFIS.

ATC information analysis:

Check-in					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
		1	1		Check in time for each passenger including RMPs and UMs
Baggage load					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
1					Air waybill
Fuelling					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
			1	1	Fuel
De-icing					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
			1	1	End of de-icing_M26
			1	1	Sequence of de-icing
			1	1	Start of de-icing
			1	1	Type of de-icing
Start-up					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
				1	Aircraft ready_M12
				1	Push back clearance request
				1	Push back connection
			1	1	Remove push back_M25
				1	Start-up approved_M14
				1	Start-up clearance request_M13
General information					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
		1		1	Aircraft information (for each turnaround process)
			1	1	Aircraft touch down
			1		Apron/Stand check finished
			1		ATC issues TSAT_M10
			1	1	CTOT allocation_M2
		1	1		FIR entry/Local Air Traffic Control_M4
			1	1	FP Activation_M1
1	1	1	1	1	Landing_M6 (ALDT)
			1	1	Meteo forecast including De-icing
				1	STA (scheduled time of arrival)
			1	1	Stand allocated
				1	STD (scheduled time of departure)
1	1	1	1	1	Take off_M16 (ATOT)

Table 10: ATC valuable information



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The analysis of the TITAN services for ATC showed that:

- The most important service for ATC is the ASRS service. He/she is interested in 22 items of information.
- The next service in importance could be the AIRS service especially in some specific items as M10 milestone (ATC issues TSAST_M10), the M4 milestone (FIR entry/Local Air Traffic Control_M4) and the check-in time for each passenger.
- BFIS and PFIS services do not have any specific information for ATC which was not already included in ASRS and AIRS.

GH information analysis:

Check-in					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
		1	1		Check in time for each passenger including RMPs and Ums
			1		Close check in_M17
	1	1	1		Open check in
Security and Passport Control					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
		1	1		Average time between passport control and gates
		1	1		Average time between security control and gates
		1	1		Last passenger crossing passport control_M19
		1	1		Last passenger crossing security control_M18
		1	1		Queue waiting time at passport control
		1	1		Queue waiting time at security control
		1	1		Specific passenger crossing passport control
		1	1		Specific passenger crossing security control
Deboarding					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
	1		1		Baggage belt allocated to each flight
1	1		1		End of baggage delivered at baggage belt (incoming baggage into the airport)
		1	1	1	End of deboarding_M20
			1	1	Stairs or bridge located (connected to the aircraft)
		1	1	1	Start deboarding
Baggage Security Process					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
	1				Baggage checked in and its information
	1		1		Baggage crossing check points *
Baggage unload					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
1	1			1	End of baggage unloading_M22
1	1			1	Open cargo doors
1	1			1	Start of baggage unloading
Baggage load					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
1					Air waybill
1	1			1	Close cargo doors_M23
1	1			1	End of load baggage/cargo
1	1		1		Last baggage delivered to baggage holding area_M21
1	1		1		Loading instruction
1	1			1	Start of baggage loading activity
Aircraft Services (catering, cleaning, water and electricity supply, ...)					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
				1	End of catering
				1	Start of catering
				1	End of cleaning - Cleaning agent is out of the aircraft
				1	Start of cleaning
			1	1	End of electrical power supply
			1	1	Location of GSE (Ground Service Equipment)
			1	1	Start of electrical power supply



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			1	1	Type of electrical supply procedure (APU or external power supply)
Fuelling					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
			1	1	End of fuelling
			1	1	Fuel
			1	1	Start of fuelling_M24
Boarding					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
		1	1	1	End of boarding
		1	1		Last passenger at gate
Maintenance					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
				1	End of passenger cabin security check
De-icing					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
			1	1	End of de-icing_M26
			1	1	Start of de-icing
			1	1	Type of de-icing
Start-up					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
				1	Aircraft ready_M12
				1	Push back clearance request
				1	Push back connection
			1	1	Remove push back_M25
				1	Start-up approved_M14
General information					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
			1	1	Aircraft configuration (planning and operations issues)
				1	Aircraft information (for each turnaround process)
		1		1	Aircraft touch down
			1	1	Apron/Stand check finished
			1		ATC issues TSAT_M10
			1	1	CTOT allocation_M2
	1	1	1		Declaration and liability release form
		1	1		Gate allocated to each flight
			1	1	Ground handling starts_M8
1	1	1	1	1	Landing_M6 (ALDT)
			1	1	Meteo forecast including De-icing
		1			PNL (Passenger name list) including SSR (Special Service Request)
				1	STA (scheduled time of arrival)
			1	1	Stand allocated
			1	1	Stand availability
				1	STD (scheduled time of departure)
1	1	1	1	1	Take off_M16 (ATOT)
				1	TTTT (Target Turnaround Time)

Table 11: GH valuable information

The analysis of the TITAN services for the GH showed that:

- The most important services for the GH are ASRS and AIRS, covering most of the information needs.
- The PFIS and BFIS services only contain one important information item that is not already included in ASRS and AIRS: the PNL list (for PFIS) and Baggage information (for BFIS).

AOC information analysis:

Check-in					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
		1	1		Check in time for each passenger including RMPs and UMs
Security and Passport Control					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
		1	1		Last passenger crossing passport control_M19



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		1	1		Last passenger crossing security control_M18
		1	1		Specific passenger crossing passport control
		1	1		Specific passenger crossing security control
Deboarding					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
		1	1	1	End of deboarding_M20
Baggage load					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
1					Air waybill
1	1			1	Close cargo doors_M23
1	1			1	End of load baggage/cargo
Aircraft Services (catering, cleaning, water and electricity supply, ...)					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
			1	1	End of electrical power supply
			1	1	Start of electrical power supply
			1	1	Type of electrical supply procedure (APU or external power supply)
Fuelling					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
			1	1	End of fuelling
			1	1	Fuel
			1	1	Start of fuelling_M24
Boarding					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
		1	1	1	End of boarding
Maintenance					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
				1	End of passenger cabin security check
				1	External visual review
De-icing					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
			1	1	End of de-icing_M26
			1	1	Start of de-icing
			1	1	Type of de-icing
Start-up					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
				1	Aircraft ready_M12
				1	Push back clearance request
				1	Push back connection
			1	1	Remove push back_M25
				1	Start-up approved_M14
General information					
CMFIS	BFIS	PFIS	AIRS	ASRS	Information level 0
				1	Aircraft information (for each turnaround process)
		1		1	Aircraft touch down
			1		ATC issues TSAT_M10
			1	1	CTOT allocation_M2
	1	1	1		Declaration and liability release form
		1	1		Gate allocated to each flight
			1	1	Ground handling starts_M8
1	1	1	1	1	Landing_M6 (ALDT)
			1	1	Meteo forecast including De-icing
		1			PNL (Passenger name list) including SSR (Special Service Request)
				1	STA (scheduled time of arrival)
			1	1	Stand allocated
				1	STD (scheduled time of departure)
1	1	1	1	1	Take off_M16 (ATOT)
				1	TTTT (Target Turnaround Time)

Table 12: AOC valuable information

The analysis of the TITAN services for the AOC showed that:



- The most important services for the AOC are ASRS and AIRS, covering most of the information needs.
- PFIS has only one important information item which is not already included in ASRS and AIRS: the PNL list. No specific information related only to BFIS services has been identified.

5.3 Additional feedback

The results described in this section are related to the Gaming technique and web application, rather than to the assessment of the TITAN concept. However, some comments on the TITAN web application could be applicable to the HMI of a TITAN tool or any tool to implement the TITAN concept.

5.3.1 Feedback on gaming technique

This section includes the outcomes collected from the questionnaire about the gaming technique performed at the start of the gaming sessions by the experts who participated in. The questionnaire is attached in Annex 3.

- Most of the experts consider that gaming technique is usable for concept validation. The mean value is 6.67 (on a scale of 1 to 10). All experts except one assessed above 5 the usability of this technique.
- 67% of the experts did not have previous experience with gaming technique. The rest of the partners (3/9) have experience in the following areas:
 - Auctions for energy prices
 - Within ATM, in EATRADA and manufacturing improving
 - Training sessions for ATC concept development.
- The confidence on the results obtained with the gaming technique was around 68%, which is considered high.

5.3.2 Feedback on TITAN web application

The TITAN web application was developed to simulate the information sharing between the actors who participate in turnaround process and did not represent the HMI of a (future) tool that could support the TITAN concept. This difference appeared to be difficult to distinguish and therefore many comments were done to improve or assess the HMI of the TITAN web application.

The following list shows the main comments about the HMI. It should be noted that this list only highlights the importance that experts give to a good representation of the information to get a right and usable access. Be that as it may, some of them could be taken into account for HMI TITAN tool design:

- A visual representation of the sequencing of the turnaround process and the status of the flights is recommended;
- Interface is not very flexible and some improvements must be done: visualization and access to the information seem very difficult to define and they are critical in order to reach the objective of TITAN. Too much information in one screen could make the identification of the needed information difficult and too less information (too much clustering) could lead to



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an increase in required navigation (too many clicks to find the information) and consequently to a decrease in efficiency with respect to the access to the information.

- A time stamp should be included in the chat window.
- The current time should be available in the TITAN web tool application
- Automatic refresh should be available in the web application.



6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The main conclusions of the gaming exercise are the following:

- List of TITAN gaming information (information level 0) is sufficiently complete to support the turnaround processes. Some slight modifications were done concerning the wording and the providers of this information.
- The additional information identified during the gaming sessions refers mostly to unexpected events and the information levels 1, 2 and 3.
- The current definition and the number of information levels are accepted by experts.
- The definition of TITAN services is considered useful and complete. However depending on the actors who performed the subscriptions some modifications were done. In general, the most valuable services are AIRS and ASRS which contain most of the TITAN information. PFIS and BFIS contain two information items crucial for the turnaround process, PNL and Baggage Information. This is because same data are included in different services (most of them in AIRS and ASRS), so the subscription to other services as PFIS and BFIS, with less information items, was not required.
- There are some activities (like de-icing, ambulift, and RMP) which might be provided by external companies which could therefore also be TIS users.

6.2 Recommendations

The main recommendations compiled from the results of the gaming exercise are the following:

- The TITAN information should meet the applicable standards, like for example the information contained in the NOP.
- The completeness of TITAN information could be improved by assessing more unexpected or abnormal situations. Based on this, the information levels 1, 2 and 3 should be further completed.
- Presentation of the information levels must be carefully designed to facilitate the identification of problems or unexpected events and plan the solutions with enough time in advance. The main aspects to be addressed are:
 - Definition of the information levels: Too much information could jeopardize the identification of the more important problems.
 - Information classification (information levels, roles and TITAN services: The current definition of the data items related information levels 1, 2 and 3 is linked to each information level 0 data. However the scenarios proposed to execute the gaming sessions assigned different information levels and different data depending on the TITAN service and the role. Clarification of these different approaches to identify and define the TITAN information levels is recommended. Furthermore, the general process to identify the information levels should be further explored. For example, the information level 1, 2 and 3 data can be defined in a more general way, unlinked to the information level 0 data: Malfunctioning of any resource (physical resource) can be a data related to information level 1, 2 or 3 and it will contain different fields depending on the level of information (type of resource, type of problem/fail,



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expected time to solve the malfunctioning, etc.). This information level 1 data can be linked to different data of information level 0 (“Availability of stand”, “End_of_deicing”).

- It must be evaluated how to present the information most clearly and efficiently.
- CDM times and milestones and ICAO times (included in the FPs) is valuable information which should be included in the TIS.



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