

SESAR 2020 Solution 28.1 SPR-INTEROP/OSED for V3 - Part IV - Human Performance Assessment Report

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Authoring & Approval

Authors of the document

Beneficiary	Date
EUROCONTROL	30/08/22

Reviewers internal to the project

Beneficiary	Date
Swedavia (SEAC2020)	
LFV	
INDRA	

Reviewers external to the project

Beneficiary	Date
PJ19 partners	

Approved for submission to the S3JU By - Representatives of all beneficiaries involved in the project

Beneficiary	Date
EUROCONTROL	30/08/22
INDRA	Silent Approval
LFV	Silent Approval
AT-One	Silent Approval
B4 Consortium	Silent Approval
Coopans	Silent Approval
Enaire	Silent Approval
Leonardo	Silent Approval
SINTEF	Silent Approval
SEAC/MUC	Silent Approval
SEAC/ADP	Silent Approval
SEAC/AMS	Silent Approval
SEAC/ZRH	Silent Approval
SEAC/AVINOR	Silent Approval
SEAC/SWE	Silent Approval

THALES

Silent Approval

Rejected By - Representatives of beneficiaries involved in the project

Beneficiary	Date
None	

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PJ.04-W2 TAM

CONNECTED REGIONAL AIRPORTS

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Abstract

This document analyses how the PJ.04-W2-28.1 'Connected Regional Airports' project impacts human performance of the Ground Handlers, Airport Operator, and Air Traffic Controllers. The assessment followed the SESAR HPA four-step process. The validation method chosen was the shadow mode trial that took place in Göteborg Landvetter Airport environment. A total of 44 HP issues/benefits were identified, out of which 13 remained open to be further assessed in future activities. The 28.1 solution was found to support users HP and improve their job satisfaction, with the primary impact on the Ground Handler. As the outcome of the assessment 10 HP recommendations and 2 HP requirements were formulated.

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1 Executive Summary

This document contains the Human Performance (HP) Assessment Report (HPAR) for the Solution PJ.04-W2-28.1 'Connected Regional Airports'. It consists of the description of the Human Performance assessment process that was applied to identify applicable HP issues and benefits and derive HP recommendations and requirements.

To support the HP assessment, five activities were proposed in order to clarify the full set of identified HP issues; however, due to staffing constraints as a result of the COVID-19 pandemic, two activities could not take place. Nevertheless, the full set of HP issues, benefits and impacts was assessed through a shadow mode validation.

A total of 44 potential HP issues and benefits were identified in the Human Performance Assessment Plan (HPAP). 13 of these items could not be fully assessed and remain with an 'Open' status, with a recommendation to be assessed prior to the deployment phase of the solution. These findings should not prevent the solution from reaching V3 maturity.

A total of 10 HP recommendations and 2 HP requirements have been formulated and should be taken into account in the future development and validation of this concept.

Based on the findings of the HP activities, solution PJ.04-W2-28.1 has been deemed mature to progress to the next V-phase from a HP perspective.

2 Introduction

2.1 Purpose of the document

The purpose of this document is to describe the result of the activities conducted according to the Human Performance (HP) assessment process [1] to derive the HP assessment report for Solution 28.1 'Connected Regional Airports' including HP requirements and recommendations.

2.2 Intended readership

The intended audience of this document are those who are interested in how the partners involved in SESAR Solution PJ.04-W2-28.1 have defined the operational concept and developed the associated validation exercise. The Solution 28.1 is also closely linked to the PJ04 Solution 28.2 whose focus is on the development of simplified and cost-effective solutions for airport operations management in the context of regional airports. The connectivity elements defined by Solution 28.1 can therefore be complemented by the tools and processes developed within Solution 28.2 and therefore 28.2 partners should find relevant support material within this document.

Additionally, the project members of all of the PJ.04-W2 solutions should find useful reference material within this document with regards to Human Performance transversal area.

2.3 Structure of the document

The PJ.04-W2-28.1 OSED consists of five parts:

- Part I, providing the Safety and Performance Requirements (SPR) and Interoperability Requirements (INTEROP), that have been developed and validated during the validation activities to a V2 maturity level. They are presented in the context of the Operational Service and Environment Definition (OSED) which describes the environment, assumptions and other issues that are applicable to the SPR and INTEROP requirements.
- Part II: The Safety Assessment Report which describes the results of the safety assessment work that justify the associated SPR and INTEROP requirements in the Part I.
- Part III: The Environmental Assessment Report which describes the results of the environmental assessment work that justify the associated SPR and INTEROP requirements in the Part I.
- Part IV: The Human Performance Assessment Report (this part) describes the results of the Human Performance Assessment Report which describes the results of the Human Performance assessment work that justify the associated SPR and INTEROP requirements in the Part I.
- Part V: The Performance Assessment Report that consolidates the performance results obtained across the different validation activities at the solutions level.

Part IV of the SESAR Solution PJ.04-W2-28.1 OSED consists of four main sections:

- Section 1: Executive Summary of the brief description of the solution and the associated HP implications;
- Section 2: Introduction covering the purpose of the document, the intended readership, the glossary of terms and the list of acronyms;
- Section 3: The objectives and approach of the SESAR Human Performance Assessment process, providing an understanding of the methodology and each of the steps involved;
- Section 4: The description of the Human Performance Assessment, the scenarios, assumptions, understanding of the ATM concept and its implication on HP.

2.4 Acronyms and Terminology

Term	Description
Human Factors (HF)	HF is used to denote aspects that influence a human's capability to accomplish tasks and meet job requirements. These can be external to the human (e.g. light & noise conditions at the work place) or internal (e.g. fatigue). In this way, "Human Factors" can be considered as <i>focussing on the variables that determine Human Performance</i> .
Human Performance (HP)	HP is used to denote the human capability to successfully accomplish tasks and meet job requirements. In this way, "Human Performance" can be considered as <i>focussing on the observable result of human activity in a work context</i> . Human Performance is a function of Human Factors (see above). It also depends on aspects related to Recruitment, Training, Competence, and Staffing (RTCS) as well as Social Factors and Change Management.
HP activity	An HP activity is an evidence-gathering activity carried out as part of Step 3 of the HP assessment process. An HP activity can relate to, among others, task analyses, cognitive walkthroughs, and experimental studies.
HP argument	An HP argument is an HP claim that needs to be proven through the HP Assessment Process.
HP assessment	An HP assessment is the documented result of applying the HP assessment process to the SESAR Solution-level. HP assessments provide the input for the HP case.
HP assessment process	The HP assessment process is the process by which HP aspects related to the proposed changes in SESAR are identified and addressed. The development of this process constitutes the scope of Project 16.04.01. It covers the conduct of HP assessments on the Solution-level as well as the HP case building over larger clusters of Solutions.
HP benefit	An HP benefit relates to those aspects of the proposed ATM concept that are likely to have a positive impact on human performance.
HP case	An HP case is the documented result of combining HP assessments from Solutions into larger clusters (SESAR Projects, deployment packages) in SESAR.
HP issue	An HP issue relates to those aspects in the ATM concept that need to be resolved before the proposed change can deliver the intended positive effects on Human Performance.
HP impact	An HP impact relates to the effect of the proposed solution on the human operator. Impacts can be positive (i.e. leading to an increase in Human Performance) or negative (leading to a decrease in Human Performance).
HP recommendations	HP recommendations propose means for mitigating HP issues related to a specific operational or technical change. HF recommendations are proposals that

	require additional analysis (i.e. refinement and validation). Once this additional analysis is performed, HF recommendations may be transformed into HF requirements.
HP requirements	HP requirements are statements that specify required characteristics of a solution from an HF point of view. HP requirements should be integrated into the DOD, OSED, SPR, or specifications. HF requirements can be seen as the stable result of the HF contribution to the Solution, leading to a redefinition of the operational concept or the specification of the technical solution.

Table 1: Acronyms and terminology

3 The Human Performance Assessment Process: Objective and Approach

The purpose of the HP assessment process described in detail in Human Performance Guidance document [1] is to ensure that HP aspects related to SESAR Solution technical and operational developments are systematically identified and managed.

The SESAR HP assessment process uses an ‘argument’ and ‘evidence’ approach. An HP argument is an ‘HP claim that needs to be proven’. The aim of the HP assessment is to provide the necessary ‘evidence’ to show that the HP arguments impacted have been considered and satisfied by the HP assessment process. This includes the identification of HP requirements and recommendations to support the design and development of the concept, which will be defined in the HP Assessment Report (HPAR).

The HP assessment process is a four-step process. Human Performance Guidance [1] provides an overview of these four steps with the tasks to be carried out and the two main outputs (i.e. HPAP and HPAR). Please note that a HP log is not to be developed in support of this solution, given the low complexity of the assessment required. As such, please disregard references to ‘HP Log’ in the figure below:

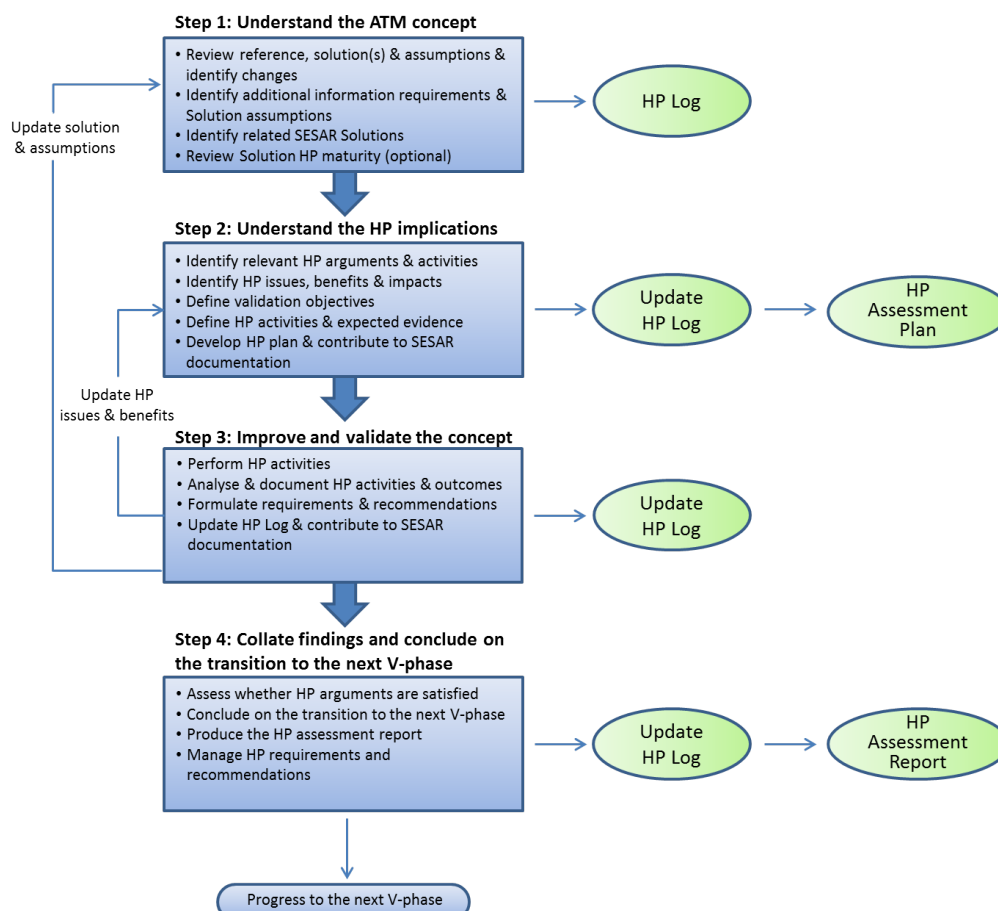


Figure 1: Steps of the HP assessment process

4 Human Performance Assessment

4.1 Step 1 Understand the ATM concept

4.1.1 Description of reference scenario

The reference scenario reflects the current state of operations in Göteborg Landvetter Airport (GOT) with departure estimates based on flight plan data with modifications through DLA or CHG messages. No TOBT values are shared between the airport partners and no DPI message transmission with NM takes place. For more details, consult the VALR Part I [2].

4.1.2 Description of solution scenario

In the Solution Scenario, target take-off times are calculated by the validation platform, based on arrival estimates and aircraft-airline known behaviour at Göteborg Landvetter Airport and shared with the NM through the Departure Planning Information (DPI) messages. For more details, consult the VALR Part I [2].

4.1.3 Consolidated list of assumptions

The consolidated list of assumptions can be found in PJ.04-W2-28.1 Validation Report - Part I [2].

4.1.4 List of related SESAR Solutions to be considered in the HP assessment

The related SESAR Solutions to PJ.04-W2-28.1 are the other solutions under PJ.04-W2.

4.1.5 Identification of the nature of the change

Table 2 summarises the assessment of change from the current mode of operations at GOT Airport to solution scenario, where DPI messages are provided based on target times, by HP argument branch. The change assessment was focused on the following actor groups:

- Airport Operator (AO);
- Ground Handler (GH); and
- Apron/Tower Controller (ATC).

HP argument branch	Change & affected actors
1. ROLES & RESPONSIBILITIES	
1.1 ROLES & RESPONSIBILITIES	GH: The introduction of the RNI concept will lead to changes in the responsibilities of the Ground Handler. GH will no longer be responsible for manual inputs concerning the maintenance of the block time but will be responsible for crosschecking the information

	provided by the system and making corrections, if necessary.
1.2. OPERATING METHODS	AO: No change in operating methods was identified. GH: The new operating methods will allow the implementation of a new and reduced set of Turnaround milestones to be monitored, concentrating on those which are 'event-driven' rather than 'time-driven'. The milestones are expected to be provided in a quasi-automatic manner. A set of DPI messages is planned to be sent to NMOC, simultaneously respecting the quality criteria inherent in the full A-CDM implementation. The key milestones for each flight will be available to each of the airport CDM partners. The new procedures associated with the receipt of TOBT information for the GH and the way in which they will crosscheck this information and update it (if needed) in the system, have to be defined and evaluated in validation activities for normal, abnormal, and degraded modes of operations. ATC: No change in the operating methods of ATC is foreseen, as the information provided (e.g. TSAT, TOBT) represents only guidance for the ATC. However, specifically for the de-icing procedures, it is expected that the amount of coordination with GH will be reduced and the procedure will be simpler to apply.
1.3 TASKS	GH: The Ground Handlers' tasks will change, as the maintenance of the block time in A-CDM will be now done by the system. This will result in task change from manual input to a monitoring task. In the event of any abnormalities, the GH will be expected to make manual corrections. The workload and situation awareness of the GH are expected to be acceptable with the introduction of the automated TOBT information. It is expected that GH workload will be positively impacted due to provision of a better overview on the situation regarding potential delays (process on turn-around, loading/boarding-de-boarding etc).
2. HUMAN & SYSTEM	

2.1 ALLOCATION OF TASKS (HUMAN & SYSTEM)	GH: The Ground Handler currently introduces information manually, which in the solution scenario will be done automatically by the system; however, the possibility of manual input will remain. In the event of a disruption, such as an aircraft technical problem or passenger-related delays, the system may not have the most accurate TOBT. In such situations, the GH is expected to correct information manually. It needs to be assured that the GH's level of confidence in those automated functionalities is neither too high or too low, to prevent from mistrust (false distrust) or overtrust in the system. In the event of unavailability of automated TOBT updates, the awareness of GH of such situations needs to be assured. AO: The departure planning information (e.g. ELDT, TSAT, TOBT) in the system will be automatically updated, therefore the AOs' understanding of this automated functionality has to be reassured.
2.2 PERFORMANCE OF TECHNICAL SYSTEM	GH: The information provided by the system to the GH is expected to be timely for carrying out tasks. However, it shall be assessed whether the Ground Handler is able to easily crosscheck the accuracy of information provided by the system. AO: The Airport Operator will be provided with more accurate departure planning information (e.g. ELDT, TSAT, TOBT), which may impact the allocation of resources and task coordination. Enhanced situation awareness is expected. ATC: Due to provision of the TOBT by the system, the accuracy and timeliness of TTOT prediction is expected to be improved. NMOC: The NM is expected to receive more accurate information due to the provision of DPI messages. All information provided by the technical system should be accurate enough to support task performance. As the impacts on NMOC were assessed in Wave 1, no HP risks are foreseen.
2.3 HUMAN – MACHINE INTERFACE	GH: The GH's HMI interface will include a linked set of arrival and departure flights (one arrival and one departure per line) with columns giving the key timestamps. A new functionality to edit the TOBT will

	be provided. A novel alert (colour coded) will be introduced and will concern the estimation of the time at which an aircraft will be ready for departure. If the system estimates a different boarding time than expected, it issues an alert and automatically updates the TOBT. The GH/ AO will be able to override the information. These changes to the HMI are expected to support GH's situation awareness.
3. TEAMS & COMMUNICATION	
3.1 TEAM COMPOSITION	No changes were identified.
3.2 ALLOCATION OF TASKS	No changes were identified.
3.3 COMMUNICATION	The RNI concept is expected not to have an impact on the communication between human actors due to reduced set of A-CDM milestones being implemented.
4. HP RELATED TRANSITION FACTORS	
4.1 ACCEPTANCE & JOB SATISFACTION	GH: To evaluate the acceptability of novel responsibilities and associated procedures for the Ground Handler.
4.2 COMPETENCE REQUIREMENTS	No changes were identified.
4.3 STAFFING REQUIREMENTS & STAFFING LEVELS	No changes were identified.
4.4. RECRUITMENT AND SELECTION	No changes were identified.
4.5. TRAINING NEEDS	GH: Changes are expected to be minimal and in regard to the Ground Handler's interaction with the new information (crosschecking of data), therefore no specific training needs are foreseen.

Table 2: Description of the change

4.2 Step 2 Understand the HP implications

4.2.1 Identification of relevant arguments, HP issues & benefits and HP activities

The relevant arguments, identified HP issues and benefits, and the corresponding HP activities have been detailed in the HPAP (Part IV of the VALP) [4]. Five HP activities were proposed in order to clarify the full set of identified HP issues; however, due to staffing constraints as a result of the COVID-19 pandemic, the following activities could not take place:

- Activity 1: End users' workshop; and

- Activity 3: Remote testing session.

Nevertheless, the full set of HP issues, benefits and impacts was assessed through a Human-in-the-loop validation exercise in the form of a shadow mode trial. The remaining activities were conducted according to the HPAP [4].

4.3 Step 3 Improve and validate the concept

4.3.1 Description of HP activities conducted

This section details the HP activities conducted to support this solution, as set out in the HPAP [4]. These HP activities were selected on the basis of the relevant arguments and HP issues and benefits that were identified in Table 2. The details of these activities are presented in the tables below.

Please note that the Activities 1 (End users' workshop) and 3 (Remote testing session) were cancelled and the numbering of the activities is in line with the HPAP [4].

Activity 2. Documentation and relevant literature review	
Description	Please refer to HPAP [4].
Arguments & related issues addressed	2.2.1; 2.3.3; 2.3.4.
HP objectives	OBJ-28.1-V3-HP2.1.1 OBJ-28.1-V3-HP2.3.3 OBJ-28.1-V3-HP2.3.4.1
Tools / Methods selected out of the HP repository	SESAR 1 WPJ16.05.01 Guidance material for HP automation support.
Summary of the HP activity	For this solution validation, the tool was not fully integrated in the working positions of the end users. This activity is therefore proposed to be undertaken prior to local implementation. The HP Expert was provided with the presentation explaining the HMI for the human actors impacted by the solution. The potential HP issues and benefits identified in this activity were taken forward to the shadow mode to be assessed with the users.

Table 3: Description of Activity 2

ACTIVITY 4. HUMAN-IN-THE-LOOP VALIDATION EXERCISE	
Description	A 3-day shadow mode trial was conducted where the HP issues, benefits and impacts were successfully assessed. For more detail, please refer to the VALR [2].

Related Arguments	1.1.2; 1.1.3; 1.2.4; 1.3.1; 1.3.3; 1.3.4; 1.3.5; 2.1.1; 2.1.2; 2.1.3; 2.1.4; 2.1.5; 2.1.6; 2.2.1; 2.2.2; 2.3.1; 2.3.3; 2.3.4; 2.3.6; 2.3.8; 2.3.9; 4.1.1; 4.5.1.
HP objectives	OBJ-28.1-V3-HP1.1.2 OBJ-28.1-V3-HP1.1.3 OBJ-28.1-V3-HP1.2.4.1 OBJ-28.1-V3-HP1.2.4.2 OBJ-28.1-V3-HP1.2.4.4 OBJ-28.1-V3-HP1.3.1 OBJ-28.1-V3-HP1.3.2.1 OBJ-28.1-V3-HP1.3.2.2 OBJ-28.1-V3-HP1.3.3 OBJ-28.1-V3-HP1.3.4.1 OBJ-28.1-V3-HP1.3.4.2 OBJ-28.1-V3-HP1.3.4.3 OBJ-28.1-V3-HP1.3.4.5 OBJ-28.1-V3-HP1.3.5.1 OBJ-28.1-V3-HP1.3.5.2 OBJ-28.1-V3-HP1.3.5.3 OBJ-28.1-V3-HP1.3.5.4 OBJ-28.1-V3-HP2.1.1 OBJ-28.1-V3-HP2.1.2 OBJ-28.1-V3-HP2.1.3.1 OBJ-28.1-V3-HP2.1.3.2 OBJ-28.1-V3-HP2.1.3.3 OBJ-28.1-V3-HP2.1.4 OBJ-28.1-V3-HP2.1.5.1 OBJ-28.1-V3-HP2.1.5.2 OBJ-28.1-V3-HP2.1.6.1 OBJ-28.1-V3-HP2.1.6.2 OBJ-28.1-V3-HP2.1.6.3 OBJ-28.1-V3-HP2.2.1.1 OBJ-28.1-V3-HP2.2.1.2 OBJ-28.1-V3-HP2.2.2.1 OBJ-28.1-V3-HP2.2.2.2 OBJ-28.1-V3-HP2.3.1 OBJ-28.1-V3-HP2.3.3 OBJ-28.1-V3-HP2.3.4.1 OBJ-28.1-V3-HP2.3.4.2 OBJ-28.1-V3-HP2.3.6 OBJ-28.1-V3-HP2.3.9 OBJ-28.1-V3-HP4.1.1 OBJ-28.1-V3-HP4.1.5
Tools/Methods selected out of the HP repository	Observations, questionnaires, debriefs

Summary of the HP activity	In the shadow mode trial, the following user group representatives participated: 1 Ground Handler, 1 Air Traffic Controller, and 1 Airport Operator representative. Due to staffing constraints as a result of COVID-19 pandemic, the participation of the AO was limited to 1 day. Prior to the shadow mode trial, the participants were briefed on the HP aspects and the questionnaires along with the assessment methodology were explained. Each day the participants were asked to fill in a post-exercise questionnaire and end-of-day debriefing sessions (please see VALR [2] for a detailed description).
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Table 4: Description of Activity 4

ACTIVITY 5. HP RESULTS AND REQUIREMENTS CONSOLIDATION WORKSHOP	
Description	Please refer to HPAP [4].
Related Arguments	1.1.2; 1.1.3; 1.2.4; 1.3.1; 1.3.3; 1.3.4; 1.3.5; 2.1.1; 2.1.2; 2.1.3; 2.1.4; 2.1.5; 2.1.6; 2.2.1; 2.2.2; 2.3.1; 2.3.3; 2.3.4; 2.3.6; 2.3.8; 2.3.9; 4.1.1; 4.5.1.
HP objectives	OBJ-28.1-V3-HP1.1.2 OBJ-28.1-V3-HP1.1.3 OBJ-28.1-V3-HP1.2.4.1 OBJ-28.1-V3-HP1.2.4.2 OBJ-28.1-V3-HP1.2.4.4 OBJ-28.1-V3-HP1.3.1 OBJ-28.1-V3-HP1.3.2.1 OBJ-28.1-V3-HP1.3.2.2 OBJ-28.1-V3-HP1.3.3 OBJ-28.1-V3-HP1.3.4.1 OBJ-28.1-V3-HP1.3.4.2 OBJ-28.1-V3-HP1.3.4.3 OBJ-28.1-V3-HP1.3.4.5 OBJ-28.1-V3-HP1.3.5.1 OBJ-28.1-V3-HP1.3.5.2 OBJ-28.1-V3-HP1.3.5.3 OBJ-28.1-V3-HP1.3.5.4 OBJ-28.1-V3-HP2.1.1 OBJ-28.1-V3-HP2.1.2 OBJ-28.1-V3-HP2.1.3.1 OBJ-28.1-V3-HP2.1.3.2 OBJ-28.1-V3-HP2.1.3.3 OBJ-28.1-V3-HP2.1.4 OBJ-28.1-V3-HP2.1.5.1 OBJ-28.1-V3-HP2.1.5.2 OBJ-28.1-V3-HP2.1.6.1

	OBJ-28.1-V3-HP2.1.6.2 OBJ-28.1-V3-HP2.1.6.3 OBJ-28.1-V3-HP2.2.1.1 OBJ-28.1-V3-HP2.2.1.2 OBJ-28.1-V3-HP2.2.2.1 OBJ-28.1-V3-HP2.2.2.2 OBJ-28.1-V3-HP2.3.1 OBJ-28.1-V3-HP2.3.3 OBJ-28.1-V3-HP2.3.4.1 OBJ-28.1-V3-HP2.3.4.2 OBJ-28.1-V3-HP2.3.6 OBJ-28.1-V3-HP2.3.9 OBJ-28.1-V3-HP4.1.1 OBJ-28.1-V3-HP4.1.5
Tools/Methods selected out of the HP repository	Focus group
Summary of the HP activity	Analysis and consolidation of the HP evidence obtained in the exercises to feed into the status of the HP validation objectives and associated Success criteria; identification of HP requirements.

Table 5: Description of Activity 5

4.4 Step 4 Collate findings & conclude on transition to next V-phase

4.4.1 Summary of HP activities results & recommendations / requirements

This part provides a summary of the HP argument and related issues / benefits along with the HP activities conducted. It reports on the outcomes of HP issues that were included into the HP assessment plan. For each argument and issue / benefit the results/evidence obtained from the activities conducted are briefly described along with the recommendations and / or requirements generated.

The status of each HP issue is also given. The status of an issue / benefit can either be 'closed', 'open', 'cancelled'.

- An issue is considered 'closed' when the issue had been sufficiently answered or no additional activities relating to that issue are foreseen as necessary;
- An issue is considered as being 'open' when the issue has been either: partially addressed and more studies are needed or; the issue had been addressed by certain activities but as a result other related issues had arisen or; when no activity has been performed to date to address a specific issue;
- An issue is considered as being 'cancelled' when the activities conducted have shown the issue to be not relevant to the given concept under investigation.

The HP recommendations and requirements fall into one of the following categories:

- System design;
- OPS (operating methods / procedures);
- New objective;
- Training;
- Other.



Issue ID	HP issue / HP Benefit	Issue/ Benefit Status	HP/ Valid. Obj. ID	Activity conducted	Results / Evidence	Recommendations	Requirements
Arg. 1.1.2: The description of roles & responsibilities covers all tasks to be performed by a human actor.							
1.1.2-1	The description of the Ground Handlers' responsibilities may not cover new tasks related to monitoring of the TOBT correctness and manual corrections.	Closed	OBJ-28.1-V3-HP1.1.2	Shadow mode	The clarity of the responsibilities of GH was assessed through a pre-validation questionnaire as well as during debriefing sessions throughout the exercise execution. GH stated that the training they have received in relation to this SESAR solution was clear and sufficient to feel confident and no issues were identified.		
Arg. 1.1.3: Roles and responsibilities are clear and consistent.							
1.1.3-1	The description of the responsibilities of the Ground Handlers may not cover	Closed	OBJ-28.1-V3-HP1.1.3	Shadow Mode	In terms of incorrect/ not functioning information, GH would return to previous operating method, i.e.		REQ-04-W2-28.1-SPRINTEROP-HP-01 In the event of incorrect / not

	degraded modes of operation (e.g. when the TOBT automated information does not function or is incorrect).				update the TOBT manually.		functioning automated TOBT information the Ground Handler shall revert to previous operating method.
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Arg. 1.2.4: The content of operating methods is clear and consistent.

1.2.4-1	Operational procedures may not be acceptable under all operating conditions for Ground Handlers.	Open	OBJ-28.1-V3-HP1.2.4.1	Shadow mode	GH found the operating methods change in relation to this concept to be fully acceptable. GH felt that the proposed procedures supported their human performance and provided sufficient information in order to manually update the TOBT. No assessment in degraded modes of operations was conducted, therefore it shall be investigated in future validations.		REQ-04-W2-28.1-SPRINTEROP-HP-02 The ability for the users to revert to previous working methods (manual TOBT / TSAT updates) in the event of transition to a degraded mode of operations shall be fully assessed in future validations.
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1.2.4-2	The new operating procedures may not be acceptable for the Tower Controller.	Closed	OBJ-28.1-V3-HP1.2.4.2	Shadow mode	A change was identified in relation to the de-icing procedures. ATCO expressed that the procedures supported their HP and at no times were insufficient to perform their tasks. Currently without precise information on which aircraft will leave the stand first, it is less efficient and requires more workload to check all details. The concept would make the procedure more straightforward as TWR ATCO would instruct de-icing procedures in a more logical order.		
1.2.4-4	The new operating procedures may not be acceptable under all operating conditions for	Cancelled	OBJ-28.1-V3-HP1.2.4.4	Shadow mode	No changes in AO operating methods were identified.		

	the Airport Operator.						
Arg. 1.3.1: The potential for human error is reduced to a tolerable level.							
1.3.1-1	The Ground Handler may overlook wrong TOBT information when crosschecking the data.	Closed	OBJ-28.1-V3-HP1.3.1	Shadow mode	GH expressed that the TOBT values displayed were easy to understand given the main aircraft timestamps and when the TOBT updated automatically it was easy to understand why. GH also expressed that as they need to monitor the TOBT as part of their regular task, they would be able to identify any incorrect details in the automated data provided. GH agreed they had adequate access to all the required information to manually update the TOBT. Based on this feedback as well as the observations, it was deemed as extremely		



					unlikely for the GH to overlook wrong TOBT information.		
1.3.1-2	The Ground Handler may forget that they should not make manual updates and override the system, resulting in stopping automated proposals from the system. ¹	Closed	OBJ-28.1-V3-HP1.3.1.2	Shadow Mode	GH may forget that it is not their responsibility to make manual updates because of automated updates of the turnaround times. This could result in stopping the system from sending automatic proposals (manual input overrides automatic input). GH expressed that an indication from the system when the responsibility lies with the GH is not mandatory but would be beneficial and could reduce the error potential.	REC-04-W2-28.1-SPRINTEROP-HP-01 It is recommended to explore in future activities the potential benefit of an HMI indication to confirm whether the responsibility of inputting proposals lies with the system or the GH.	

¹ New HP issue created based on the validation exercise results.

					If the design change is implemented, it is recommended to further investigate GH's human error potential in future validation activities.		
Arg. 1.3.2: Tasks can be achieved in a timely manner.							
1.3.2-1	The introduction of the automated TOBT information allows the Ground Handler to perform their tasks in a timely manner.	Open	OBJ-28.1-V3-HP1.3.2.1	Shadow mode	GH agreed that when provided with automatic updates on the turnaround times, they would be able to achieve their tasks efficiently and in a timelier manner. GH expressed that they would have a better overview of the potential delays if the solution was implemented. Even though there are no indications of negative effects on the timeliness of tasks achievement, it could not be fully assessed	REC-04-W2-28.1-SPRINTEROP-HP-02	It is recommended that GH's timeliness of tasks achievement is further investigated prior to the deployment phase (V4).

					given the nature of a shadow mode. In the future activities this issue should be further explored to assure no negative impacts on HP.		
1.3.2-2	The Ground Handler does not perform the crosscheck of the TOBT data in a timely manner and hence transmits the wrong information to the NM.	Open	OBJ-28.1-V3-HP1.3.2.2	Shadow mode	No potential of omitting incorrect information / too slow identification by GH was identified during the validation. GH agreed that they would be able to identify in a timely manner if the information proposed by the system was not accurate and mitigate any negative impacts. Even though there are no indications of negative effects on the timeliness of tasks achievement, it could not be fully assessed given the nature of a shadow mode. In the future activities this	REC-04-W2-28.1-SPRINTEROP-HP-02 It is recommended that GH's timeliness of tasks achievement is further investigated prior to the deployment phase (V4).	

					issue should be further explored to assure no negative impacts on HP.		
Arg. 1.3.3: The level of workload (induced by cognitive and/or physical task demands) is acceptable.							
1.3.3-1	The introduction of the new TOBT automated information is expected to not negatively impact the Ground Handler's workload.	Open	OBJ-28.1-V3-HP1.3.3	Shadow mode	GH rated their workload as acceptable throughout the validation exercise execution. GH expressed that introduction of the concept would reduce their workload while gaining a better overview of the traffic situation, e.g. to turnaround process potential delays, loading or boarding the aircraft. Nevertheless, given the nature of the shadow mode, workload assessment was not conducted in an environment that simulates the actual	REC-04-W2-28.1-SPRINTEROP-HP-03	It is recommended that further assessments on the key HP indicators (workload, SA) are conducted with respect to the integration of the RNI system in the GH's primary tasks prior to the deployment phase (V4).



					working environment. It requires further assessment in future validations.		
Arg. 1.3.4: The level of trust in the new concept/the new procedures is appropriate.							
1.3.4-1	Ground Handler may not trust the new concept.	Closed	OBJ-28.1-V3-HP1.3.4.1	Shadow mode	GH expressed high level of trust in the concept during the validation. GH agreed that it was easy to understand why the TOBT value changed, and they were provided with adequate access to all required information, which improved their trust.		
1.3.4-2	The level of trust in the provision of the new data may be inappropriate for the Airport Operator.	Open	OBJ-28.1-V3-HP1.3.4.2	Shadow mode	No concerns with regards to AO's level of trust were identified. However, the assessment of the impact of the concept on AO's HP was limited, i.e. available only for one day of the validation and should	REC-04-W2-28.1-SPRINTEROP-HP-04 It is recommended that the AO's trust in the concept is further investigated prior to deployment phase (V4).	

					be further investigated in future validations of this concept.		
1.3.4-3	The level of trust in the provision of the new data may be inappropriate for the Tower Controller.	Closed	OBJ-28.1-V3-HP1.3.4.3	Shadow mode	ATCO's level of trust was found to be acceptable. They did not foresee any issues with being able to identify inaccuracies of the system and felt confident to revert to previous working methods in a degraded mode of operations. However, they did not fully understand why the TSAT was changed when automatically updated. The trust could be improved if ATCOs understood the automatic updates.	REC-04-W2-28.1-SPRINTEROP-HP-05 It is recommended that the ATCOs are trained on the concept in such way to clearly understand why the turnaround times (TOBT, TSAT) are automatically updated.	
1.3.4-5	The level of trust in the provision of the new data is inappropriate for the NMOC.	Open	OBJ-28.1-V3-HP1.3.4.5	Shadow mode	The impact on the NMOC is very limited in this solution and the impact on NMOC trust was not assessed. .	REC-04-W2-28.1-SPRINTEROP-HP-06 It is recommended to further investigate the impact on NMOC HP	

					Despite no assessment was conducted in this SESAR Wave 2 in relation to NMOC, this platform was already used in Wave 1 in the transmission of DPI messages and no issues were identified. Therefore, no potential risks are identified in relation to this HP Arg.	prior to the deployment stage (V4).	
Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.							
1.3.5-1	The Ground Handler's level of situational awareness is expected to improve with the introduction of the TOBT automated data.	Closed	OBJ-28.1-V3-HP1.3.5.1	Shadow mode	The automatically updated TOBT was perceived as a benefit for the GH, allowing them to focus on other tasks whilst being fully aware of the current state. Moreover, the automatic TOBT updates allowed them to better assess future events, which is an indication of improved Level 3 of SA.	REC-04-W2-28.1-SPRINTEROP-HP-03 It is recommended that further assessments on the key HP indicators (workload, SA) are conducted with respect to the integration of the RNI system in the GH's primary tasks prior to the	

						deployment phase (V4).	
1.3.5-2	Airport Operator's situational awareness may be negatively impacted by the automated TOBT information.	Open	OBJ-28.1-V3-HP1.3.5.2	Shadow mode	AO's SA was assessed using China Lakes Situational Awareness questionnaire. The SA was rated as 'Very Good' (9 out of 10) and overall feedback showed no negative impact, with possible increase, of AO situational awareness. However, AO's involvement was limited, i.e. they were available only for one day of the validation, therefore prior to the deployment phase the impacts on AO's SA should be further explored.	REC-04-W2-28.1-SPRINTEROP-HP-07 It is recommended that further assessment on the situational awareness is conducted with respect to the integration of the RNI system in the AO's primary tasks in future activities.	
1.3.5-3	The ATCOs' situational awareness may be negatively impacted by the	Closed	OBJ-28.1-V3-HP1.3.5.3	Shadow mode	ATCO assessed their overall SA as 8 out of 10 ('Good'). The reason for slightly lower score was ATCO perception	28.1-SPRINTEROP-HP-08 It is recommended that further	

	guidance received from the ground handlers (if the ground handlers misidentify the errors in the automated data).				that the system was slower than would be expected for an operational tool. However, this was most likely caused by the validation technique chosen. ATCO stated that for their working position, the automatically updated turnaround times would support their SA. One of the validation limitations was not fully representative ATC interface which required more manual updates than in real life. It is recommended to further assess ATCO SA, once a more mature HMI prototype is developed.	evaluation of SA is conducted once a more mature prototype is developed that is more representative of an operational tool for ATCO.	
1.3.5-4	The NMOC situational awareness is expected to be	Open	OBJ-28.1-V3-HP1.3.5.4	Shadow mode	The impact on the NMOC is very limited in this solution and the impact on situational	REC-04-W2-28.1-SPRINTEROP-HP-06	

	improved with the provision of DPI messages.				awareness was deemed as not relevant at this stage of the solution development. Despite no assessment was conducted in this SESAR Wave 2 in relation to NMOC, this platform was already used in Wave 1 in the transmission of DPI messages and no issues were identified. Therefore, no potential risks are identified in relation to this HP Arg.	It is recommended to further investigate the impact on NMOC HP prior to the deployment stage (V4).	
Arg. 2.1.1: The task allocation between the human and the machine is consistent with automation principles.							
2.1.1-1	Task allocation between human (Ground Handler) and machine may not be consistent with automation principles.	Closed	OBJ-28.1-V3-HP2.1.1	Shadow mode	GH was satisfied with their ability to make manual updates if necessary and agreed that the manual outputs should override the automatic inputs, whilst being provided with alerts from the system. This change in the		

					allocation of tasks between human and the machine would not result in the change in the role of the GH, i.e. their tasks would not change from manual inputs to only monitoring the outputs. The GH will be constantly engaged and actively cross-check the data, e.g. making checks against the radar, in order to make manual inputs if needed.		
Arg. 2.1.2: Changes to the task allocation between human and machine support human performance.							
2.1.2-1	Human performance may be negatively impacted by the changes to task allocation between the Ground Handlers and the system (e.g. GH unable	Closed	OBJ-28.1-V3-HP2.1.2	Shadow mode	GH expressed that due to automatically updated TOBT values their workload would be lower and felt that the tool fully supported them in their tasks. No negative impacts on GH HP were identified.	REC-04-W2-28.1-SPRINTEROP-HP-03 It is recommended that further assessments on the key HP indicators (workload, SA) are conducted with respect to the integration of the	

	to accurately crosscheck the correctness of data, workload increased, or situation awareness negatively impacted).				Nevertheless, given the limitations of a shadow mode, the GH's HP should be further explored prior to the deployment stage.	RNI system in the GH's primary tasks prior to the deployment phase (V4).	
Arg. 2.1.3: Transition from automatic to manual modes and vice versa, human-intended or failure induced, can be performed by the human actors in a timely, efficient and accurate manner.							
2.1.3-1	The Ground Handler is expected to manage manual inputs to the TOBT data (if needed) in a timely and efficient manner.	Closed	OBJ-28.1-V3-HP2.1.3.1	Shadow mode	As a result of increased situational awareness and reduced workload, the GH expressed they would be able to achieve their tasks more efficiently and in a timelier manner.		
2.1.3-2	In a degraded mode of operation (automated data no longer available) the Ground Handler may have	Closed	OBJ-28.1-V3-HP2.1.3.2	Shadow mode	GH expressed that in the event of an inaccurate information provided by the system, it is easily noticeable and acceptable for them to override the outputs		

	difficulties reverting to the evaluation and manual input of data with regard to the TOBT.				provided by the tool. As the change in GH tasks is not significant (i.e. they would still be required to actively monitor and make updates where necessary) a concern in relation to reverting to previous methods was deemed as not credible.		
2.1.3-3	In the event of a degraded mode of operation (TOBT data no longer automatically available) the Ground Handler may be unaware of it and may forget to check for this information.	Closed	OBJ-28.1-V3-HP2.1.3.3	Shadow mode	As GH is actively monitoring TOBT, it was deemed as not realistic for the GH to forget to check for this information.		

Arg. 2.1.4: The level of workload (induced by the allocation of tasks between the human and the machine) is acceptable.

2.1.4-1	The allocation of tasks between human and the machine is expected to not negatively impact the Ground Handler's workload.	Closed	OBJ-28.1-V3-HP2.1.4	Shadow mode	During the validation, it was found that GH workload would be reduced as a result of handing over some of their tasks to the machine. GH expressed that this reduction would support their performance and would allow them to achieve their tasks in a timelier manner. Nevertheless, given the limitations of a shadow mode, the impact on GH's workload should be further investigated prior to the deployment stage (V4).	REC-04-W2-28.1-SPRINTEROP-HP-03 It is recommended that further assessments on the key HP indicators (workload, SA) are conducted with respect to the integration of the RNI system in the GH's primary tasks prior to the deployment phase (V4).	
Arg. 2.1.5: Human actors can acquire an adequate mental model of the machine and its automated functions.							
2.1.5-1	The Ground Handler may not have appropriate understanding of TOBT automated updates.	Closed	OBJ-28.1-V3-HP2.1.5.1	Shadow mode	GH expressed that the automatic updates were always understandable to them. Moreover, the automatic TOBT updates allowed them		

					to better assess future events.		
2.1.5-2	The Airport Operator may not have appropriate understanding of TOBT automated updates.	Open	OBJ-28.1-V3-HP2.1.5.2	Shadow mode	AO expressed that the system's calculations are logical and understandable with no information missing. However, AO's involvement was limited, i.e. they were available only for one day of the validation, therefore prior to the deployment phase the impacts on AO's understanding of the automatic updates should be further explored.	REC-04-W2-28.1-SPRINTEROP-HP-09 It is recommended that further assessment on the workload is conducted with respect to the integration of the RNI system in the AO's primary tasks in future activities.	
2.1.5-3	The Tower Controller may not have appropriate	Closed	See Arg. 1.3.4-3	Shadow Mode	See Arg. 1.3.4-3	REC-04-W2-28.1-SPRINTEROP-HP-05 It is recommended that the ATCOs are trained on the concept in such way to clearly understand why the	

	understanding of TSAT updates ² .					turnaround times (TOBT, TSAT) are automatically updated.	
Arg. 2.1.6: The level of trust in automated functions is appropriate.							
2.1.6-1	Ground Handlers may mistrust (false distrust) the source of information for the TOBT data.	Closed	OBJ-28.1-V3-HP2.1.6.1	Shadow mode	GH expressed that they would fully trust the RNI platform and the information provided by the system (SATI=6). No concerns were expressed in terms of over-trust in the tool since GH would remain constantly engaged with the information.		
2.1.6-2	Ground Handlers may overtrust the source of information for the TOBT data.	Closed	OBJ-28.1-V3-HP2.1.6.2	Shadow mode	As GH is actively monitoring TOBT, it was deemed as not realistic for the GH to rely too much on the		

² New HP issue created based on the validation exercise results.

					information provided by the system.		
2.1.6-3	The level of trust in the provision of the new data may be inappropriate for the Airport Operator.	Open	OBJ-28.1-V3-HP2.1.6.3	Shadow mode	See Arg. 1.3.4-2	REC-04-W2-28.1-SPRINTEROP-HP-04 It is recommended that the AO's trust in the concept is further investigated prior to deployment phase (V4).	
Arg. 2.2.1: The accuracy of information provided by the system is adequate for carrying out the task.							
2.2.1-1	The accuracy of information provided by the system may not be adequate for carrying out tasks by the Ground Handler.	Closed	OBJ-28.1-V3-HP2.2.1.1	Shadow mode	Feedback with regards to the accuracy of information provided by the system was highly positive. GH found the automatically updated times to be precise, which helped them to make a more efficient plan for operations by having better overview of the traffic situation. No changes were proposed for the		

					enhancement of the tool.		
2.2.1-2	The Ground Handlers may not be able to easily crosscheck the accuracy of information provided by the system.	Closed	OBJ-28.1-V3-HP2.2.1.2	Shadow mode	GH found the interface to be easy to use. During the validation, GH was able to easily crosscheck information and felt that they did not have to learn a lot in order to use the system.		
Arg. 2.2.2: The timeliness of information provided by the system is adequate for carrying out the task.							
2.2.2-1	The timeliness of information provided to the Ground Handler by the system is expected to be adequate for carrying out the task.	Open	OBJ-28.1-V3-HP2.2.2.1	Shadow mode	The information was provided in a timely manner to the GH. GH found the various functions of the tool to be well integrated, which supported them in achieving their tasks efficiently. Nevertheless, given the nature of a shadow mode, task achievement could not be fully assessed and should be further	REC-04-W2-28.1-SPRINTEROP-HP-02 It is recommended that GH's timeliness of tasks achievement is further investigated prior to the deployment phase (V4).	

					explored prior to the deployment stage.		
2.2.2-2	The alert indicating a different boarding time than expected may appear too late on the Ground Handler's HMI.	Closed	OBJ-28.1-V3-HP2.2.2.2	Shadow mode	The design of event-based milestones and alerts was found to be fully appropriate. For more details on the types of alerts, please consult VALR – Part I [2].		
Arg. 2.3.1: The type of information provided satisfies the information requirements of the human.							
2.3.1-1	Ground Handler requires more information from the system in order to be able to appropriately crosscheck the accuracy of data.	Closed	OBJ-28.1-V3-HP2.3.1	Shadow mode	See Arg. 2.2.1-1		
Arg. 2.3.3: Visual displays and other types of output devices adhere to HF principles.							
2.3.3-1	The TOBT information display may have poor usability characteristics	Closed	OBJ-28.1-V3-HP2.3.3	Shadow mode	The mean SUS score for the RNI system was 'Excellent' (M=85, SD=13.8). Users agreed that the system was		

	and may not support the Ground Handlers in performing their tasks.				useful, reliable and that it was easy to identify all the necessary information. Additionally, users were fully satisfied with the design of the alerts.		
Arg. 2.3.4: Alarms and alerts have been developed according to HF principles.							
2.3.4-1	The alert indicating a different boarding time than expected may not be designed according to HF principles.	Closed	OBJ-28.1-V3-HP2.3.4.1	Shadow mode		REC-04-W2-28.1-SPRINTEROP-HP-10 It is recommended that the alerts' design is further investigated prior to the deployment phase (V4) to assure accordance with HF principles.	
2.3.4-2	The alert indicating a different boarding time than is expected to improve the monitoring of data for Ground Handlers.	Closed	OBJ-28.1-V3-HP2.3.4.2	Shadow mode	GH expressed the alerts provided by RNI system to be fully accurate and to be supporting them in their tasks.		

Arg. 2.3.6: The usability of the user interface (input devices, visual displays/output devices, alarm& alerts) is acceptable.

2.3.6-1	The usability of the HMI (input devices, visual displays, output devices, alerts and alarms) may be not intuitive nor easy to use/interpret, hence may reduce situational awareness of the Ground Handler.	Closed	OBJ-28.1-V3-HP2.3.6	Shadow mode	The SUS scores obtained during this validation ranged between 'Good' and 'Best imaginable'. The mean SUS score for the RNI system was 'Excellent' (M=85, SD=13.8). Participants agreed that the system was useful, reliable and that it was easy to identify all the necessary information. For more details, please refer to VALR – Part I [2].		
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Arg. 2.3.8: The user interface design supports a sufficient level of individual situation awareness.

2.3.8-1	See argument 1.3.5/ 2.3.4	Closed	See argument 1.3.5/ 2.3.4	See argument 1.3.5/ 2.3.4	See argument 1.3.5/ 2.3.4		
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Arg. 2.3.9 The user Interface design supports a sufficient level of team situational awareness.

2.3.9-1	The introduction of the RNI concept positively contributes to a shared situational awareness between all actors involved (e.g. Ground Handlers, NM, Tower Controllers).	Closed	OBJ-28.1-V3-HP2.3.9	Shadow mode	Participants expressed that, when the information will be provided automatically by the system, the common awareness of the current situation and future impacts will be improved amongst all airport stakeholders. This is expected to result in a reduction in the amount of communication needed between ATC and GH, and the potential benefit was identified specifically for the de-icing procedures. Nevertheless, given the nature of the shadow mode, team SA should be further investigated prior to the deployment phase.	REC-04-W2-28.1-SPRINTEROP-HP-11 It is recommended that the impact of the concept introduction on the team SA is further explored prior to the deployment phase (V4).	
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Arg. 4.1.1.1: Changes in roles and responsibilities are acceptable to the affected human actors.

4.1.1-1	Changes in responsibilities may not be acceptable for the Ground Handlers.	Closed	OBJ-28.1-V3-HP4.1.1	Shadow mode	GH found the changes in their responsibilities fully acceptable and supporting their HP.		
Arg. 4.1.2: The impact of changes on the job satisfaction of affected human actors has been considered.							
4.1.2-1	It is expected that the change brought by solution 28.1 will increase GH and ATC job satisfaction ³ .	Closed	OBJ-28.1-V3-HP4.1.2	Shadow mode	GH expressed that the new concept would greatly increase their job satisfaction. They perceived the RNI system as supporting their human performance. ATC expressed that the implementation of this solution would increase their job satisfaction due to improved situational awareness with no detrimental effect on their task		

³ New HP objective added based on the validation exercise results.

					achievement and overall performance.		
Arg. 4.5.1: The content of training for each actor group is specified.							
4.5.1-1	The introduction of the automated information and the associated change in procedures may not be appropriately captured in the training material.	Closed	OBJ-28.1-V3-HP4.1.5	Shadow mode	No specific training needs apart from the need of familiarity with the HMI were identified.		

Table 6: Summary of the HP results and recommendations/ requirements for each identified issue & related argument



4.4.2 Maturity of the Solution

Maturity checklist for finalising the V3 assessment			
ID	Question	Answer	Comments
1	Has a Human Performance Assessment Report been completed? Have all relevant arguments been addressed and appropriately supported?	Yes	The consolidated list of identified arguments, issues, requirements and recommendations can be found in Table 6. HP issues and arguments have been appropriately assessed through questionnaires and interviews (debriefings), including the use of standardised assessment techniques.
2	Are the benefits and issues in terms of human performance and operability related to the proposed solution sufficiently assessed (i.e. on the level required for V3)?	Yes	The consolidated list of identified arguments, issues, requirements and recommendations can be found in Table 6. All relevant HP issues and arguments were investigated sufficiently for V3 maturity in relation to the Ground Handler and Air Traffic Controller. Nevertheless, the issues that remained 'Open' are recommended to be further investigated prior to the deployment stage. It was identified that the Airport Operator will be less impacted by the change brought by this solution, as they will receive access to more refined information with no changes in their operating methods. Therefore, the HP issues identified in this document are not currently foreseen to impact negatively AO's HP. The HP issues that remained 'Open' are a result of limited participation of AO in the validation, however the initial feedback received was positive with benefits identified. Nonetheless, it is recommended that prior to implementation, the impact on the AO's HP is further investigated. The platform used in this solution for the NMOC was successfully used in SESAR Wave 1. Therefore, the changes are not considered to have a negative impact on the B2B changes. Nevertheless, as the NMOC was not involved in the validation in this Wave, it is recommended that further analysis is done at the next maturity level.
3	Have all the parts of the solution/concept been considered?	Yes	The concept consisted of one OI step which was fully considered.
4	Have potential interactions with related projects/concepts been considered and addressed?	Yes	The interactions with other PJ.04-W2 solutions have been considered.

5	Is the level of human performance needed to achieve the desired system performance for the proposed solution consistent with human capabilities?	Yes	The results can be found in Table 6. No negative impacts were identified for all affected human actors. Potential benefits in terms of Ground Handler's workload and situational awareness were identified. Even though no indication of negative impact on the users HP was identified, given the nature of the validation technique chosen, it is recommended to conduct additional activities exploring the key HP measures (workload, SA, human error) prior to the deployment stage.
6	Are the assessments results in line with what is targeted for that concept? If not, has the impact on the overall strategic performance objectives/targets been analysed?	Yes	No targets were set in relation to the Human Performance for this solution.
7	Has the proposed solution been tested with end-users and under sufficiently realistic conditions, including abnormal and degraded conditions?	No	No abnormal and degraded modes were tested for this solution. Additional HP activities should be conducted to include degraded modes of operation prior to the deployment stage.
8	Do validation results confirm that the interactions between human and technology are operationally feasible, and consistent with agreed human performance requirements?	Yes	The results along with recommendations and requirements can be found in Table 6 under HP Arg. 2.
9	Have all relevant SESAR documentation been updated according to the HP activities outcomes (OSD, SPR)?	Yes	All relevant documentation has been updated in accordance with HP outcomes.
10	Do the outcomes satisfy the HP issues/benefits in order to reach the expected KPA?	Yes	The identified HP benefits and issues with associated evidence can be found in Table 6. For the outcomes of validation exercise please refer to Solution 28.1 VALR – Part I.
11	Have HP recommendations and HP requirements correctly been considered in HMI design, procedures/documentation and training?	Yes	HP recommendations and requirements can be found in Appendix A and Appendix B of this document.
12	Have the major factors that can influence the transition feasibility (e.g. changes in competence requirements, recruitment and selection, training needs, staffing requirements, and relocation of the workforce) been addressed? Are there any ideas on how to overcome any issues?	Yes	No training and staffing needs were identified that could influence the transition feasibility.



13	Have any impacts been identified that may require changes to regulation in the area of HP/ATM? This includes changes in roles & responsibilities, competence requirements, or the task allocation between human & machine.	N/A	No regulatory impact is expected to be introduced by this solution from an HP perspective.
14	Has the next V-phase sufficiently been prepared (additional testing conditions, open HP issues to be addressed)?	Yes	List of open issues/benefits and associated validation objectives not yet validated along with recommendations for further research can be found in Table 6.



5 References

Human Performance

- [1] SESAR Human Performance Assessment Process V1 to V3 - including VLD, 00.03.01

Reference Documents

- [2] PJ.04-W2-28.1 VALR V3 – Part I D2.1.040, 00.00.04
- [3] PJ.04-W2-28.1 OSED V3 – Part I D2.1.050
- [4] PJ.04-W2-28.1 VALP – Part IV (Human Performance Assessment Plan) D2.1.010, 01.01.0
- [5] PJ.04-01 SPR-INTEROP/OSED – Part IV (Human Performance Assessment Plan) D2.1, 01.00.01

Appendix A – HP Recommendations Register

As per the HP assessment guidance[1], the statuses for HP recommendations are defined as follows:

- Accepted – The recommendation has been agreed and accepted by the project team;
- Rejected – The recommendation has been rejected by the project team and a rationale has been provided;
- To be analysed – The recommendation is awaiting agreement from the project team.

HP Recommendations Register					
Reference	Type of recommendation	Recommendation	Rationale	Assessment source + Reference report	Recommendation status
REC-04-W2-28.1-SPRINTEROP-HP-01	Design	It is recommended to explore in future activities the potential benefit of an HMI indication to confirm whether the responsibility of inputting proposals lies with the system or the GH.	GH expressed that a “nice-to-have” feature to have an indication from the system when the responsibility lies with the GH to reduce the potential for an error.	PJ.04-W2-28.1 Validation Report	To be analysed
REC-04-W2-28.1-SPRINTEROP-HP-02	VAL	It is recommended that GH’s timeliness of tasks achievement is further investigated prior to the deployment phase (V4).	No concerns in relation to task achievement in timely manner were identified. However, given the limitations of the shadow mode technique the task	PJ.04-W2-28.1 Validation Report	To be analysed



			achievement should be further investigated.		
REC-04-W2-28.1-SPRINTEROP-HP-03	VAL	It is recommended that further assessments on the key HP indicators (workload, SA) are conducted with respect to the integration of the RNI system in the GH's primary tasks prior to the deployment phase (V4).	The exercise was conducted by means of a shadow mode validation, which limits the ability to assess HP in relation to primary user tasks.	PJ.04-W2-28.1 Validation Report	To be analysed
REC-04-W2-28.1-SPRINTEROP-HP-04	Other	It is recommended that the AO's trust in the concept is further investigated prior to deployment phase (V4).	Even though there are no indications of AO's insufficient trust in the concept, their participation in the validation was limited and requires more solid evidence before deployment.	PJ.04-W2-28.1 Validation Report	To be analysed
REC-04-W2-28.1-SPRINTEROP-HP-05	Training	It is recommended that the ATCOs are trained on the concept in such way to clearly understand why the turnaround times (TOBT, TSAT) are automatically updated.	ATCO did not foresee any issues with regards to not being able to identify inaccuracies of the system. However, ATC did not fully understand why the TSAT was changed when automatically updated, therefore specific training on the concept is recommended prior to the deployment phase.	PJ.04-W2-28.1 Validation Report	To be analysed





REC-04-W2-28.1-SPRINTEROP-HP-06	Other	It is recommended to further investigate the impact on NMOC HP prior to the deployment stage (V4).	The impact on the NMOC is very limited in this solution and the impact on trust was deemed as not relevant at this stage of the solution development. Nevertheless, prior to the deployment stage, the impact on NMOC HP should be further explored.	PJ.04-W2-28.1 Validation Report	To be analysed
REC-04-W2-28.1-SPRINTEROP-HP-07	VAL	It is recommended that further assessment on the situational awareness is conducted with respect to the integration of the RNI system in the AO's primary tasks in future activities.	The exercise was conducted by means of a shadow mode validation, which limits the ability to assess HP in relation to primary user tasks.	PJ.04-W2-28.1 Validation Report	To be analysed
REC-04-W2-28.1-SPRINTEROP-HP-08	VAL	It is recommended that further evaluation of SA is conducted once a more mature prototype is developed that is more representative of an operational tool for ATCO.	One of the validation limitations was not fully representative ATC interface which required more manual updates than in real life.	PJ.04-W2-28.1 Validation Report	To be analysed
REC-04-W2-28.1-SPRINTEROP-HP-09	VAL	It is recommended that further assessment on the workload is conducted with respect to the integration of the RNI system	The exercise was conducted by means of a shadow mode validation, which limits the ability to assess HP in relation to primary user tasks.	PJ.04-W2-28.1 Validation Report	To be analysed



		in the AO's primary tasks in future activities.			
REC-04-W2-28.1-SPRINTEROP-HP-10	VAL	It is recommended that the alerts' design is further investigated prior to the deployment phase (V4) to assure accordance with HF principles.	Even though no issues were identified with relation to the alerts, based on the final design of alerts need to be checked against HF principles prior to the deployment stage.	PJ.04-W2-28.1 Validation Report	To be analysed
REC-04-W2-28.1-SPRINTEROP-HP-11	VAL	It is recommended that the impact of the concept introduction on the team SA is further explored prior to the deployment phase (V4).	Even though no issues were identified with relation to team SA, based on the limitations of a shadow mode this topic should be further explored prior to the deployment stage.	PJ.04-W2-28.1 Validation Report	To be analysed

Table 7: HP recommendations





Appendix B – HP Requirements Register

As per the HP assessment guidance [1], the statuses for HP requirements are defined as follows:

- Accepted – The requirement has been agreed and accepted by the project team;
- Rejected – The requirement has been rejected by the project team and a rationale has been provided;
- To be analysed – The requirement is awaiting agreement from the project team.

HP Requirements Register					
Reference	Type of requirement	Requirement	Rationale	Assessment source + Reference report if available	Requirement status
REQ-04-W2-28.1-SPRINTEROP-HP-01	OPS	In the event of incorrect / not functioning automated TOBT information the Ground Handler shall revert to previous operating method.	In terms of incorrect/ not functioning information, GH would return to previous operating method, i.e. update the TOBT manually.	PJ.04-W2-28.1 Validation Report	To be analysed
REQ-04-W2-28.1-SPRINTEROP-HP-02	VAL	The ability for the users to revert to previous working methods (manual TOBT / TSAT updates) in the event of transition to a degraded mode of operations shall be fully assessed in future validations.	No assessment in degraded modes of operations was conducted, therefore it shall be investigated in future validations.	PJ.04-W2-28.1 Validation Report	To be analysed

Table 8: HP Requirements



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