

SESAR PJ.07-W2-38: INTEROP/OSED (VALR) for V1 - Part IV - Human Performance Assessment Report

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PJ.07-W2-OAUO

SESAR2020 PJ.07-W2-OAUO OPTIMISED AIRSPACE USERS OPERATIONS

This Human Performance Assessment Plan is part of a project that has received funding from the SESAR3 Joint Undertaking under grant agreement No 874465 under European Union's Horizon 2020 research and innovation programme.



Abstract

This document contains the Human Performance (HP) assessment report for the PJ.07-W2-38 which consists of the HP assessment plan, the results of the HP activities conducted according to the HP assessment process, newly identified issues, and the HP recommendations & requirements. It corresponds to the completion of the four steps of the Human Performance assessment process, namely: Step 1 – Understand the concept: Baseline, Solution and Assumptions, Step 2 – Understand the Human Performance Implications, Step 3 – Improve and Validate the concept and Step4 – Collate findings & conclude on transition to next V-phase.

Four main HP assessment activities have been conducted to evaluate and optimize human performance.

PJ.07-W2-38 aims at introducing new services (AUO-O219 and AUO-0208) which will be provided as a B2B service and implemented in Airline/FMP/NMOC's systems.

To support the implementation of both Ols, a design support has been provided thanks to "Mock-up and Prototyping" activity. Mock-ups have been used to discuss Ols concept and implementation with all stakeholders and the final prototype was used as a "guideline" to implement both Ols.

Three validation exercises implicating humans in the loop were planned from November 2021 to May 2022.

Human Performance evaluation objectives, described in the <u>D2.1.004-PJ.07-W2-38- Final VALP V3 -</u> <u>Part IV - Ed 02.00.00.docx</u>, were assessed during these three exercises. Associated results and recommendations/requirement are described in this document (and **Error! Reference source not found.** - **Error! Reference source not found.**).





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1 Executive Summary

The HP Assessment Report ensures that V2 HP requirements and recommendations are followed up and V3 HP aspects have been identified and considered for the operational and technical development of the "Enriched DCB information and Advanced What-If functionalities for AUs (including Protection Hotspot)" and "use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P-FDCI)" concepts, based on the HP Assessment methodology. The HP Assessment Report is built on the structure of the HP Arguments which are "HP claims that need to be proven", according to the HP Reference Material. In a first step – the scoping and change assessment- the arguments that are relevant for the concept were identified.

Following arguments were identified as being relevant for the concept:

- **Argument 1**: The role of the human is considered consistent with human capabilities and limitations.
- Argument 2: Technical systems support the human actors in performing their tasks.
- Argument 3: Team structures and team communication support the human actors in performing their tasks.
- Argument 4: Human Performance related transition factors are considered.

In the next steps issues, HP objectives and HP activities meant to assess the feasibility of the concepts were identified.

Three activities have been identified for the Protection Hotspot and P-FDCI concepts:

- 1. Design of working method, Mock-up, and prototyping with quick user testing throughout the process
- 2. Task analysis (current operations and with new OI implemented)
- 3. RTS with observation, questionnaire, and debriefing

These activities have been performed according to the Validation Objectives, which comprise Human Performance aspects as well taken from the current HP Assessment Plan.

This document describes the Human Performance Assessment for PJ07-W2-38, targeting V3 maturity. The Human Performance assessment commenced with the drafting of the HP plan. The HP assessment report outlines the activities that were conducted, the issues, the validated mitigations, and the results of the validations. The results of the HP assessment are the HP recommendations and requirements.

The SESAR HP assessment process provides a framework to help ensure that HP aspects related to SESAR 2020 technical and operational developments are systematically identified and managed in the concept design, development, and validation process. The SESAR HP assessment process uses an 'argument' and 'evidence' approach. A HP argument is a '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.

The output or 'evidence' collected from each of these activities that are relevant to the HP assessment are summarised in this report together with recommendations and / or requirements that have been proposed to help prevent or mitigate each of the potential HP issues identified. These recommendations and requirements relate to the operational concept, the technical system and HMI and the training of the end user.

In addition, the information is captured in the HP log in the "Change & Argument Identification" and "Issue-Objective-Outcome" Tabs (see Appendix C), in terms of HP arguments, HP issues, benefits and impacts, HP objectives, activities and expected evidence at V3.





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 to derive the HP assessment report for EXE-PJ07W238-02, EXE-PJ07W238-03 and EXE-PJ07W238-04. The document also includes new Human Performance requirements and recommendations that have been expressed following the results / evidence from EXE-PJ07W238-02, EXE-PJ07W238-03 and EXE-PJ07W238-04.

2.2 Intended readership

The intended audience for this document is the other team members of the Solution PJ.07-W2-38.

HP practitioners at the level of the transversal areas and federating projects are also expected to have an interest in this document.

And members of related SESAR projects:

- PJ.07-W2-38 Solutions members;
- Airspace Users involved in PJ.07;
- PJ.07 PCIT;
- PJ.19;
- The SJU.





2.3 Structure of the document

The Human Performance Assessment Report contains 5 Chapters:

- Chapter 1 contains an executive summary which gives information about the purpose and scope of the validation exercise, including a reference to results and conclusions, as well as recommendations and recommendations.
- Chapter 2 describes the purpose and the scope of the document, introducing the intended readership and detailing the HP work schedule within the Solution. It entails a list of acronyms and terminology.
- Chapter 3 provides information with regard to the HP Assessment Process.
- Chapter 4 in line with the HP reference material, it describes the 4 steps defined in the HP Assessment Process:
 - Step 1: Understand the operational improvements
 - Step 2: Understand the HP Implications
 - Step 3: Improve and validate the concept
 - Step 4: Collate findings & conclude on transition to the next V-phase.
- Chapter 5 is intended to include all relevant reference material as well as additional information in the Appendixes:
 - Appendix A: recommendations register
 - Appendix B: requirements register
 - Appendix C: HP Log

2.4 Acronyms and Terminology

| Acronym | Definition |
|---------|------------------------------------|
| AU | Airspace User |
| ВА | Business Aviation |
| eDCB | Enriched Demand Capacity Balancing |
| FPL | Flight Plan (FF-ICE FPL) |
| FDCI | Flight Delay Criticality Indicator |
| FMP | Flow Management Position |





| FOC | Flight Operations Centre |
|--------|-------------------------------------|
| NM(OC) | Network Manager (Operations Centre) |
| 01 | Operational Improvement |
| P-FDCI | Proactive FDCI |
| РН | Protection Hotspot |
| R-FDCI | Reactive FDCI |
| STAM | Short-Term ATFCM Measures |
| ТВО | Trajectory Based Operations |
| TV | Traffic Volume |

Table 1 : Acronyms

For more exhaustive acronyms list, refer to Error! Reference source not found. (Chapter 2.6)

| Term | Definition | | | | |
|--------------------------|---|--|--|--|--|
| DCB Constraints | ATM Constraints originating from Demand Capacity Balancing (DCB) that impact a trajectory. Example of DCB Constraints: ATFM regulations, Scenarios and STAM applied to a flight | | | | |
| DCB Trajectory Measure | A trajectory change notified to an AU for a flight due to DCB Constraints. Example: CTOT or Target Time (TT), re-routing or level capping imposed in the context of Scenarios or STAMs | | | | |
| Enriched-DCB Information | In addition to DCB Constraints and DCB Trajectory Measures, information provided to the AU to give awareness of DCB information along the trajectory. This includes hotspot information (resolution and protection) and traffic volume load. | | | | |
| HotSpot | A local demand/capacity imbalance on the day of operations, which may result from a complex traffic situation or a short period of high demand. A hotspot is created to raise awareness of the situation and may act as a precursor to solving the imbalance (STAM or ATFM regulation). | | | | |
| 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. | |
| 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 SESAR Solutions into larger clusters (e.g. SESAR Projects, deployment packages) in SESAR. | |
| 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 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 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 SPR-INTEROP/OSED, or TS/IRS. 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. | |
| 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 workplace) 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 <i>as focussing on the observable result of human</i> <i>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. | |





| Mandatory Cherry Picking Measure | A Mandatory Cherry Pick regulation (MCP) is used as a DCB measure to solve short peaks (e.g., 1h or 1h 30min) of limited number of flights in congested areas. It consists of selecting flights creating complexity and applying ATFCM measures only to those flights. It may be used in combination with other measures (e.g., scenario) or other options available to the FMP. | | |
|---|---|--|--|
| Negotiating 4D Trajectory | A 4D trajectory proposed by airspace user or ASP as a potential agreed 4D trajectory. Explanation: For trajectory planning purposes, multiple trajectories may be required however, each participant would be allowed only one negotiating 4D trajectory at a time which represents their most recent proposal in the negotiation. These trajectories may not necessarily be a gate-to-gate trajectory. These trajectories are intended to be transitory. | | |
| Planning Status | The expected operational acceptability and applicable constraints for a submitted Preliminary Flight Plan. | | |
| | In this document, the planning status is considered as the container of information of the FF-ICE planning service to provide to AUs enriched DCB information related to the planned trajectory included in the flight plan. This planning status information is provided/updated all along the flight plan lifecycle whatever the type of flight plan (PFP, eFPL). This is a deviation from the ICAO definition (Planning status only related to PFPs). | | |
| Preliminary Flight Plan | The flight plan submitted by an operator or a designated representative to conduct collaborative planning of a flight, prior to filing a flight plan for use by ATS units. | | |
| Pro-active FDCI (or Proactive PFDCI) | Pro-active FDCI: issued for critical flights, with no reported delay yet and before any DCB measure is allocated to the flight. The intention is that NMF consider this information before implementing any measure. | | |
| Protection Hotspot | Hotspot associated to a traffic volume usually close to saturation to protect an airspace from undesired rerouted flights and prevents the application of DCB measures (e.g.: ATFCM regulation, cherry picking measures). This is a new kind of hotspot. In the rest of this document the term "protection hotspot" is used when referring to this specific type of hotspot. | | |
| Provisional Delay | The indicative and non-final ATFCM delay incurred by a flight subject to a CASA regulation before the time at which the slot is issued 2 hours before EOBT. This delay may vary because of, for instance, slot revision which re-assigns the slots dynamically in function of the changing traffic demand | | |
| Reactive FDCI | Reactive FDCI (validated during W1, V3 maturity): issued when a DCB measure is already affecting the flight with the aim that NMF can take any corrective action to reduce the impact. | | |





| Real Time Simulation (RTS) | Simulations where part of the agents are computer models while some | | |
|----------------------------|---|--|--|
| | of them are human operators (e.g.: pilots, controllers, FMPs, AUs) | | |

Table 2: Terminology

For more exhaustive terminology list, refer to Error! Reference source not found. Error! Reference source not found. (Chapters 2.5 and 2.6)





3 The Human Performance Assessment Process: Objective and Approach

The purpose of the HP assessment process described in detail in **Error! Reference source not found.** is to ensure that HP aspects related to SESAR 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.

The HP assessment process is a four-step process. **Error! Reference source not found.** provides an overview of these four steps with the tasks to be carried out and the two main outputs (i.e., HP plan and HP assessment report).

Throughout the HP assessment process, the HP experts collaborate with the other Transversal Areas (TAs) to ensure that there is not overlap between the objectives defined or that there are no issues/benefits that have not been considered. Safety is one of the TAs with whom the HP experts interact the most, from identifying the list of changes and activities that will be included in the HP Plan to conducting joint workshops following the validation exercises. A detailed overview of the synergies with other TAs can be found in the HP reference Material.







Figure 2: Step of the HP assessment process





4 Human Performance Assessment

4.1 AUO-0219

4.1.1 Step 1 Understand the ATM concept

4.1.1.1 Description of reference scenario

The reference scenarios linked to AUO-0219 "Enriched DCB Information and What-if function" are described in [EXE-PJ07W238-02] Section 5.2.4.1 and [EXE-PJ07W238-04] Section 5.4.4.1 of the Validation Plan Part [1].

4.1.1.2 Description of solution scenario

The assumptions linked to AUO-0219 "Enriched DCB Information and What-if function" are described in [EXE-PJ07W238-02] Section 5.2.4.2 and [EXE-PJ07W238-04] Section 5.4.4.2 of the Validation Plan Part I [1].

The EXE-PJ07W238-02 was based on traffic replay, no specific event occured during the session. For instance, we were not able to add a strong weather event or ATC Capacity event. Thus, the solution scenario was quite similar to reference scenario situation, but human operators were able to handle the situation with all added features introduced by AUO-0219.

Note that the focus was not set on HMI's usability, but on the operational concepts. However, a HP objective to outline the needs for future implementation has been writen and considered.

4.1.1.3 Consolidated list of assumptions

The assumptions linked to AUO-0219 "Enriched DCB Information and What-if function" are described in [EXE-PJ07.W2-38-02] Section 5.2.5 and [EXE-PJ.07-W2-38-04] Section 5.4.5 of the Validation Plan Part I [1].

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

No relevant related SESAR Solution has been identified.

| HP argument branch | Change & affected actors | |
|------------------------------|--|--|
| 1. ROLES & RESPONSIBILITIES | | |
| 1.1 ROLES & RESPONSIBILITIES | No change | |
| 1.2 OPERATING METHODS | AUs & FMPs: | |
| | - Rules regarding PH declaration | |
| | - Rules regarding Infringers and unplanned flights | |

4.1.1.5 Identification of the nature of the change





| 1.3 TASKS | AUs: | | | | |
|----------------------------------|--|--|--|--|--|
| | - Check before refiling if the flight enters a PH and if yes try to avoid | | | | |
| | - Check rerouting proposals from automatic system | | | | |
| | | | | | |
| | FMPs: | | | | |
| | - Declare and monitor PH using the monitoring and alert information | | | | |
| | - Check the feasibility to activate DCB measure (MCP) impacting only infringers | | | | |
| | - Post-ops analysis on PH | | | | |
| | NMOC: | | | | |
| | - Monitoring the delays and regulations | | | | |
| 2. Human & System | | | | | |
| 2.1 ALLOCATION OF TASKS (HUMAN & | AUs | | | | |
| System) | - The system proposes proactively or on demand some re- routings to reduce ATFCM delay | | | | |
| | | | | | |
| | FMPs | | | | |
| | - The system informs FMPs about the evolution of the traffic (IN/OUT/Alert) and the project load. | | | | |
| | - The system informs FMPs about Infringer flights | | | | |
| 2.2 PERFORMANCE OF TECHNICAL | AUs: | | | | |
| System | - Enriched DCB information must be relevant & necessary to the tasks being performed, accurate and presented in a timely manner. | | | | |
| | FMPs: | | | | |





| | - TV loads and evolution of the traffic loads information must be relevant & necessary to the tasks being performed, accurate and presented in a timely manner. |
|-------------------------------|---|
| 2.3 HUMAN – MACHINE INTERFACE | AUs |
| | - AOWIR function providing enriched DCB information and Infringer status |
| | - Display of AU system proposals (with enriched DCB information) for re-routings to reduce ATFCM delay, based on Airline Satisfaction Index |
| | - Display of Enriched DCB information related to a flight |
| | - Display infringer status for a flight |
| | |
| | FMPs |
| | - The FMP declares threshold for specific TVs |
| | - The system alerts the FMP when potential need for PH (when traffic above the threshold) |
| | - The system informs the FMP about the evolution of the traffic load |
| | - The FMP declares PH in the HM Interface |
| | - The system informs the FMPs about Infringing flights (best candidate for MCP) |
| | |

3. TEAMS & COMMUNICATION

| 3.1 TEAM COMPOSITION | No change |
|-------------------------|--|
| 3.2 ALLOCATION OF TASKS | No change |
| 3.3 COMMUNICATION | No change [No major change in communication means, but changes may impact the communication efficiency. So, note that this argument is still assessed with an objective related to "Arg. 3.3.4: The communication load of team members is acceptable in normal and abnormal conditions and degraded mode of operations." and "Arg. 3.3.5: Team members can maintain a sufficient level of shared situation awareness."] |





| 4. HP RELATED TRANSITION FACTORS | |
|---|---|
| 4.1 ACCEPTANCE & JOB SATISFACTION | No change. |
| 4.2 COMPETENCE REQUIREMENTS | Training to use the system evolutions (To be confirmed by validation exercises to identify if any noticeable change in training is necessary) |
| 4.3 STAFFING REQUIREMENTS & STAFFING LEVELS | No change. |

Table 3: Description of the change





4.1.2 Step 2 Understand the HP implications

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

Most of identified Human Performance Issues and Benefits are not related to a particular event or situation. Moreover, the assessed OIs are not expected to have a major impact on a particular aspect of Human Performance (workload, situation awareness, fatigue, social factors / CRM, etc.). Therefore, the majority of HP recommended activities are standards and could be summarized as follow:

- Design of working method, Mock-up, and prototyping with quick user testing throughout the design process
- Task analysis (current operations and with new OI implemented)
- RTS with observation, questionnaire, and debriefing

These three activities have been conducted and contributed to all HP issues and benefits. Therefore, the dedicated column has been deleted to keep the table below light and clear.

Some of the following HP issues and benefits have not been fully assessed during the real time simulation. Indeed, during the design phase some extra features have been anticipated but unfortunately, we were not able to develop them in time. In addition, several HP issues have been anticipated regarding abnormal conditions, more specifically lost features. Unfortunately, the simulation platform was not flexible enough to disable (on demand) specific feature. When it was possible, even if we were not able to remove a feature, we provided preliminary analysis based on other feedback we got (verbatims, logs...).

Apart from these exceptions, the activities took place as planned (cf: HP Log).

| Arg. | Issue ID | HP issue / Benefit | Actors involved | HP/Valid. Obj. ID | HP validation objective |
|-------|---------------------------------------|--|--------------------|--------------------------------|--|
| 1.2.1 | HP- PJ07W238- V3-VALP- H11-1 | BENEFIT: Operating methods for FMP (and NM) related to PH declaration are expected to be exhaustive and cover operations in normal operating conditions | FMP, NM | OBJ-PJ07W238-V3- VALP-H11-1 | Assess if the system provides exhaustive solution for FMP to declare PH in normal operating conditions |

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EUROPEAN PARTNERSHIP





| 1.2.1 | HP- PJ07W238- V3-VALP- H11-2 | BENEFIT : The operating methods related to PH identification and its integration with current routing operation are expected to cover operations in normal operational conditions for AUs | AU | OBJ-PJ07W238-V3- VALP-H11-2 | Assess if the system provides exhaustive solution to AUs to identify PH and integrate them in routing operations in normal operating conditions |
|-------|---------------------------------------|---|-------------|--------------------------------|---|
| 1.2.1 | HP- PJ07W238- V3-VALP- H11-3 | BENEFIT: The operating methods related to Infringer flights identification, alert and management are expected to be exhaustive and cover operations in normal operational conditions for FMPs and AUs | AU, FMP | OBJ-PJ07W238-V3- VALP-H11-3 | Assess if the system provides exhaustive solution to FMPs and AUs to identify, alert and manage flight infringing PH in normal operating conditions |
| 1.2.2 | HP- PJ07W238- V3-VALP- H11-4 | ISSUE: In case the identification of flights infringing PH is not available, FMPs will not be able to identify them, potentially resulting in a non-optimal application of MCP regulation | FMP | OBJ-PJ07W238-V3- VALP-H11-4 | Assess if the system supports FMPs decision making considering MCP regulation even if FMPs are not able to identify PH infringement. |
| 1.2.2 | HP- PJ07W238- V3-VALP- H11-5 | ISSUE: In case the PH declaration is not shared with AUs, they may refile in the PH, resulting in a potential "penalty". This may also lead to a new refiling and therefore workload increase for AUs, FMPs and NM | AU | OBJ-PJ07W238-V3- VALP-H11-5 | Assess if the system supports AUs refiling even if PH declaration information is not available. |
| 1.2.4 | HP- PJ07W238- V3-VALP- H11-6 | BENEFIT: The operating methods related to PH concept are expected to be clear and consistent for all relevant staff involved in the process. | AU, FMP, NM | OBJ-PJ07W238-V3- VALP-H11-6 | Evaluate the consistency of operating methods related to eDCB between all relevant staff involved in the process. |
| 1.3.3 | HP- PJ07W238- V3-VALP- H12-1 | BENEFIT: AU trajectory planning taking into account enriched DCB information (e.g. Hotspot Information) helps some heavy and complex current tasks. | AU | OBJ-PJ07W238-V3- VALP-H12-1 | Assess whether AU trajectory planning is facilitated (workload) thanks to eDCB information |
| 1.3.3 | HP- PJ07W238- V3-VALP- H12-2 | ISSUE: The FMP's workload could slightly increase as they may need to monitor more information such as traffic load tendency. However, this slight increase should be counterbalanced by the reduction of traffic volatility | FMP | OBJ-PJ07W238-V3- VALP-H12-2 | Assess if FMP's workload related to traffic monitoring and protection hotspot declaration is maintained to an acceptable level |





| 1.3.3 | HP- PJ07W238- V3-VALP- H12-3 | ISSUE: The workload could slightly increase for NM operators as they may need to monitor PH at network level. However, this slight increase should be counterbalanced by the reduction of traffic volatility | NM | OBJ-PJ07W238-V3- VALP-H12-3 | Assess if NM's workload related to network monitoring and protection hotspot declared is maintained to an acceptable level |
|-------|---------------------------------------|--|---------|--------------------------------|---|
| 1.3.1 | HP- PJ07W238- V3-VALP- H13-1 | BENEFIT: For AUs, the system may trigger an alert/confirmation step to inform AUs if a rerouting on a protection hotspot is performed, mitigating the risk of unintentional rerouting in protection hotspot. | AU | OBJ-PJ07W238-V3- VALP-H13-1 | Assess if the system provides appropriate information to AUs to identify human error in case of rerouting in PH (leading to a flight tagged as infringer) |
| 1.3.5 | HP- PJ07W238- V3-VALP- H13-2 | BENEFIT: The system provides multiple means to mitigate the risk of erroneous action. For FMPs, the system provides an alert to clearly identify TVs that are suitable for PH declaration, which may reduce the risk of erroneous declaration or missed declaration opportunity. It also helps identifying unplanned flight. The system also provides an easy way to identify PH infringement, which should mitigate the risk of inappropriate selection of flights for MCP. Moreover, the system supports FMPs to identify when a PH should be cancelled. | AU, FMP | OBJ-PJ07W238-V3- VALP-H13-2 | Assess if the system provides appropriate information to AUs and FMPs to avoid human error related to identifying TV suitable for PH, identifying unplanned flight and PH infringer. |
| 1.3.5 | HP- PJ07W238- V3-VALP- H13-3 | BENEFIT: The AUs are, when needed, informed of the up-to-date status of loaded TVs and PH declaration. It allows them to maintain a sufficient level of awareness of the operational situation when they need to refile. | AU | OBJ-PJ07W238-V3- VALP-H13-3 | Assess AUs' situational awareness about TV loading for refiling operations |
| 1.3.5 | HP- PJ07W238- V3-VALP- H13-4 | BENEFIT: The FMPs are always informed of the up- to-date traffic evolution of their monitored TV. It allows them to create PH when they need to protect a TV. | FMP | OBJ-PJ07W238-V3- VALP-H13-4 | Assess FMPs' situational awareness considering flight traffic evolution on their TVs (thanks to unplanned flight information) |





| 1.3.5 | HP- PJ07W238- V3-VALP- H13-5 | BENEFIT: NM has a better view of TV saturation level. It allows them to improve the network operational situation. | NM | OBJ-PJ07W238-V3- VALP-H13-5 | Assess if situational awareness considering TV saturation level helps NM to improve the network operational situation |
|-------|---------------------------------------|--|-------------|--------------------------------|---|
| 3.3.5 | HP- PJ07W238- V3-VALP- H13-6 | BENEFIT: Thanks to the additional information sharing the shared situation awareness is expected to be improved for all actors (AUs, FMP & NM). | AU, FMP, NM | OBJ-PJ07W238-V3- VALP-H13-6 | Assess if the shared situational awareness between AUs, FMPs and NM is acceptable and improved compared to the reference scenario |
| 1.3.1 | HP- PJ07W238- V3-VALP- H13-7 | BENEFIT: For FMPs, when they apply MCP measures in a hotspot protected TV, the system may trigger an alert/confirmation step to inform FMPs if they plan to apply MCP to "non infringer flight" (only when alternative infringer flights are available) | FMP | OBJ-PJ07W238-V3- VALP-H13-7 | Assess if the system provides appropriate information to FMPs to identify human error |
| 1.3.5 | HP- PJ07W238- V3-VALP- H13-8 | BENEFITS: The system provides a "Traffic trend" feature to visualize last 30 minutes traffic evolution. This feature improves FMP's situation awareness about the traffic evolution (and potential upcoming traffic tendency) | FMP | OBJ-PJ07W238-V3- VALP-H13-8 | Assess FMPs' situational awareness considering Traffic trend/tendency |
| 2.1.2 | HP- PJ07W238- V3-VALP- H14-1 | BENEFIT : New automation features provided by the system is expected to efficiently support AU operator to find the best solution when filing/refiling | AU | OBJ-PJ07W238-V3- VALP-H14-1 | Evaluate how the automated refiling proposals support AU decision making during filing/refiling operations |
| 2.1.6 | HP- PJ07W238- V3-VALP- H14-2 | ISSUE: Automated functions provide an alert to FMPs to identify "TV of interest". A poor design / configuration may trigger too many false alarm or missed positive leading to a loss of trust in the system. | FMP | OBJ-PJ07W238-V3- VALP-H14-2 | Assess if the level of trust in the identification of "TV of interest" by the FMPs is acceptable |
| 2.2.2 | HP- PJ07W238- | BENEFIT: In case of ATFCM delay, the new process allows the AUs to generate/check What-if rerouting or ask/check for automatic route proposals to refile out of PH in a timely manner. It should improve | AU | OBJ-PJ07W238-V3- VALP-H14-3 | Assess if the new operating procedures allow AUs to efficiently and timely reroute out of PH. |





| 2.2.2 | V3-VALP- H14-3 HP- PJ07W238- V3-VALP- H14-4 | timeliness of task-related analysing and decision making refiling actions. ISSUE: FMPs are supported by automated alerts triggered by the system to identify potential problematic TVs. This identification should occur in the right time to allow FMPs to react consequently. A bad timing (too soon or too late) may result in | FMP | OBJ-PJ07W238-V3- VALP-H14-4 | Assess if the timeliness of automated detection of problematic TVs and associated alarm triggering is appropriate to cope with the situation (understand the criticality of the situation; declare hotspot) and support efficiently the |
|-------|--|--|-------------|--------------------------------|--|
| | | either a alarm disregard (or even alarm deactivation) or unexpected increase of workload and stress due to late action to be performed | | | FMP |
| 2.3.1 | HP- PJ07W238- V3-VALP- H14-5 | BENEFIT : The system provides additional information for FMPs such as: - Identification of problematic TV - Detailed Traffic loads (including movements In & Out) - Current traffic tendency - Means to declare a protection hotspot - Identification of PH infringement All these information should satisfy information requirements for FMP to perform their tasks efficiently | FMP | OBJ-PJ07W238-V3- VALP-H14-5 | Evaluate if the information provided by the system to FMPs are exhaustive enough to support their task efficiently |
| 2.3.1 | HP- PJ07W238- V3-VALP- H14-6 | BENEFIT: The system provides additional information for AUs such as: filing/refiling proposal Declared PH All this data should satisfy information requirements for AUs to perform their tasks efficiently | AU | OBJ-PJ07W238-V3- VALP-H14-6 | Evaluate if the information provided by the system to AUs are exhaustive enough to support their task efficiently |
| 2.3.6 | HP- PJ07W238- V3-VALP- H14-7 | ISSUE: A poorly designed HMI may reduce human performance and lead to human error, loss of motivation or loss of commitment (for all actors). | AU, FMP, NM | OBJ-PJ07W238-V3- VALP-H14-7 | Assess if the usability of user interface is acceptable (for all actors) |





| 2.3.1 | HP- PJ07W238- V3-VALP- H14-8 | BENEFITS: The OI AUO-0219 is intended to support collaborative decision making thanks to additional information sharing. The system (back end and front end HMI) is expected to efficiently assist human operators (AUs, FMP & NM) by providing adequate exchanged data through appropriate visual displays. | AU, FMP, NM | OBJ-PJ07W238-V3- VALP-H14-8 | Assess if the system does provide enough support for collaborative decision making (data pertinence, understandable and useful visual displays, etc.) for all human operator involved (AUs, FMPs & NM) |
|-------|---------------------------------------|--|-------------|--------------------------------|--|
| 3.3.4 | HP- PJ07W238- V3-VALP- H15-1 | BENEFIT: Thanks to the additional information sharing provided by enriched DCB, the communication/coordination load is expected to be reduced for team members (AUs, FMP & NM) | AU, FMP, NM | OBJ-PJ07W238-V3- VALP-H15-1 | Evaluate the communication/coordination load for each actor (AUs, FMP & NM) and compare it to the reference communication load |
| 4.2.1 | HP- PJ07W238- V3-VALP- H16-1 | ISSUE: New features provided by the system may lead to a need of training for all actors involved (AUs, FMP & NM) | AU, FMP, NM | OBJ-PJ07W238-V3- VALP-H16-1 | Evaluate key component of training required for each actor involved (AUs, FMPs and NM) |
| 1.2.1 | HP- PJ07W238- V3-VALP- H31-1 | ISSUE (common to AUO-0219 and AUO-0208) : A P-FDCI flight may be refiled in a protection hotspot and become infringer. According to the defined procedures, infringer flights should be the first ones to be penalized (e.g., with MCP) but, as a P-FDCI flight, it should be exempt from delay as much as possible leading to a conflicting situation for NM and FMP that should manage the TV | FMP, NM | OBJ-PJ07W238-V3- VALP-H31-1 | Assess if NM and FMP can manage efficiently the conflicting situation of P-FDCI flight infringing a PH |
| 1.2.1 | HP- PJ07W238- V3-VALP- H31-2 | ISSUE (common to AUO-0219 and AUO-0208) : A P-FDCI flight may be refiled in a protection hotspot and become infringer. This conflicting situation may not be easy to manage locally or centrally, so it may be interesting to manage it directly at the AU level (e.g., refile out of PH, remove FDCI, etc.) | AU | OBJ-PJ07W238-V3- VALP-H31-2 | Assess how AU can manage the conflicting situation of P-FDCI flight infringing a PH |

Table 4: HP Arguments, related HP issues and benefits, and proposed HP activity



4.1.3 Step 3 Improve and validate the concept

4.1.3.1 Description of HP activities conducted

This section describes Human Performance activities selected based on the relevant arguments and HP issues & benefits, identified in the **Error! Reference source not found.** (see Appendix C).

Four major human performance activities have been conducted in this project. Three of them were validation exercises implicating human in the loop and the other one was a design process based on mock-ups and prototyping.

Even if there were three validation exercises in total, only two validation exercises covered on AUO-0219. The table below lists the HP activities related to AUO-0219 with their targeted deadlines.

| HP activity | By when |
|--|---------|
| Mock-ups and Prototyping of ATM solutions | Q2 2021 |
| EXE-PJ07W238-02 (RTS, AUO-0219) | Q4 2021 |
| EXE-PJ07W238-04 (RTS, AUO-0219 & AUO-0208) | Q2 2022 |

Table 5: Table of proposed HP activities and their priority

| ACTIVITY 1. | Mock-ups and Prototyping of ATM solutions for PLANTA | | | |
|--|---|--|--|--|
| Description | Mock-ups are static user interfaces used to illustrate the future human-machine interfaces to visualize how new concepts could be implemented later. Prototypes are interactive and functional user interfaces used to test the concept in a more realistic and dynamic conditions. | | | |
| HP OBJECTIVES | HP Objectives from VALP are macro objectives including several HP objectives from HP log: HP-PJ07W238-V3-VALP-H11 HP-PJ07W238-V3-VALP-H12 HP-PJ07W238-V3-VALP-H13 HP-PJ07W238-V3-VALP-H14 Detailed HP objectives can be found in the Error! Reference source not found. (see Appendix C). | | | |
| Tool selected out of the HP repository | N/A | | | |

| Planning | and | Mock-up and prototyping activities were performed from Q3 | | |
|----------|-----|--|--|--|
| Approach | | 2020 to Q2 2021. The approach could be summarized as: | | |
| | | Understand the ATM concepts Define all related needs for all operators (focus for the mockups has been done on FMP side as DSNA performed this activity) Understand the current platform used as a reference (PLANTA) for the design (platform was updated to implement new concepts) Design mockups with associated working methods Iterative process with regular meetings to share the mockups and discuss with end users, and quick updates of the HMIc; | | |
| timeline | | Initial draft of HMIs has been completed by Q4 2020 Final version of HMIs has been discussed and provided for dauglagment by Q2 2021 | | |
| | | Additional mock-ups and prototypes was performed between Q4 2021 and Q2 2022 to support EXE-PJ07W238-04 in case the platform used for the evaluation is not the same as the one used for EXE-PJ07W238-02 | | |

Table 6: Description of Activity 1- Mock-ups and Prototyping of ATM solutions

| Αςτινιτγ 2 | EXE-PJ07W238-02 (RTS, AUO-0219) |
|---------------|---|
| Description | HP evidences were gathered during a Real Time Simulation implicating FMP operators from DSNA and ENAV, and NMOC. During this activity, Airspace Users behaviour was "simulated" by the system, no AU ops personnel was involved from AU side. |
| | The RTS was based on real traffic from 2 days of summer 2019 (thanks to replay mode) in order to evaluate AUO-0219 concept with a representative traffic distribution (before the worldwide sanitary crisis). |
| | Due to the sanitary context (COVID-19), this exercise was performed remotely, which means that every participant was staying at his own premises. |
| | Human Performance analysis was mainly based on observation and debriefing sessions performed immediately after each runs/scenarios. Custom questionnaires were used to complete the analysis as well as some logs. Because of the multiple locations, questionnaires were sent and filled via an online tool. |
| HP objectives | HP Objectives from VALP are macro objectives including several HP objectives from HP log: |



| | HP-PJ07W238-V3-VALP-H11 HP-PJ07W238-V3-VALP-H12 HP-PJ07W238-V3-VALP-H13 HP-PJ07W238-V3-VALP-H14 HP-PJ07W238-V3-VALP-H15 HP-PJ07W238-V3-VALP-H16 Detailed HP objectives can be found in the Error! Reference source not found. (see Appendix C). |
|---|---|
| Tool selected out of the HP repository | N/A |
| Planning and Approach | The validation exercise EXE-PJ07W238-02 was performed from October to December 2021, more precisely: A scenario testing session was organized in October Final rehearsal / Dry run occurred at the end of November Exercise runs (4 half days) were performed from 30/11/21 to 01/12/21 |
| timeline | The overall timeline may be summarized as follow: Concept definition (Use cases, definition, working methods, discussions with all partners,) until Q2 2021 Definition of validation objectives and associated evaluation methods from Q1 to Q4 2021 Validation scenarios definition from Q3 to Q4 2021 Final exercise preparation until November Exercise runs performed from 30/11/21 to 02/12/21 Analysis and report integrating all exercises for August 2022 |

Table 7: Description of Activity 2 - EXE-PJ07W238-02 (RTS, AUO-0219 e-DCB)

| Астіvіту З | EXE-PJ07W238-04 (RTS, AUO-0219 & AUO-0208) |
|-------------|---|
| Description | HP evidences have been gathered during a Real Time Simulation implicating human operators from all stakeholders, namely ANSPs (DSNA & ENAV), Network Manager (NMOC) and AUs (Air France, Transavia, Air Baltic, El Al, Swiss, Ryanair & DASSAULT). |
| | The RTS was performed with shadow mode traffic with adapted plan to have an interesting scenario. |
| | This exercise was performed remotely, the participants were located in their own operational centres. |
| | Human Performance analysis was mainly based on observation and debriefing sessions performed immediately after each runs/scenarios. Custom |



| | questionnaires were used to complete the analysis as well as some logs. Because of the multiple locations, especially with AU, questionnaires were sent and filled via an online tool. In addition, two standardized questionnaires were used (online): SATI - SHAPE Automation Trust Index [3] |
|--------------------------|--|
| | SASHA - Situation Awareness for SHAPE [4] |
| | A global debriefing was also be performed with all operators from ANSP, NM and AU in order to confront actors with each other's opinions and gather an overall feedback considering the collaborative decision making and shared situational awareness. |
| HP objectives | HP Objectives from VALP are macro objectives including several HP objectives from HP log: |
| | AUO-0219 (e-DCB): |
| | HP-PJ07W238-V3-VALP-H11 HP-PJ07W238-V3-VALP-H12 HP-PJ07W238-V3-VALP-H13 HP-PJ07W238-V3-VALP-H14 HP-PJ07W238-V3-VALP-H15 HP-PJ07W238-V3-VALP-H16 |
| | AUO-0208 (P-FDCI): |
| | HP-PJ07W238-V3-VALP-H21 HP-PJ07W238-V3-VALP-H22 HP-PJ07W238-V3-VALP-H23 HP-PJ07W238-V3-VALP-H24 HP-PJ07W238-V3-VALP-H25 HP-PJ07W238-V3-VALP-H26 |
| | In addition, an objective specific to the combination of P-FDCI and eDCB has been included in exercise 04: |
| | • HP-PJ07W238-V3-VALP-H31 |
| | Detailed HP objectives linked to these macro HP objectives from VALP can be found in the Error! Reference source not found. (see Appendix C). |
| Tool selected out of the | Two standardized questionnaires from HP repository were used (online): |
| HP repository | SATI - SHAPE Automation Trust Index [3] SASHA - Situation Awareness for SHAPE [4] |
| Planning and Approach | Two dry runs were planned in April and May 2022: |
| | • 21 & 22 April 2022 including all AUs, NMOC, and ENAV; |





| | 3 May 2022 including AF and/or Transavia, NMOC, ENAV and DSNA. The validation exercise EXE-PJ07W238-04 has been performed in May (2x2days): 05 & 06 May 2022 12 & 13 May 2022 |
|----------|---|
| timeline | The overall timeline can be summarized as follow: Concept definition (Use cases, definition, working methods, discussions with all partners,) until Q2 2021 Definition of validation objectives and association evaluation methods from Q1 to Q4 2021 Validation scenarios definition during Q1 2022 Dry runs in April and May (2 sessions) Final exercise preparation until May 2022 Exercise runs were performed 5 & 6 May 2022 and 12 & 13 May 2022 Analysis and report integrating all exercises for August 2022 |

Table 8: Description of Activity 3 - EXE-PJ07W238-04 (RTS, AUO-0219 & AUO-0208)

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

4.1.4.1 Summary of HP activities results & recommendations / requirements

Following table provides a summary of the HP argument and related issues/benefits along with the HP activities conducted during the V3 validation phase. It reports on the outcomes of HP issues that were included into the V3 HP assessment plan. For each argument and issue/benefit the results/evidences 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'. Note that, in this phase, the issue is considered as being 'open' because the issue has been either: partially addressed and more studies are needed. All the results/evidence gathered in the following table, are extrapolated during the Real Time Simulation through-ad hoc post run, post simulation questionnaire and several debriefings.

The HP recommendations and requirements fall into one of several categories:

- HMI
- OPS (operating methods/procedures)
- Training
- Other aspect investigated during the Real Time Simulation EXE-PJ07W238-02 and EXE-PJ07W238-04.





For more details, standard tools used to assess main Human Performance aspects, refers to Validation Report Part I [2].

The table is sequenced according to the different concepts tested during three exercises:

- EXE-PJ07W238-02 (RTS, AUO-0219)
- EXE-PJ07W238-04 (RTS, AUO-0219 & AUO-0208)





Finding and results for AUO-0219

| Issue ID | HP issue / Benefit | Status | HP/ Valid. Obj. ID | activity conducted | results / evidence | recommendatio ns | requirements | | | |
|---|--|--------|--|-------------------------|--|---------------------|--|--|--|--|
| Arg. 1.2.1: Operating methods cover operations in normal operating conditions | | | | | | | | | | |
| HP- PJ07W238- V3-VALP- H11-1 | BENEFIT: Operating methods for FMP (and NM) related to PH declaration are expected to be exhaustive and cover operations in normal operating conditions | Open | OBJ- PJ07W238- V3-VALP- H11-1 | Real Time Simulation | FMPs had no difficulty for the declaration of a PH, they declared the solution "easy to use". The approved workflow was: FMPs put a PH on a sector to protect it from an overload in anticipation of a future regulation FMPs put on a TV a high-rate regulation (so as not to constrain the flights), to avoid them from passing "wildly" FMPs decided who can pass into the sector protected by the PH, and gave priority to flights affected by the regulation During the evaluation (EXE-PJ07W238-04), this workflow was disrupted by NM who was unaware of the PHs. He made rerouting within the PH which caused a loss of control of it by the FMPs (cf: H12-2; H12-3; H13-6). The protection hotspot declaration process is perceived as clear and relevant for all users and consistent with the current activities. | | PJ.07-W2- 38_AUO- 0219_REQ_Desi gn_01 | | | |
| HP- PJ07W238- | BENEFIT: The operating methods related to PH identification and its integration | Open | OBJ- PJ07W238- | Real Time Simulation | AUs found the solution exhaustive enough to perform their tasks. The PH were well identified thanks to the integration in the NavBlue and Dassault prototypes. | | | | | |

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| V3-VALP- H11-2 | with current routing operation are expected to cover operations in normal operational conditions for AUs | | V3-VALP- H11-2 | | Flight trajectory tool was able to integrate PH information allowing AU operators to perform rerouting within or outside of PH. | |
|---------------------------------------|--|------|--|-------------------------|---|--|
| HP- PJ07W238- V3-VALP- H11-3 | BENEFIT: The operating methods related to Infringer flights identification, alert and management are expected to be exhaustive and cover operations in normal operational conditions for FMPs and AUs | Open | OBJ- PJ07W238- V3-VALP- H11-3 | Real Time Simulation | FMPs had no difficulty to identify the infringers. They used the filters to display them, and the associated tags to help in their identification. During the debriefing, the FMPs explained they did not have a lot of infringers to deal with. They later believed that the AUs probably saw PH as an impermeable place in which they can't enter. FMPs see them more as an information provided to the AUs, indicating that the sector is sensitive. AUs reported being more likely to enter a PH under low workload, knowing that they will have time to react to a potential MCP or later regulation on this TV. All FMPs considered the treatment of infringer flight as clear, relevant, timely and easy with an acceptable workload. FMPs also used "infringer information" for MCP measures: when there was an infringer, FMPs looked first if it overloads the capacity of the sector. To do this, they clicked on it and the infringer appeared on the charts: the information was described as easy to access. If an aircraft was infringer and if it overloaded the capacity, they applied MCP on it after considering its P-FDCI status (cf : h31-1). | |

Arg. 1.2.2: Operating methods cover operations in abnormal operating conditions

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| HP- PJ07W238- V3-VALP- H11-4 | ISSUE: In case the identification of flights infringing PH is not available, FMPs will not be able to identify late refiling in the TV with PH, potentially resulting in a non-optimal application of MCP regulation | Open | OBJ- PJ07W238- V3-VALP- H11-4 | Real Time Simulation | Abnormal conditions have not been assessed directly during the evaluation. Indeed, the platforms used were not modular enough to be able to turn off/on a specific feature. The missing "infringer" information has not been assessed. | PJ.07-W2- 38_AUO- 0219_Reco_Ne wObjective_01 | |
|---------------------------------------|--|------|--|-------------------------|---|---|--|
| HP- PJ07W238- V3-VALP- H11-5 | In case the PH declaration is not shared with AUs, they may refile in the PH, resulting in a potential "penalty". This may also lead to a new refiling and therefore workload increase for AUs, FMPs and NM | Open | OBJ- PJ07W238- V3-VALP- H11-5 | Real Time Simulation | Abnormal conditions have not been assessed directly during the evaluation. Indeed, the platforms used were not modular enough to be able to turn off/on a specific feature. The missing PH information has not been assessed. | PJ.07-W2- 38_AUO- 0219_Reco_Ne wObjective_02 | |

Arg. 1.2.4. The content of operating methods is clear and consistent (in V1: non-contradictory).

| HP- | ISSUE: The operating methods | Open | OBJ- | Real Time | FMPs declared that the operating methods are clear | |
|-----------|-----------------------------------|------|-----------|------------|--|--|
| PJ07W238- | related to PH concept are | | PJ07W238- | Simulation | and exhaustive. FMPs had no difficulty to apply them, | |
| V3-VALP- | expected to be clear and | | V3-VALP- | | and described the concept as useful and easy to use. | |
| H11-6 | consistent for all relevant staff | | H11-6 | | | |
| | involved in the process. | | | | For the AUs, it was clear and as long as they have the | |
| | | | | | information, no issue with the proposed process has | |
| | | | | | been seen. They may accept to refile in PH / create an | |
| | | | | | infringer, or they may try to avoid the PH, depending | |
| | | | | | on the situation (mainly their workload). | |
| | | | | | | |
| | | | | | For NM as mentioned before he did not have the PH | |
| | | | | | information, but during the debriefing he mentioned it | |
| | | | | | should be ok as long as the information is available. | |
| | | | | | | |

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| | | All actors had the same representation of what a PH is | |
|--|--|--|--|
| | | and its potential consequences | |
| | | | |

Arg. 1.3.1. The potential for human error is reduced as far as possible.

| HP- PJ07W238- V3-VALP- H13-1 | BENEFIT: For AUs, the system may trigger an alert/confirmation step to inform AUs if a rerouting on a protection hotspot is performed, mitigating the risk of unintentional rerouting in protection hotspot. | Open | OBJ- PJ07W238- V3-VALP- H13-1 | Real Time Simulation | This alerting feature has not been assessed during the evaluation because it was not implemented in time. Note: this feature was suggested as an optional feature (nice to have) but was not described in the initial definition of the solution. | PJ.07-W2- 38_AUO- 0219_Reco_Des ign_04 | |
|---------------------------------------|---|------|--|-------------------------|---|---|--|
| HP- PJ07W238- V3-VALP- H13-7 | BENEFIT: For FMPs, when they apply MCP measures in a hotspot protected TV, the system may trigger an alert/confirmation step to inform FMPs if they plan to apply MCP to "non infringer flight" (only when alternative infringer flights are available) | Open | OBJ- PJ07W238- V3-VALP- H13-7 | Real Time Simulation | This alerting feature has not been assessed during the evaluation because it was not implemented in time. We can however mention that situational awareness was sufficient to avoid mistakes. Note : this feature was suggested as an optional feature (nice to have) but was not described in the initial definition of the solution. | PJ.07-W2- 38_AUO- 0219_Reco_Des ign_07 | |

Arg. 1.3.3: The level of workload (induced by cognitive and/or physical task demands) is acceptable.

| HP- | BENEFIT: AU trajectory planning | Open | OBJ- | Real Time | The PH made possible to warn the AU of a potentially | PJ.07-W2- |
|-----------|---------------------------------|------|-----------|------------|---|---------------|
| PJ07W238- | taking into account enriched | | PJ07W238- | Simulation | loaded sector in order to dissuade them from entering | 38_AUO- |
| V3-VALP- | DCB information (e.g., Hotspot | | V3-VALP- | | in it, without prohibiting them from doing so. | 0219_Reco_Des |
| H12-1 | Information) helps some heavy | | H12-1 | | | ign_03 |
| | and complex current tasks. | | | | Unfortunately, due to the platform limitations on one | |
| | | | | | prototype the refilling tool was not able to identify | |
| | | | | | properly PH and operators had to manually refile | |
| | | | | | outside PH. Ideally, a better implemented tool could | |

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| | | | | | propose better routing solutions. Another prototype provided this feature and it was well appreciated. | |
|---------------------------------------|---|------|--|-------------------------|--|--|
| HP- PJ07W238- V3-VALP- H12-2 | ISSUE: The FMP's workload could slightly increase as they may need to monitor more information such as traffic load tendency. However, this slight increase should be counterbalanced by the reduction of traffic volatility | Open | OBJ- PJ07W238- V3-VALP- H12-2 | Real Time Simulation | Traffic monitoring and PH declaration didn't increase the workload of FMPs. The reporting method was described as clear enough to allow FMPs to use it efficiently. Protection hotspot slightly reduced the overall workload, especially thanks to infringer information as it really helped to identify flights that are not willing to comply with FMPs' strategy. FMPs considered the level of workload acceptable to declare protection hotspot and to treat infringer flights. They also believed that the use of protection hotspot may reduce the number of regulations and number of resolution hotspots. Moreover, the PH helped to better collaborate with AU and NM, so it reduced the workload. Nevertheless, NM wasn't aware of the PH set by FMPs, which had cause unexpected refiling into the PH by NM operator (cf : H11-1 ; H12-2 ; H13-6). | PJ.07-W2- 38_AUO- 0219_REQ_Desi gn_01 |
| HP- PJ07W238- V3-VALP- H12-3 | ISSUE: The workload could slightly increase for NM operators as they may need to monitor PH at network level. However, this slight increase should be counterbalanced by the reduction of traffic volatility | Open | OBJ- PJ07W238- V3-VALP- H12-3 | Real Time Simulation | NM was unaware of the PHs as they were not implemented in the NMVP tool (cf: H11-1 ; H12-2 ; H13-6). | PJ.07-W2- 38_AUO- 0219_REQ_Desi gn_01 |

Arg. 1.3.5. Human actors can maintain a sufficient level of situation awareness

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| HP- PJ07W238- V3-VALP- H13-2 | BENEFIT: The system provides multiple means to mitigate the risk of erroneous action. For FMPs, the system provides an alert to clearly identify TVs that are suitable for PH declaration, which may reduce the risk of erroneous declaration or missed declaration opportunity. It also help identifying unplanned flight. The system also provides an easy way to identify PH infringement, which should mitigate the risk of inappropriate selection of flights for MCP. Moreover, the system supports FMPs to identify when a PH should be cancelled. | Open | OBJ- PJ07W238- V3-VALP- H13-2 | Real Time Simulation | Information associated to PH were mainly described as relevant. Thanks to the new process, users clearly identified infringer flights in a relevant, accurate and timely manner. The FMPs considered the infringer flight information useful and the provided information on infringer flights allowed them to perform their work efficiently. They knew how to treat infringer flight. During the exercise, FMPs explained that the idea of "Infringer" is great because they could easily/instantly identify which flights did not respect the rules and select them for MCP measure. Also, the overall concept of automated alerting features allowed FMPs to identify TV of interest for Protection Hotspotin a relevant, accurate and timely manner. However, the way alerting was implemented was not optimal. It must be improved in the future HMI, and the alerting features allowed FMPs to identify TV of interest for identify TV of interest for Protection Hotspotin a relevant. | PJ.07-W2- 38_AUO- 0219_Reco_Syst emDesign_05 |
|---------------------------------------|---|------|--|-------------------------|---|---|
| HP- PJ07W238- V3-VALP- H13-3 | BENEFIT: The AUs are, when needed, informed of the up-to- date status of loaded TVs and PH declaration. It allows them to maintain a sufficient level of awareness of the operational | Open | OBJ- PJ07W238- V3-VALP- H13-3 | Real Time Simulation | One of the prototypes used by AU allowed them to visualize and declared PH directly on a map. It was also integrated in the flight trajectory planning feature. Both features allowed AUs' operator to optimize their situation awareness about TV saturation. They also stressed that they do not need more information about the current saturation level | |

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| | situation when they need to refile. | | | | (such as an indicator about the percentage of saturation in a specific TV) because it is not their job to monitor this information. The proposed PH concept perfectly fits their requirement of having an additional information about a TV close to saturation (which should be avoided in case of refiling) without being overloaded with non-relevant information | | |
|---------------------------------------|---|------|--|-------------------------|---|---|--|
| HP- PJ07W238- V3-VALP- H13-4 | BENEFIT: The FMPs are always informed of the up-to-date traffic evolution of their monitored TV. It allows them to create PH when they need to protect a TV. | Open | OBJ- PJ07W238- V3-VALP- H13-4 | Real Time Simulation | FMPs mainly agreed on the fact that unplanned flights information allowed them to understand the situation. Two FMPs disagreed, and explained as things stand they don't know what to do with this information (cf : HP-PJ07W238-V3-VALP-H14-5): it would be very interesting to have more information about the unplanned flights like "why did this flight perform this refiling?" With more information, FMPs could evaluate more easily the impact of a measure (e.g., MCP, level capping, etc.) for a specific unplanned flight. | PJ.07-W2- 38_AUO- 0219_Reco_Syst emDesign_06 | |
| HP- PJ07W238- V3-VALP- H13-5 | BENEFIT: NM has a better view of TV saturation level. It allows them to improve the network operational situation. | Open | OBJ- PJ07W238- V3-VALP- H13-5 | Real Time Simulation | PH information was not shared with NM operator. Thus, he was not able to get a better situation awareness than with current operation. However, during debriefing, NM operator declared it could be an interesting information to better understand which sectors are close to saturation, and in addition on which sectors he should avoid to purpose RRP. Note: this feature was suggested as an optional feature (nice to have) but was not described in the initial definition of the solution. | | |

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| HP- | BENEFIT: The system provides a | Open | OBJ- | Real Time | This "traffic trend" feature has not been assessed | PJ.07-W2- | |
|-----------|-----------------------------------|------|-----------|------------|---|---------------|--|
| PJ07W238- | "Traffic trend" feature to | | PJ07W238- | Simulation | during the evaluation because it was not developed in | 38_AUO- | |
| V3-VALP- | visualize last 30 minutes traffic | | V3-VALP- | | time. | 0219_Reco_Ne | |
| H13-8 | evolution. This feature | | H13-8 | | | wObjective_08 | |
| | improves FMP's situation | | | | | | |
| | awareness about the traffic | | | | | | |
| | evolution (and potential | | | | | | |
| | upcoming traffic tendency) | | | | | | |
| | upcoming traffic tendency) | | | | | | |

Arg. 2.1.2. Changes to the task allocation between human and machine support human performance

| HP- PJ07W238- V3-VALP- | BENEFIT: New automation features provided by the system is expected to efficiently | Open | OBJ- PJ07W238- V3-VALP- | Real Time Simulation | NavBlue, SWISS and Dassault prototypes used for flight planning, were able to integrate PH information in their computations. The systems provided | PJ.07-W2- 38_AUO- 0219_REO_Desi |
|------------------------------|--|------|-------------------------------|-------------------------|--|---------------------------------------|
| H14-1 | support AU operator to find the best solution when filing/refiling | | H14-1 | | computed flight routes considering the presence of protection hotspot in their paths, which helped AUs' operator to adapt their decision. | gn_02 |
| | | | | | In addition, automation from NM perspective allows automated RRP, integrating new DCB information, to be sent to AU. These RRP provide a valuable support to AU operators to adapt their operation as they only have to accept or decline the proposal instead of finding the most appropriate route by themselves. | |

Arg. 2.1.6. The level of trust in automated functions is appropriate

| HP- | ISSUE: Automated functions | Open | OBJ- | Real Time | The FMP prototype used during the assessment | PJ.07-W2- | |
|-----------|-----------------------------------|------|-----------|------------|--|---------------|--|
| PJ07W238- | provide an alert to FMPs to | | PJ07W238- | Simulation | provided a basic automation to identify "TV of | 38_AUO- | |
| V3-VALP- | identify "TV of interest". A poor | | V3-VALP- | | interest". Ideally, these kinds of TV are those with high | 0219_Reco_OPS | |
| H14-2 | design / configuration may | | H14-2 | | level of refiling occurring in a short period of time. The | _09 | |
| | trigger too many false alarm or | | | | prototype only relied on the number of refiling, but it | | |
| | missed positive leading to a loss | | | | was sufficient to assess the overall concept of this | | |
| | of trust in the system. | | | | feature. | | |
| | · | | | | | | |

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| Within this context, FMP confirmed that alerting feature helped them to identify TV of interest in a relevant, accurate and timely manner. |
|---|
| Some FMPs stressed the need to further refine the rule behind the algorithm to detect TV of interest. As it was implemented, the system was helpful but the relevance and trust in its alerting could be strongly improved. |

Arg. 2.2.2. The timeliness of information provided by the system is adequate for carrying out the task.

| HP- PJ07W238- V3-VALP- H14-3 | BENEFIT: In case of ATFCM delay, the new process allows the AUs to generate/check What-if rerouting or ask/check | Open | OBJ- PJ07W238- V3-VALP- H14-3 | Real Time Simulation | During the evaluation, the NM systems were able to send RRP to Airspace Users, especially if they were caught into a protection hotspot. These rerouting proposals were sent to each AU via an online chat, but | PJ.07-W2- 38_AUO- 0219_Reco_Ne wObjective 10 | |
|---------------------------------------|---|------|--|-------------------------|---|---|--|
| | for automatic route proposals in order to refile out of PH in a timely manner. It should improve timeliness of task- related analysing and decision- making refiling actions. | | | | the concept has been assessed. These route proposals helped AUs' operator to better manage their flights because they did not have to find a reroute themselves, which can be very complex. AUs highlighted the interest of having automatic route proposal sent by the network manager to save time. But if the route is not good enough, their own tools allow them to generate their own what-if rerouting (e.g. avoiding a PH or a regulation). | | |
| HP- PJ07W238- V3-VALP- H14-4 | ISSUE: FMPs are supported by automated alerts triggered by the system to identify potential problematic TVs. This identification should occur in the right time to allow FMPs to react consequently. A bad timing (too soon or too late) may result in either a alarm | Open | OBJ- PJ07W238- V3-VALP- H14-4 | Real Time Simulation | The FMP prototype used during the assessment provided a basic automation to identify "TV of interest". Ideally, these kinds of TV are those with high level of refiling occurring in a short period of time. The prototype only relied on the number of refiling, but it was sufficient to assess the overall concept of this feature. | PJ.07-W2- 38_AUO- 0219_Reco_OPS _09 | |

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| disregard (or even alarm | About the timeliness of this information, 75% of FMP |
|---------------------------------|---|
| deactivation) or unexpected | declared the alerting was done in a timely manner. |
| increase of workload and stress | However, it is worth noting that the time aspect is |
| due to late action to be | very dependent on the rule behind the triggering of |
| performed | such alerting. Indeed, if the rule is set on "trigger an |
| | alert if more than 30 flights are refiling in the last |
| | 60min", an alert may occur only after a long period of |
| | time. If the rule is set with a lower time configuration |
| | (e.g., trigger an alert if more than 6 flights are refiling |
| | in the last 10min), it may help to identify the |
| | "interesting situation" guicker. |

Arg. 2.3.1. The type of information provided satisfies the information requirements of the human

| HP- PJ07W238- V3-VALP- H14-5 | BENEFIT: The system provides additional information for FMPs such as: - Identification of problematic TV - Detailed Traffic loads (including movements In & Out) - Current traffic tendency - Means to declare a protection hotspot - Identification of PH infringement All these information should satisfy information requirements for FMP to perform their tasks efficiently | Open | OBJ- PJ07W238- V3-VALP- H14-5 | Real Time Simulation | All FMPs agreed with the statement "The information provided is useful and supports FMP in their decision- making process". They declared it as clear and exhaustive enough to support their task efficiently and support their decision making. However, the current system provided information about "unplanned" flight, which are flights refiling in another TV after SIT1 (i.e., less than 2 hours before EOBT). This information was not well understood by FMPs and they declared it was difficult to do something with this information. | |
|---------------------------------------|---|------|--|-------------------------|---|--|
| HP- PJ07W238- | BENEFIT: The system provides additional information for AUs such as: - filing/refiling proposal | Open | OBJ- PJ07W238- | Real Time Simulation | The overall result of EXE-PJ07W238-02 and EXE- PJ07W238-04 is that additional information really provided support to AUs' operations. | |

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| V3-VALP- H14-6 | - Declared PH All these information should satisfy information requirements for AUs to perform their tasks efficiently | | V3-VALP- H14-6 | | The rerouting proposal and (manual) rerouting tool were able to propose the optimal route to AUs' operator and the information about declared PH was very valuable as it helps AUs to get more information about the airspace congestion, which is quite new. In conclusion, all these information helped them to better perform their task, especially thanks to a better situation awareness and reduced workload. | |
|---------------------------------------|---|------|--|-------------------------|---|--|
| HP- PJ07W238- V3-VALP- H14-8 | BENEFITS: The solution AUO- 219 is intended to support collaborative decision making thanks to additional information sharing. The system (back end and front end HMI) is expected to efficiently assist human operators (AUs, FMP & NM) by providing adequate exchanged information through appropriate visual displays. | Open | OBJ- PJ07W238- V3-VALP- H14-8 | Real Time Simulation | Despite some issue with the prototypes (e.g., PH information was not available for NM), the shared situation awareness has been evaluated as very good. The individual information provided to each actor has been judged as interesting and valuable even if there are some reserves All operators agreed to say that the information received helped them to share the same situation awareness. | |

Arg. 2.3.6. The usability of the user interface (input devices, visual displays/output devices, alarm& alerts) is acceptable. [V1: AIR only]

| HP- | ISSUE: A poorly designed HMI | Open | OBJ- | Real Time | Because of the prototypes used, the main focus of the | PJ.07-W2- |
|-----------|-----------------------------------|------|-----------|------------|---|---------------|
| PJ07W238- | may reduce human | | PJ07W238- | Simulation | evaluation was not HMI usability, but the assessment | 38_AUO- |
| V3-VALP- | performance and lead to human | | V3-VALP- | | provided some guidelines for future evaluation. | 0219_REQ_Desi |
| H14-7 | error, loss of motivation or loss | | H14-7 | | | gn_03 |
| | of commitment (for all actors). | | | | Overall, the proposed information was seen as | |
| | | | | | appropriate and not confusing. However, the way to | |
| | | | | | display it may be improved as some prototypes (e.g., | |
| | | | | | Planta, NavBlue) had some information not well | |
| | | | | | integrated. A clear example is the information to | |
| | | | | | "identify costly regulation" in Planta. This panel is not | |

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| accessible through the main working window and user |
|--|
| must perform 4 or 5 actions to get this information. |
| It is also worth noting that information provided were |
| accurate enough to efficiently support human |
| accurate enough to enciencly support numan |
| performance and mitigate the risk of human error, but |
| some design flaws induced an increased time to |
| perform the task (e.g., Alerting for FMP to inform |
| them of a TV of interest was not perceived quickly). |
| The main guidelines for future HMI implementation |
| may be summarized as the following statements: |
| - Flight planning tool should be able to consider PH in |
| its route computation |
| - Flight planning tool should allow user to generate |
| routes with "avoid PH" option |
| - AUs planning tool should allow user to display PH |
| easily in its tool to get better situation awareness and |
| support flight planning operations |
| - Alls tool should be able to inform them when a flight |
| is identified as "infringer" |
| - The rule behind the identification of Ty of interest / |
| alerting for EMP should be improved and HMI |
| reviewed to make it more noticeable for the user |
| - FMP tool should support them to quickly identify |
| infringers |
| - NM HMI should integrate protection botspot |
| - With High Should Integrate protection notspot |

Arg. 3.3.4: The communication load of team members is acceptable in normal and abnormal conditions and degraded mode of operations.

| HP- | BENEFIT: Thanks to the | Open | OBJ- | Real Time | From FMP and AU perspective, communication and |
|-----------|--------------------------------|------|-----------|------------|--|
| PJ07W238- | additional information sharing | | PJ07W238- | Simulation | coordination were ok and did not impact the |
| V3-VALP- | provided by enriched DCB, the | | V3-VALP- | | workload. They mainly declared that the |
| H15-1 | communication/coordination | | H15-1 | | communication / coordination load is reduced for all |
| | load is expected to be reduced | | | | the team members and the interaction between |

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| for team members (AUs, FMP & | actors introduced in the operating methods were |
|------------------------------|--|
| NM) | consistent with their daily work. One FMP was |
| | disagreed with this, explaining that NM was unaware |
| | about the PH information, which caused RRP on it |
| | without consulting the FMPs. |
| | Note that a chat was proposed as an alternative |
| | communication solution, because we had some |
| | limitations (voice communication not available), but |
| | this specific solution has not been deeply assessed |
| | because it was not in the scope of the evaluation. We |
| | still got some feedbacks about it: for NM the use of |
| | the chat increases the workload due to the writing but |
| | other participants appreciated this feature because it |
| | made the information accessible at all times and did |
| | not interrupt the tasks in progress |

Arg. 3.3.5: Team members can maintain a sufficient level of shared situation awareness.

| HP- | BENEFIT: Thanks to the | Open | OBJ- | Real Time | The shared situational awareness between NM and | PJ.07-W2- |
|-----------|--------------------------------|------|-----------|------------|---|---------------|
| PJ07W238- | additional information sharing | | PJ07W238- | Simulation | the FMPs was not efficient. NM was not aware of PH, | 38_AUO- |
| V3-VALP- | the shared situation awareness | | V3-VALP- | | and thus proposed rerouting in a PH. | 0219_REQ_Desi |
| H13-6 | is expected to be improved for | | H13-6 | | | gn_01 |
| | all actors (AUs, FMP & NM). | | | | NM explained: "Would be great to see protection | |
| | | | | | hotspot declaration and visualize it in NM tools. It | |
| | | | | | would really help us to understand the big picture of a | |
| | | | | | current situation. It would also prevent us from | |
| | | | | | proposing rerouting in protected TV." | |
| | | | | | | |

Arg. 4.2.1: Knowledge, skill and experience requirements for human actors have been identified

| HP- | ISSUE: New features provided | Open | OBJ- | Real Time | No major training need has been identified during the |
|-----------|---------------------------------|------|-----------|------------|---|
| PJ07W238- | by the system may lead to a | | PJ07W238- | Simulation | different exercises. |
| V3-VALP- | need of training for all actors | | V3-VALP- | | |
| H16-1 | involved (AUs, FMP & NM) | | H16-1 | | However, strong need of awareness sessions / |
| | | | | | communication campaign to inform the operators |

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| (AU, FMPs, NM) of the introduction of Proactive FDCI and its distinction with Reactive FDCI: |
|---|
| • A key for the success of this concept will be the communication |
| AU are often not aware of new concepts |
| • The concept itself is not complicated and should be understood immediately |
| Additional information and procedure should be explained properly to each operator, but no specific needs are required. |

Table 9: Summary of the HP results and recommendations/ requirements for each identified issue & related argument for the AUO-0219 ENRICHED DCB

Common finding and results for AUO-0219 and AUO-0208

| Issue ID | HP issue / Benefit | Status | HP/ Valid. Obj. ID | activity conducted | results / evidence | recommendations | requirements |
|----------------|---------------------------------------|-------------|--------------------------|-----------------------|---|-----------------|--------------|
| Arg. 1.2.1: Op | erating methods cover operations in r | normal oper | ating conditio | ns. | | | |
| | | 0.000 | | Deal Times | Asserding to FMDs the desision | | |
| HP- | ISSUE (common to AUU-0219 and | Open | OB1- | Real lime | According to FMPS, the decision | | |
| PJ07W238- | AUO-0208): A p-FDCI flight may | | PJ07W238- | Simulation | process could be explained as | | |
| V3-VALP- | be refiled in a protection hotspot | | V3-VALP- | | following. First, the penalization of | | |
| H31-1 | and become infringer. | | H31-1 | | flight in PH will occur only if there is an | | |
| | According to the defined | | | | overload. If so, the FMP may apply | | |
| | procedures, infringer flights | | | | MCP to mitigate the traffic peak. To do | | |
| | should be the first ones to be | | | | so, he will pick "non P-FDCI" flights in | | |
| | penalized (e.g. with MCP) but, as | | | | priority. If it is not the most | | |

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| | a p-FDCI flight, it should be exempt from delay as much as possible leading to a conflicting situation for NM and FMP that should manage the TV | | | | appropriate, any P-FDCI flight may be picked to get delay. This process is consistent with current operations and allows FMP to fully manage the TV load. In accordance with the concept of P-FDCI, the flight may be penalized but this additional information about flight criticality will be considered during the FMP's decision making. NM operator has not been confronted to this situation, but he agreed on the proposed way of handling the situation and confirmed that the P-FDCI treatment is mainly a FMP matter. | |
|---------------------------------------|---|------|--|-------------------------|---|--|
| HP- PJ07W238- V3-VALP- H31-2 | ISSUE (common to AUO-0219 and AUO-0208): A p-FDCI flight may be refiled in a protection hotspot and become infringer. This conflicting situation may not be easy to manage locally or centrally, so it may be interesting to manage it directly at the AU level (e.g. refile out of PH, remove FDCI, etc.) | Open | OBJ- PJ07W238- V3-VALP- H31-2 | Real Time Simulation | AUs' operators are aware of the risk to be confronted to this situation. However, they highlighted that ideally, P-FDCI flight should be positively treated before any need to refile in a protection hotspot, so theoretically, this situation should rarely happen. Furthermore, the management of this situation will depend on several factors. Depending on the flight criticality, AU operator may try to refile out of the PH. The workload may also impact their decision. If there are subjected to high workload situation, they may try to avoid the PH as much as possible | |

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| | | |
|--|---|------|
| | because in case of later TV saturation | |
| | in the PH, they will not have time to | |
| | manage the situation a second time. If | |
| | the workload is acceptable, they may | |
| | decide to keep the P-FDCI flight in the | |
| | PH because they will have time to find | |
| | an alternative solution in case of | |
| | penalization. | |
| | | |

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4.1.4.2 Maturity of the Solution

The maturity of the solution is V2 and targets V3.





4.2 AUO-0208

4.2.1 Step 1 Understand the ATM concept

4.2.1.1 Description of reference scenario

The reference scenarios linked to AUO-0208 "Pro-active FDCIs" are described in [EXE-PJ07W238-03] Section 5.3.4.1 and [EXE-PJ07W238-04] Section 5.4.4.1 of the Validation Plan Part I [1].

4.2.1.2 Description of solution scenario

The reference scenarios linked to AUO-0208 "Pro-active FDCIs" are described in [EXE-PJ07W238-03] Section 5.3.4.2 and [EXE-PJ07W238-04] Section 5.4.4.2 of the Validation Plan Part I [1].

Considering EXE- PJ07W238-03, it is worth noting that because the session was based on shadow mode traffic, no specific event occurred during the session. For instance, we were not able to add a strong weather event or ATC Capacity event. Thus, the solution scenario was quite like reference scenario situation, but human operator was able to handle the situation with all added features introduced by AUO-0208. However, FMP and NMOC was able to adapt the situation (ATC Capacity, regulation plan, etc.) to create situations of interest (need of P-FDCI, transfer from proactive FDCI to reactive FDCI, etc.).

During the validation exercises, the focus was set on HMI's usability. However, a HP objective has been formulated to study the needs for future implementation.

4.2.1.3 Consolidated list of assumptions

The solution scenarios linked to AUO-0208 "Pro-active FDCIs" are described in [EXE-PJ07W238-03] Section 5.3.5 and [EXE-PJ07W238-04] Section 5.4.5 of the Validation Plan Part I [1].

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

No relevant related SESAR Solution has been identified.

4.2.1.5 HP maturity of the Solution

The maturity of the solution is V2 and targets V3.



6

4.2.1.6 Identification of the nature of the change

| HP argument branch | Change & affected actors |
|------------------------------|---|
| 1. ROLES & RESPONSIBILITIES | |
| 1.1 ROLES & RESPONSIBILITIES | Shared responsibility between NMOC and FMPs for the management of critical flights |
| | - As much as possible, FMPs monitoring FDCIs locally should look and propose solution for a flight |
| | - FDCI information can be used even in execution phase by FMPs/ATC supervision units (e.g. proposal to expedite a flight) |
| | [Note that objectives related to "roles and responsibilities" changes are covered by Arg. 3.2 & Arg. 4.1]" |
| 1.2 OPERATING METHODS | - Introduction of P-FDCI flights with quota |
| | Global daily quota in sub-quota per periods of the day could be interesting to smooth to number of requests and NMOC/FMP workload along the day |
| | In the validation exercise we should implement a "simple" quota for P-FDCI (daily quota, fixed as percentage of AU flights, flights counted both in P-FDCI & R-FDCI quotas in case of transfer). It was an objective of the validation to determine if a quota is needed and, if needed, if it can be simple or needs to be more complex (e.g. split per period of the day, consider the proportion of regulated flights) |
| | - Give to the AUs the possibility to declare a P-FDCI before flight plan submission |
| | - Automatic transfer from P-FDCI to R-FDCI on AU choice (need to give to the AU the possibility to "block" for a flight the transfer to R-FDCI while keeping the P-FDCI status after SIT 1) |
| | - Introduction of the notion of P-FCDI locally monitored |
| | - Rules related to P-FDCI flights with ATFCM delay after SIT 1: |
| | R-FDCI flights are treated in priority by NMOC & FMPs against P-FDCI flights |
| | P-FDCI flights are not visible to the NM Helpdesk |





| | P-FDCI flights remain important flights for AUs so treatment of R-FDCI flights should not penalise (e.g. increase delay) of P-FDCI flights. It seems not feasible to address this requirement rigorously. |
|----------------------------------|---|
| 1.3 TASKS | AUs: |
| | - Declaration of P-FDCIs |
| | NMOC, FMP: |
| | - Manage delayed P-FDCI flights during pre-active phase (before SIT1) |
| 2. Human & System | |
| 2.1 ALLOCATION OF TASKS (HUMAN & | AUs: |
| System) | - The system transfers automatically P-FDCI to R-FDCI (AU choice), the transfer from P-FDCI to R-FDCI was automatized |
| 2.2 PERFORMANCE OF TECHNICAL | AUs: |
| System | - Quota information must be accurate and presented in a timely manner. |
| | FMPs: |
| | - P-FDCI information must be relevant & necessary to the tasks being performed, accurate and presented in a timely manner. |
| 2.3 HUMAN – MACHINE INTERFACE | AUs: |
| | - Declaration of P-FDCI flights |
| | - Display function to support the monitoring of quota |
| | - Display function to support the transfer from P-FDCI to R-FDCI |
| | - Alert when a P-FDCI flight is affected by an ATFCM constraint (DCB or Enriched DCB) |
| | NMOC, FMPs: |
| | - Display of P-FDCI information |
| 3. TEAMS & COMMUNICATION | |
| 3.1 TEAM COMPOSITION | No change |
| 3.2 ALLOCATION OF TASKS | Shared responsibility between NMOC and FMPs for the treatment of delayed P-FDCI flights |





| 3.3 COMMUNICATION | Digital information sharing instead of communication voice |
|---|---|
| 4. HP RELATED TRANSITION FACTORS | L |
| 4.1 ACCEPTANCE & JOB SATISFACTION | Acceptance of this shared responsibility between NMOC and FMPs. Local and Central management of P-FDCI |
| 4.2 COMPETENCE REQUIREMENTS | No noticeable changes |
| 4.3 STAFFING REQUIREMENTS & STAFFING LEVELS | No change |

Table 10: Description of the change





4.2.2 Step 2 Understand the HP implications

4.2.2.1 Relevant arguments, issues & benefits, and HP activities

Most of identified Human Performance Issues and Benefits are not related to a particular event or situation. Moreover, the assessed OIs are not expected to have a major impact on a particular aspect of Human Performance (workload, situation awareness, fatigue, social factors / CRM, etc.). Therefore, the majority of HP recommended activities are standards and could be summarized as follows:

- Design of working method, Mock-up, and prototyping with quick user testing throughout the design process
- Task analysis (current operations and with new OI implemented)
- RTS with observation, questionnaire, and debriefing

In order to keep the table below light and clear, these recommended activities have not been repeated in every row.

| Arg. | Issue ID | HP issue / Benefit | Actors involved | HP/Valid. Obj. ID | HP validation objective |
|-------|---------------------------------------|--|--------------------|--------------------------------|---|
| 1.2.1 | HP- PJ07W238- V3-VALP- H21-1 | BENEFIT: Operating methods for FMP (and NM) related to the use of proactive FDCI information are expected to be exhaustive and cover operations* in normal operating conditions * "operations" refers to the 3 use cases identified for FMPs considering P-FDCI, see OSED | FMP, NM | OBJ-PJ07W238-V3- VALP-H21-1 | Assess if the system provides exhaustive solution to use efficiently P-FDCI (for FMP & NM) in normal operating conditions |
| 1.2.1 | HP- PJ07W238- V3-VALP- H21-2 | BENEFIT: Operating methods for AU related to proactive FDCI declaration are expected to be exhaustive and cover operations in normal operating conditions | AU | OBJ-PJ07W238-V3- VALP-H21-2 | Assess if the system provides exhaustive solution for AUs to declare proactive FDCI in normal operating conditions |





| 1.2.1 | HP- PJ07W238- V3-VALP- H21-3 | BENEFIT: The operating methods related to P- FDCI quotas management are expected to be exhaustive and cover operations in normal operational conditions for AUs | AU | OBJ-PJ07W238-V3- VALP-H21-3 | Assess if the system provides exhaustive solution to AUs to manage P-FDCI quotas in normal operating conditions |
|-------|---------------------------------------|--|-------------|--------------------------------|--|
| 1.2.4 | HP- PJ07W238- V3-VALP- H21-4 | BENEFIT: The operating methods related to P-FDCI concept are expected to be clear and consistent for all relevant staff involved in the process (AUs, FMP & NM) | AU, FMP, NM | OBJ-PJ07W238-V3- VALP-H21-4 | Evaluate the consistency of operating methods related to P-FDCI between all relevant staff involved in the process (AUs, FMP & NM) |
| 2.1.2 | HP- PJ07W238- V3-VALP- H21-5 | ISSUE : The introduction of proactive FDCI introduces a slight change of task allocation for AUs. Indeed, AU operator (human) is now asked to declare P-FDCI before any regulation, and in case auto-transfer is activated, the R-FDCI is automatically declared (machine) for P-FDCI flights concerned by a regulation. However, AU human operator still has the possibility to manually declare R-FDCI. Human operator may have difficulties to handle both automatic behaviour and manual actions. | AU | OBJ-PJ07W238-V3- VALP-H21-5 | Evaluate how the existence of automated and manual FDCI declaration (proactive and reactive) may affect human performance for AUs. |
| 1.2.2 | HP- PJ07W238- V3-VALP- H21-6 | ISSUE : After P-FDCI declaration, this information may not appear on FMP's HMI, which may lead to regulation on these flights. | FMP | OBJ-PJ07W238-V3- VALP-H21-6 | Assess the impact of inconsistent information between AU and FMP considering P-FDCI declaration |
| 1.3.3 | HP- PJ07W238- V3-VALP- H22-1 | ISSUE : For AUs, considering P-FDCI declaration, if the associated procedure is complicated, it may lead to an increase of workload for AU operators. However, this slight increase should counterbalance by a decrease of workload because of the reduction of communication load / refiling due to regulation applied on critical flights. | AU | OBJ-PJ07W238-V3- VALP-H22-1 | Assess if the AUs' workload associated to P-FDCI declaration is acceptable enough considering all current operations |





| 1.3.3 | HP- PJ07W238- V3-VALP- H22-2 | ISSUE : When MCP are applied by FMP, the identification of P-FDCI may slightly increase the workload associated to selection of affected flights. However, this slight increase should counterbalance by a decrease of workload because of the reduction of communication load / refiling due to regulation applied on critical flights. | FMP | OBJ-PJ07W238-V3- VALP-H22-2 | Assess the overall impact on workload when the FMP must consider P-FDCI for MCP flight selection |
|-------|---------------------------------------|--|-------------|--------------------------------|---|
| 1.3.3 | HP- PJ07W238- V3-VALP- H22-3 | BENEFIT : P-FDCI may be used by FMPs/NMOC to identify costly regulations. This work is facilitated by P-FDCI and associated system. This aid should help to reduce FMPs' workload | FMP, NM | OBJ-PJ07W238-V3- VALP-H22-3 | Assess the overall impact on workload when the FMP & NM must consider P-FDCI to identify costly regulations |
| 3.2.1 | HP- PJ07W238- V3-VALP- H22-4 | BENEFIT : When a sector is "centrally managed", some responsibilities are transferred from FMP to NM. Thus, it may release some workload to FMP because pre-regulated flights tagged as P-FDCI are managed by NMOC | FMP | OBJ-PJ07W238-V3- VALP-H22-4 | Assess if the "centrally managed" option decreases FMPs' workload |
| 1.3.5 | HP- PJ07W238- V3-VALP- H23-1 | ISSUE: In case the system does not provide enough/appropriate feedback about used P-FDCI "tokens" (initial and remaining), AUs may have difficulties managing their P-FDCI quota | AU | OBJ-PJ07W238-V3- VALP-H23-1 | Assess if the system provides appropriate information to AUs to manage P-FDCI quota (remaining tokens) |
| 3.3.5 | HP- PJ07W238- V3-VALP- H23-2 | BENEFIT: Thanks to the proactive FDCI information sharing, the shared situation awareness considering flight criticality is expected to be improved for all actors (AUs, FMP & NM). | AU, FMP, NM | OBJ-PJ07W238-V3- VALP-H23-2 | Assess if the shared situational awareness between AUs, FMPs and NM is acceptable and improved compared to the reference scenario |
| 1.3.1 | HP- PJ07W238- V3-VALP- H23-3 | BENEFIT: for FMPs, when they apply MCP measures on a P-FDCI flight, an alert/attention getter is triggered to make sure the FMP notices the criticality of this regulated flight (which may induce further refiling later) | FMP | OBJ-PJ07W238-V3- VALP-H23-3 | Assess if the system provides appropriate information to FMPs to mitigate the risk of human error |





| 1.3.5 | HP- PJ07W238- V3-VALP- H23-4 | ISSUE : When a flight tagged as proactive FDCI is concerned by a regulation, the system will automatically switch from proactive FDCI to reactive FDCI. If this FDCI status in not shared with all operators (FMP, NMOC and AU), it may lead to inappropriate actions. | AU, FMP, NM | OBJ-PJ07W238-V3- VALP-H23-4 | Assess if the system provides appropriate feedback on FDCI status to human operators (FMP, NMOC and AU) to manage operations related to FDCI and efficiently support a collaborative decision making. |
|-------|---------------------------------------|--|-------------|--------------------------------|---|
| 1.3.1 | HP- PJ07W238- V3-VALP- H24-1 | ISSUE: AUs are asked to declare P-FDCI before SIT1. The system should provide an easy way to identify and declare P-FDCI to mitigate the risk of human errors (e.g., wrong flight declared as P- FDCI) | AU | OBJ-PJ07W238-V3- VALP-H24-1 | Assess if the system provides appropriate means to AUs to identify and declare P-FDCI without any ambiguity in order to mitigate the risk of erroneous P-FDCI declaration (e.g. wrong flight declared as P- FDCI) |
| 2.3.6 | HP- PJ07W238- V3-VALP- H24-2 | ISSUE: Considering P-FDCI declaration, a poorly designed solution may lead to unnecessary workload, frustration, and risk of error from AUs. | AU | OBJ-PJ07W238-V3- VALP-H24-2 | Assess the usability of P-FDCI declaration mean(s) provided to AUs |
| 2.3.6 | HP- PJ07W238- V3-VALP- H24-3 | ISSUE: Considering identification of costly regulation (for FMP & NM), a poorly designed solution may lead to unnecessary workload or frustration | FMP, NM | OBJ-PJ07W238-V3- VALP-H24-3 | Assess the usability of identifying costly regulation thanks to P-FDCI (for FMP & NM) |
| 2.2.1 | HP- PJ07W238- V3-VALP- H24-4 | ISSUE: AU system provides an alert to inform operator when a P-FDCI flight has been impacted by a regulation (and status passed to R-FDCI). A late alerting could prevent AU operator to react in a timely manner. | AU | OBJ-PJ07W238-V3- VALP-H24-4 | Assess the timeliness of alerting provided to AUs when a P-FDCI flight is impacted by a regulation (and status passed to R-FDCI) |
| 2.1.6 | HP- PJ07W238- V3-VALP- H24-5 | ISSUE: In case auto-transfer is activated, if a P-FDCI flight is not updated automatically to R-FDCI, AUs' trust in the system may be lost | AU | OBJ-PJ07W238-V3- VALP-H24-5 | Assess AUs' trust in the auto-transfer function after incident on this function |
| 3.3.4 | HP- PJ07W238- | BENEFIT: Current operation considering (reactive) FDCI flights involve a heavy communication load (for AU, FMP and NMOC) when AU operator needs to negotiate the | AU, FMP, NM | OBJ-PJ07W238-V3- VALP-H25-1 | Evaluate the communication/coordination load for each actor (AUs, FMP & NM) and compare it to the reference communication load |

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| | V3-VALP- H25-1 | exclusion of R-FDCI flight of a regulation. Thanks to the proactive FDCI information sharing, FMP can exclude a P-FDCI directly when declaring the regulation. This is expected to reduce the occurrence of R-FDCI, and thus, reduce the associated communication load. | | | |
|-------|---------------------------------------|---|---------|--------------------------------|---|
| 4.1.1 | HP- PJ07W238- V3-VALP- H26-1 | ISSUE : Centrally and locally manage may induce confusion in roles and responsibilities between FMP and NMOC | FMP, NM | OBJ-PJ07W238-V3- VALP-H26-1 | Assess if the existence of both "centrally" and "locally" option induces confusion in roles and responsibilities between FMP and NMOC |
| 1.2.1 | HP- PJ07W238- V3-VALP- H31-1 | ISSUE (common to AUO-0219 and AUO-0208): A P-FDCI flight may be refiled in a protection hotspot and become infringer. According to the defined procedures, infringer flights should be the first ones to be penalized (e.g., with MCP) but, as a P-FDCI flight, it should be exempt from delay as much as possible leading to a conflicting situation for NM and FMP that should manage the TV | FMP, NM | OBJ-PJ07W238-V3- VALP-H31-1 | Assess if NM and FMP can manage efficiently the conflicting situation of P-FDCI flight infringing a PH |
| 1.2.1 | HP- PJ07W238- V3-VALP- H31-2 | ISSUE (common to AUO-0219 and AUO-0208) : A P-FDCI flight may be refiled in a protection hotspot and become infringer. This conflicting situation may not be easy to manage locally or centrally, so it may be interesting to manage it directly at the AU level (e.g., refile out of PH, remove FDCI, etc.) | AU | OBJ-PJ07W238-V3- VALP-H31-2 | Assess how AU can manage the conflicting situation of P-FDCI flight infringing a PH |

Table 11: HP Arguments, related HP issues and benefits, and proposed HP activity



4.2.3 Step 3 Improve and validate the concept

4.2.3.1 Description of HP activities conducted

This section describes Human Performance activities selected based on the relevant arguments and HP issues & benefits, identified in the **Error! Reference source not found.** (see Appendix C).

Four major human performance activities have been conducted in this project. Three of them were validation exercises implicating human in the loop and the other one was a design process based on mock-ups and prototyping.

Even if there were three validation exercises in total, only two validation exercises focused on AUO-0208. The table below lists the HP activities related to AUO-0208 with their targeted deadlines.

| HP activity | By when |
|--|-------------------|
| Mock-ups and Prototyping of ATM solutions | Q2 2021 – Q1 2022 |
| EXE-PJ07W238-03 (RTS, AUO-0208 P-FDCI) | Q4 2021 |
| EXE-PJ07W238-04 (RTS, AUO-0219 & AUO-0208) | Q2 2022 |

Table 12: Table of proposed HP activities and their priority

| Αςτινιτγ 1. | Mock-ups and Prototyping of ATM solutions |
|---------------|---|
| Description | Mock-ups are static user interfaces used to illustrate the future human- machine interfaces to visualize how new concepts could be implemented later. |
| | Prototypes are interactive and functional user interfaces used to test the concept in a more realistic and dynamic conditions. |
| | Mock-ups and prototypes support discussion between partners and between operational end users, as it provides a concrete example of how operators may use the new services. They also aid at designing the future implementation on the system as it is easier to quickly modify following discussions with end users. Therefore, it allows the design team to roughly evaluate usability of the design before implementation. |
| HP OBJECTIVES | HP Objectives from VALP are macro objectives including several HP objectives from Error! Reference source not found. : |
| | • HP-PJ07W238-V3-VALP-H11 |
| | • HP-PJ07W238-V3-VALP-H12 |
| | • HP-PJ07W238-V3-VALP-H13 |
| | • HP-PJ07W238-V3-VALP-H14 |



| | Detailed HP objectives can be found in the Error! Reference source not found. (see Appendix C). |
|--|--|
| Tool selected out of the HP repository | N/A |
| Planning and Approach | Mock-up and prototyping activities are planned to be performed from Q3 2020. The approach could be summarized as: 1. Understand the ATM concepts 2. Define all related needs for all operators (focus has been done on FMP side as DSNA performed this activity) 3. Understand the current platform used as a reference for the design (platform was be updated to implement new concepts) 4. Design HMIs with associated working methods Iterative process with regular meetings to share the HMIs and discuss with end users, and quick updates of the HMIs; Mock-up and interactive prototypes to discuss the dynamic of working methods. |
| timeline | Initial draft of HMIs has been completed by Q2 2022 Final version of HMIs has been discussed and provided for development by Q2 2021 Additional mock-ups and prototypes may be performed between Q4 2021 and Q2 2022 to support EXE-PJ07W238-04 in case the platform used for the evaluation is not the same as the one used for EXE-PJ07W238-02 |

Table 13: Description of Activity 1- Mock-ups and Prototyping of ATM solutions

| Αςτινιτγ 2 | EXE-PJ07W238-03 (RTS, AUO-0208 P-FDCI) |
|-------------|--|
| Description | HP evidences were gathered during a Real Time Simulation implicating FMP operator from DSNA and ENAV, AU operators and NMOC. |
| | The RTS was held using a Shadow Mode trial. The traffic was provided to operators based on actual traffic, but action from operators (P-FDCI declaration, regulation, etc.) was only applied to the simulation platform. The shadow mode allows participants to perform the exercise in an immersive environment with realistic traffic and traffic volume management. |
| | The evaluation was divided in 3 sessions as follow: |
| | Day 1: |
| | - Sessions 1 (Reference scenario) from 9:00 to 12:00 |
| | - Session 2 (with quota, without auto-transfer) from 13:30 to 16:30 |





| | Day 2: |
|--|--|
| | Session 3 (without quota, with auto-transfer and LFEE centrally monitored) |
| | A questionnaire was filled at the end of the first day and updated/completed if needed at the end of the second day. A debriefing with all participants were conducted at the end of each day. |
| | Due to the sanitary context (COVID-19), this exercise was performed remotely, which means that every participant was staying at his own premises. |
| | Human Performance analysis was mainly based on observation and debriefing sessions performed immediately after each run/scenario. Custom questionnaires were used to complete the analysis as well as some logs. Because of the multiple locations, especially with AU, questionnaires were sent and filled via an online tool. |
| HP objectives | HP Objectives from VALP are macro objectives including several HP objectives from HP log: |
| | HP-PJ07W238-V3-VALP-H21 HP-PJ07W238-V3-VALP-H22 HP-PJ07W238-V3-VALP-H23 HP-PJ07W238-V3-VALP-H24 HP-PJ07W238-V3-VALP-H25 HP-PJ07W238-V3-VALP-H26 |
| | (see Appendix C). |
| Tool selected out of the HP repository | N/A |
| Planning and Approach | The validation exercise EXE-PJ07W238-03 has been performed during October and November 2021, more precisely: |
| | A training session was done the 29th of October Final rehearsal / Dry-run occurred from 02/11/21 to 03/11/21 Exercise runs (4 half day) was performed from 09/11/21 to 11/11/21 |
| timeline | The overall timeline may be summarized as follow: |
| | Concept definition (Use cases, definition, working methods, discussions with all partners,) until Q2 2021 Definition of validation objectives and association evaluation methods from Q1 to Q4 2021 Validation scenarios definition from Q3 to Q4 2021 Final exercise preparation until November Exercise runs performed from Q9/11/21 to 11/11/21 |



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• Analysis and report integrating all exercises for August 2022

Table 14: Description of Activity 2 - EXE-PJ07W238-03 (RTS, AUO-0208 P-FDCI)

| Астіvіту З | EXE-PJ07W238-04 (RTS, AUO-0219 & AUO-0208) |
|---------------|--|
| Description | HP evidence was gathered during a Real Time Simulation implicating human operators from all stakeholders, namely ANSPs (DSNA & ENAV), Network Manager (NMOC) and AUs (Air France, Transavia, Air Baltic, El Al, Swiss, Ryanair & DASSAULT). |
| | The RTS was performed with shadow mode traffic with adapted plan to have an interesting scenario. |
| | This exercise has been performed remotely, the participants were located in their operational centres and Bretigny. |
| | Human Performance analysis was mainly based on observation and debriefing sessions performed immediately after each run/scenario. Custom questionnaires were used to complete the analysis as well as some logs. Because of the multiple locations, especially with AU, questionnaires were sent and filled via an online tool. In addition, two standardized questionnaires were used (online): |
| | SATI - SHAPE Automation Trust Index [3] SASHA - Situation Awareness for SHAPE [4] |
| | A global debriefing was also performed with all operators from ANSP, NM and AU in order to confront actors with each other's opinions and gather overall feedback considering the collaborative decision making and shared situational awareness. |
| HP objectives | HP Objectives from VALP are macro objectives including several HP objectives from HP log: |
| | AUO-0219 (e-DCB): |
| | HP-PJ07W238-V3-VALP-H11 HP-PJ07W238-V3-VALP-H12 HP-PJ07W238-V3-VALP-H13 HP-PJ07W238-V3-VALP-H14 HP-PJ07W238-V3-VALP-H15 HP-PI07W238-V3-VALP-H16 |
| | ALIO-0208 (P-EDCI): |
| | |
| | HP-PJ07W238-V3-VALP-H21 HP-PJ07W238-V3-VALP-H22 |



| | HP-PJ07W238-V3-VALP-H23 HP-PJ07W238-V3-VALP-H24 HP-PJ07W238-V3-VALP-H25 HP-PJ07W238-V3-VALP-H26 In addition, an objective specific to the combination of P-FDCI and eDCB has been included in exercise 04: HP-PJ07W238-V3-VALP-H31 Detailed HP objectives linked to these macro HP objectives from VALP can be |
|--|---|
| | found in the Error! Reference source not found. (see Appendix C). |
| Tool selected out of the HP repository | Two standardized questionnaires from HP repository were used (online): SATI - SHAPE Automation Trust Index [3] SASHA - Situation Awareness for SHAPE [4] |
| Planning and Approach | Two dry runs are planned in April and May 2022: 21 & 22 April 2022 including all AUs, NMOC, and ENAV. 3 May 2022 including AF and/or Transavia, NMOC, ENAV and DSNA. The validation exercise EXE-PJ07W238-04 was performed in May (2x2days): 05 & 06 May 2022 12 & 13 May 2022 |
| timeline | The overall timeline can be summarized as follow: Concept definition (Use cases, definition, working methods, discussions with all partners,) until Q2 2021 Definition of validation objectives and association evaluation methods from Q1 to Q4 2021 Validation scenarios definition during Q1 2022 Dry runs in April and May (2 sessions) Final exercise preparation until May 2022 Exercise runs were performed 5 & 6 May 2022 and 12 & 13 May 2022 Analysis and report integrating all exercises for August 2022 |

Table 15: Description of Activity 3 - EXE-PJ07W238-04 (RTS, AUO-0219 & AUO-0208)



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

4.2.4.1 Summary of HP activities results & recommendations / requirements

Following table provides a summary of the HP argument and related issues/benefits along with the HP activities conducted during the V3 validation phase. It reports on the outcomes of HP issues that were included into the V2 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'. Note that, in this phase, the issue is considered as being 'open' because the issue has been either: partially addressed and more studies are needed. All the results/evidence gathered in the following table, are extrapolated during the Real Time Simulation through-ad hoc post run, post simulation questionnaire and several debriefings.

The HP recommendations and requirements fall into one of several categories:

- HMI
- OPS (operating methods/procedures)
- Training
- Other aspect investigated during the Real Time Simulation, EXE-PJ07W238-03, EXE-PJ07W238-04.

For more details, standard tools used to assess main Human Performance aspects, refers to Validation Report Part I [2].

The table is sequenced according to the different concepts tested during three exercises:

- EXE-PJ07W238-03 (RTS, AUO-0208 P-FDCI)
- EXE-PJ07W238-04 (RTS, AUO-0219 & AUO-0208)





AUO-0208

| Issue ID | HP issue / Benefit | Status | HP/ Valid. Obj. ID | activity conducted | results / evidence | recommendatio ns | requirements |
|---------------------------------------|--|-------------|--|-------------------------|--|--|--------------|
| Arg. 1.2.1: Op | perating methods cover op | erations in | normal opera | ting conditions. | | | |
| HP- PJ07W238- V3-VALP- H21-1 | BENEFIT: Operating methods for FMP (and NM) related to the use of proactive FDCI information are expected to be exhaustive and cover operations* in normal operating conditions * "operations" refers to the 3 use cases identified for FMPs considering p-FDCI, see OSED | Open | OBJ- PJ07W238- V3-VALP- H21-1 | Real Time Simulation | FMP and NM operators were comfortable with the proposed operating methods. Following the training sessions, the only issue remaining with proposed solution was a need of clarification about process related to "Centrally managed*" configuration, asked by some FMPs. Other than that, no noticeable question or demand of clarification occurred during the exercises, no lack of procedure has been identified neither. Final debriefing confirmed this feedback. FMP stressed that using P-FDCI information may be tricky to integrate properly in the workflow of current operations in case of busy days, but they confirmed the operational interest of having such information and they will try to integrate it as much as possible. The questionnaire also confirmed the exhaustivity and understanding of proposed operations but FMPs and NM. In addition, FMPs stressed that "identification of costly measures" is a new way of working that they will have to integrate in their workflow. | PJ.07-W2-38_AUO- 0208_Reco_Other_1 1 | |

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| | | | | | * Reminder: "centrally managed" configuration defines the situation when the P-FDCI management is handled by NM (central) instead of local FMPs. | |
|---------------------------------------|---|------|--|-------------------------|--|--|
| HP- PJ07W238- V3-VALP- H21-2 | BENEFIT: Operating methods for AU related to proactive FDCI declaration are expected to be exhaustive and cover operations in normal operating conditions | Open | OBJ- PJ07W238- V3-VALP- H21-2 | Real Time Simulation | Proposed operating method for P-FDCI declaration were found exhaustive and cover all normal operating conditions. AUs confirmed that the solution may be integrated in their current operations The questionnaire confirmed this point, as 80% of AUs agreed with the statement "The P-FDCI prioritisation process covers all operations". The other ones highlighted the lack of feedback about P-FDCI treatment, which will be handled in the appropriate objective (about Situational Awareness). | |
| HP- PJ07W238- V3-VALP- H21-3 | BENEFIT: The operating methods related to pFDCI quotas management are expected to be exhaustive and cover operations in normal operational conditions for AUs | Open | OBJ- PJ07W238- V3-VALP- H21-3 | Real Time Simulation | Procedures related to quota were found clear and exhaustive. The need of quota has been confirmed by almost all operators, during debriefing and questionnaires. Indeed, 100% AUs agreed or strongly agreed that "P-FDCI quota is needed to ensure equity between AUs" and more than 80% of participant agreed that "Specific quota for P-FDCI is needed". Excluding technical issue with the platform used, AUs were able to properly monitor and manage their quota (100% AUs agreed or strongly agreed to the statement "The HMI allows me to monitor my remaining quota") About the quota value, participants mainly agree with the proposal of "Fixed percentage of P-FDCI per AU" per day (e.g., 10% of the AU's flights submitted in the day) | PJ.07-W2-38_AUO- 0208_REQ_Design_04 |

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| | About quota, it is worth noting that FMPs stressed that setting a quota too high may lead to have too many P- FDCI flights that should ideally be treated by NMF (FMP or NM), which may discourage them to even look at it. | |
|--|--|--|
| | FDCI flights that should ideally be treated by NMF (FMP or NM), which may discourage them to even look at it. | |

Arg. 1.2.2: Operating methods cover operations in abnormal operating conditions.

| HP- | ISSUE: After p-FDCI | Open | OBJ- | Real Time | Abnormal conditions have not been assessed directly | PJ.07-W2-38_AUO- | |
|-----------|----------------------|------|-----------|------------|---|------------------|--|
| PJ07W238- | declaration, this | | PJ07W238- | Simulation | during the evaluation. Indeed, the platforms used were | 0208_Reco_NewObj | |
| V3-VALP- | information may not | | V3-VALP- | | not modular enough to be able to turn off/on a specific | ective_13 | |
| H21-6 | appear on FMP's HMI, | | H21-6 | | feature. | | |
| | which may lead to | | | | | | |
| | regulation on these | | | | | | |
| | flights. | | | | | | |
| | | | | | | | |

Arg. 1.2.4: The content of operating methods is clear and consistent (in V1: non-contradictory).

| HP- | BENEFIT: The | Open | OBJ- | Real Time | No major issue has been identified about clarity and |
|-----------|-------------------------|------|-----------|------------|---|
| PJ07W238- | operating methods | | PJ07W238- | Simulation | consistency of proposed operating methods. The global |
| V3-VALP- | related to p-FDCI | | V3-VALP- | | feedback is very positive and proposed operating |
| H21-4 | concept are expected | | H21-4 | | methods are seen as clear and compatible with current |
| | to be clear and | | | | operations. |
| | consistent for all | | | | |
| | relevant staff involved | | | | Questionnaires confirmed this perception as all AUs |
| | in the process (AUs, | | | | agreed or strongly agreed with "The P-FDCI |
| | FMP & NM) | | | | prioritisation process is clear", so as 80% of FMPs. |
| | | | | | |
| | | | | | Identical results are observed for the question about |
| | | | | | consistency with current process. |
| | | | | | |
| | | | | | In addition, evolution in roles and responsibility in the |
| | | | | | P-FDCI process are also seen as consistent with the |
| | | | | | current roles, especially in the "local management" |
| | | | | | configuration as all actors agreed on this. About |
| | | | | | "central management" configuration, half of FMPs |

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| mentioned a slight evolution as they may have more coordination to perform with NM. | |
|---|--|
| Also, NM mentioned that they need to be the one who treats the P-FDCI when the flight is caught by several different FMP's regulations. | |

Arg. 1.3.1: The potential for human error is reduced as far as possible.

| HP- PJ07W238- V3-VALP- H23-3 | BENEFIT: for FMPs, when they apply MCP measures on a p-FDCI flight, an alert/attention getter is triggered to make sure the FMP notices the criticality of this regulated flight (which may induce further refiling later on) | Open | OBJ- PJ07W238- V3-VALP- H23-3 | Real Time Simulation | Abnormal conditions (missing feature) have not been assessed directly during the evaluation. Indeed, the platforms used were not modular enough to be able to turn off/on a specific feature. Note : this feature was suggested as an optional feature (nice to have) but was not described in the initial definition of the solution. | PJ.07-W2-38_AUO- 0208_Reco_NewObj ective_16 | |
|---------------------------------------|---|------|--|-------------------------|--|---|--|
| HP- PJ07W238- V3-VALP- H24-1 | ISSUE: AUs are asked to declare p-FDCI before SIT1. The system should provide an easy way to identify and declare p-FDCI in order to mitigate the risk of human errors (e.g. wrong flight declared as p-FDCI) | Open | OBJ- PJ07W238- V3-VALP- H24-1 | Real Time Simulation | The different prototypes used by AU's operators (Metron, SWISS or Dassault) were designed to provide simplified features. Indeed, none of these platforms were able to gather all relevant data to support operator's decision making. However, during the exercise, no error in P-FDCI declaration occurred as the information displayed was clear and unambiguous. Operators were able to declare P-FDCI without noticeable risk of error. | | PJ.07-W2-38_AUO- 0208_REQ_Design_10 |

Arg. 1.3.3: The level of workload (induced by cognitive and/or physical task demands) is acceptable.

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| HP- | ISSUE: For AUs, | Open | OBJ- | Real Time | AUs operators found the P-FDCI declaration very easy to | PJ.07-W2-38_AUO- |
|-----------|------------------------|------|-----------|------------|--|--------------------|
| PJU/W238- | considering p-FDCI | | PJU/W238- | Simulation | perform on all prototypes used (Metron, SWISS and Dassault) | 0208_REQ_Design_06 |
| H22-1 | associated procedure | | H22-1 | | Dassaultj. | |
| | is complicated, it may | | | | During the exercise and several debriefings, the increase | |
| | lead to an increase of | | | | of workload due to P-FDCI has been judged by AUs as | |
| | workload for AU | | | | minimal and acceptable. | |
| | operators. | | | | This result is confirmed by supplicing inc. | |
| | However, this slight | | | | This result is confirmed by questionnaire: | |
| | increase should | | | | • 80% of AUs agreed with "I consider the level of | |
| | decrease of workload | | | | workload acceptable to assess the criticality of my flights | |
| | because of the | | | | in order to declare them as P-FDCIs" | |
| | reduction of | | | | · · · · · · · · · · · · · · · · · · · | |
| | communication load / | | | | • 80% agreed with "I consider the level of workload | |
| | refiling due to | | | | acceptable to fill in and submit P-FDCI to NMF" | |
| | regulation applied on | | | | In addition, the slight increase of workload is balanced | |
| | critical flights. | | | | by time saved in later coordination. AUs also stressed | |
| | | | | | that P-FDCI information is only an optional information | |
| | | | | | intended to improve their flight management, then if | |
| | | | | | they do not have enough time to declare P-FDCI, they | |
| | | | | | may not do it. | |
| | | | | | It is also worth noting that we observed differences in | |
| | | | | | workload related to P-FDCI declaration between | |
| | | | | | Airlines. For example, the flight management of | |
| | | | | | RYANAIR does not allow to easily identify P-FDCI | |
| | | | | | candidate nor to "automate" this identification (e.g., | |
| | | | | | recurrent flight, recurring pattern on a flight, clear | |
| | | | | | selection criteria). For those companies, the identification of P-EDCI candidates may be complex and | |
| | | | | | flight should be evaluated one at a time. However, for | |
| | | | | | "traditional" company such as Air France, a lot of P-FDCI | |
| | | | | | candidates can be easily identified based on clear | |

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| | | | | | criteria (e.g., curfew, crew time, aircraft assignment, planned maintenance) | | |
|---------------------------------------|--|------|--|-------------------------|---|---|--|
| HP- PJ07W238- V3-VALP- H22-2 | ISSUE: When MCP are applied by FMP, the identification of p- FDCI may slightly increase the workload associated to selection of affected flights. However, this slight increase should counterbalance by a decrease of workload because of the reduction of communication load / refiling due to regulation applied on critical flights. | Open | OBJ- PJ07W238- V3-VALP- H22-2 | Real Time Simulation | During EXE-PJ07W238-03 and EXE-PJ07W238-04, FMPs were able to easily identify P-FDCI flight, which helped them in their decision-making process. Individually, the identification of P-FDCI used as a key information for MCP flight selection does not induce a noticeable workload increase. However, FMPs stressed the risk of significant increase of workload if there is too many P-FDCI flights as it may restrict the number of MCP candidates and make it difficult to decide which flights can be picked. Remark: in addition to potential workload issue if there is too many P-FDCI flights, another risk is to prevent FMP's acceptability of the concept if the number of P- FDCI is too high. Indeed, if the FMP faces a huge number of P-FDCI, he may be discouraged to consider this information as it will be seen as overly time consuming | PJ.07-W2-38_AUO- 0208_Reco_NewObj ective_14 | PJ.07-W2-38_AUO- 0208_REQ_Design_07 |
| HP- PJ07W238- V3-VALP- H22-3 | BENEFIT: p-FDCI may be used by FMPs/NMOC to identify costly regulations. This work is facilitated by p-FDCI and associated system. This aid should help to reduce FMPs' workload | Open | OBJ- PJ07W238- V3-VALP- H22-3 | Real Time Simulation | During EXE-PJ07W238-03 & EXE-PJ07W238-04, FMP (mainly) and NM were asked to identify "costly*" regulation by regularly checking the number of P-FDCI flights affected by a regulation (e.g., Every 30min). The workload associated to this task is acceptable, but the frequency of verification may be problematic. Indeed, when FMPs were asked to check the "cost" of a regulation every 15 minutes, they stressed that it was too much to handle, especially when integrated with current operations. However, it appears that this task may be done less frequently, such as every hour, which will limit the impact on workload. | PJ.07-W2-38_AUO- 0208_Reco_NewObj ective_15 | |

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| In addition, some FMPs found it difficult to properly identify costly regulation as the prototype platform did not provide a well-integrated feature to do it (access to the feature was not easy and information were missing) | |
|--|--|
| *in terms of ATFCM impact (i.e. causing a lot of delays, generating instability, etc.) | |

Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.

| HP- | ISSUE: In case the | Open | OBJ- | Real Time | Abnormal conditions have not been assessed directly | | PJ.07-W2-38 AUO- |
|-----------|--------------------------|------|-----------|------------|--|------------------|--------------------|
| PJ07W238- | system does not | • | PJ07W238- | Simulation | during the evaluation. Indeed, the platforms used were | | 0208 REQ Design 08 |
| V3-VALP- | provide | | V3-VALP- | | not modular enough to be able to turn off/on a specific | | |
| H23-1 | enough/appropriate | | H23-1 | | feature. | | |
| | feedback about used | | | | | | |
| | p-FDCI "tokens" (initial | | | | However, this feature was not available during several | | |
| | and remaining), AUs | | | | runs, due to platform issues. During these periods, AU's | | |
| | may have difficulties | | | | operators stressed the necessity to get a real time | | |
| | managing their p-FDCI | | | | feedback on quota consumption as it helps them to | | |
| | quota | | | | better manage and anticipate the declaration of P-FDCI. | | |
| | | | | | Without this features, many AU's operators used an | | |
| | | | | | alternative method to monitor their quota, for instance | | |
| | | | | | the old school pen and paper. | | |
| | | - | | a 1=: | | | |
| HP- | ISSUE: When a flight | Open | OBJ- | Real Lime | Abnormal conditions (missing feature) have not been | PJ.07-W2-38_AUO- | |
| PJ07W238- | tagged as proactive | | PJ07W238- | Simulation | assessed directly during the evaluation. Indeed, the | 0208_Reco_NewObj | |
| V3-VALP- | FDCI is concerned by a | | V3-VALP- | | platforms used were not modular enough to be able to | ective_17 | |
| H23-4 | regulation, the system | | H23-4 | | turn off/on a specific feature. | | |
| | will automatically | | | | | | |
| | Switch from proactive | | | | | | |
| | FDCI to reactive FDCI. | | | | | | |
| | not charad with all | | | | | | |
| | not stidied with all | | | | | | |
| | NMOC and ALL) it may | | | | | | |
| | iviviou and AUJ, it may | | | | | | |

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| lead to inappropriate | | | |
|-----------------------|--|--|--|
| actions. | | | |

Arg. 2.1.2: Changes to the task allocation between human and machine support human performance.

| | | 1 | 1 | 1 | | 1 | |
|-----------|---------------------------|------|-----------|------------|---|-------------------|--------------------|
| HP- | ISSUE: The | Open | OBJ- | Real Time | As explained in other objective (cf : H22-1) it is also worth | PJ.07-W2-38_AUO- | PJ.07-W2-38_AUO- |
| PJ07W238- | introduction of | | PJ07W238- | Simulation | noting that we observed differences in workload related | 0208_Reco_Design_ | 0208_REQ_Design_05 |
| V3-VALP- | proactive FDCI | | V3-VALP- | | to P-FDCI declaration between Airlines. For example, the | 12 | |
| H21-5 | introduces a slight | | H21-5 | | flight management of RYANAIR does not allow to easily | | |
| | change of task | | | | identify P-FDCI candidate nor to "automate" this | | |
| | allocation for AUs. | | | | identification (e.g., recurrent flight, recurring pattern on | | |
| | Indeed, AU operator | | | | a flight, clear selection criteria). For those companies, | | |
| | (human) is now asked | | | | the identification of P-FDCI candidates may be complex | | |
| | to declare P-FDCI | | | | and flight should be evaluated one at a time. However, | | |
| | before any regulation, | | | | for "traditional" company such as Air France, a lot of P- | | |
| | and in case auto- | | | | FDCI candidates can be easily identified based on clear | | |
| | transfer is activated, | | | | criteria (e.g., curfew, crew time, aircraft assignment, | | |
| | the R-FDCI is | | | | planned maintenance). | | |
| | automatically declared | | | | | | |
| | (machine) for P-FDCI | | | | We did not observe any issue with both way of | | |
| | flights concerned by a | | | | declaration. When available / appropriate, automation | | |
| | regulation. However, | | | | may help AUs operator in terms of workload because it | | |
| | AU human operator | | | | will reduce the manual declaration to perform. | | |
| | still has the possibility | | | | | | |
| | to manually declare R- | | | | The operational interest of auto transfer function was | | |
| | FDCI. | | | | validated. To optimize task allocation between human | | |
| | Human operator may | | | | and machine, and keep the human operator in the loop | | |
| | have difficulties to | | | | (improve his situation awareness), system should inform | | |
| | handle both automatic | | | | the human operator when auto transfer is activated (R- | | |
| | behavior and manual | | | | FDCI is automatically declared by the system when P- | | |
| | actions. | | | | FDCI flight is affected by regulation). | | |
| | | | | | | | |

Arg. 2.1.6: The level of trust in automated functions is appropriate

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| HP- PJ07W238- V3-VALP- H24-5 | ISSUE: In case auto- transfer is activated, if a p-FDCI flight is not updated automatically to r-FDCI, AUs' trust in the system may be lost | Open | OBJ- PJ07W238- V3-VALP- H24-5 | Real Time Simulation | The auto-transfer mechanism was mainly perceived as clear and useful by the AUs. Incident on this function (auto transfer not working) has not been tested, but AUs explained if it happens, they should keep their trust on the system. | |
|---------------------------------------|--|-----------|--|--|---|--|
| | | | | | | |
| Are 2 2 1. Th | a a a a una a una a tima a lin a a a | - 6 : - 6 | the second s | and the second sec | and a subscription of the second state of the | |

Arg. 2.2.1: The accuracy and timeliness of information provided by the system is adequate for carrying out the task.

| HP- PJ07W238- V3-VALP- H24-4 | ISSUE: AU system provides an alert to inform operator when a p-FDCI flight has been impacted by a regulation (and status passed to r-FDCI). A late alerting could prevent ALI operator | Open | OBJ- PJ07W238- V3-VALP- H24-4 | Real Time Simulation | This feature was not implemented and have not been assessed directly during the evaluation. However, during debriefing, operators declared that the alerting is not necessary because they regularly monitor their flights. | PJ.07-W2-38_AUO- 0208_Reco_Design_ 18 | |
|---------------------------------------|--|------|--|-------------------------|---|---|--|
| | late alerting could prevent AU operator to react in a timely manner. | | | | | | |
| | | | | | | | |

Arg. 2.3.6: The usability of the user interface (input devices, visual displays/output devices, alarm& alerts) is acceptable. [V1: AIR only

| HP- PJ07W238- V3-VALP- H24-2 | ISSUE: Considering p- FDCI declaration, a poorly designed solution may lead to unnecessary workload, frustration and risk of error from AUs. | Open | OBJ- PJ07W238- V3-VALP- H24-2 | Real Time Simulation | AU did not have difficulty to declare P-FDCI. All AUs described the declaration process as easy. The workload was described as "acceptable" to fill and submit P-FDCI to NM. | | |
|---------------------------------------|--|------|--|-------------------------|---|---|--|
| HP- PJ07W238- V3-VALP- H24-3 | ISSUE: Considering identification of costly regulation (for FMP & NM), a poorly | Open | OBJ- PJ07W238- V3-VALP- H24-3 | Real Time Simulation | In majority FMPs and NM declared that the management of P-FDCI allowed to easily identify costly regulations. | PJ.07-W2-38_AUO- 0298_Reco_NewObj ective_19 | PJ.07-W2-38_AUO- 0208_REQ_Design_11 |

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| designed solution may | Some confusion had been noted between AUs and | |
|-----------------------|--|--|
| lead to unnecessary | FMPs regarding the definition of "costly". | |
| workload or | | |
| frustration | The workflow has been disrupted by the interface | |
| | which forced users to switch between the tabs to see | |
| | the costly regulation. Users did not seem to be | |
| | interested by this information; the reason still need to | |
| | be studied. | |
| | | |

Arg. 3.2.1: Changes to the task allocation between human actors do not lead to adverse effects on human tasks.

| HP- PJ07W238- V3-VALP- | BENEFIT: When a sector is "centrally managed", some | Open | OBJ- PJ07W238- V3-VALP- | Real Time Simulation | Thanks to the delegation of responsibility from FMP to NM, the FMP's workload is reduced. When the situation is centrally managed, the FMP does not have | |
|------------------------------|--|------|-------------------------------|-------------------------|--|--|
| H22-4 | responsibilities are transferred from FMP to NM. Thus, it may release some workload to FMP because pre-regulated flights tagged as p- FDCI are managed by | | H22-4 | | to proactively treat P-FDCI However, the impact on NM's workload is noticeable, especially when there is a lot of P-FDCI. NMOC have already a lot of tasks to handle, such as managing R- FDCI requests, and they usually do not have a lot of spare time available. In this context, NM operator insisted on the necessity to ask FMP to treat P-FDCI | |
| | NMOC | | | | directly as much as possible. Nevertheless, this result should be treated cautiously because the P-FDCI information is not a request and does not necessarily lead to an action from NMF. This information may or may not be used by FMP or NMOC, if they have time and workload available, without any obligation. Thus, the "additional workload" induced will be voluntarily accepted by the operator. | |

Arg. 3.3.4: The communication load of team members is acceptable in normal and abnormal conditions and degraded mode of operations

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| HP- | BENEFIT: Current | Open | OBJ- | Real Time | Compared to the reference (current situation), required | |
|-----------|-------------------------|------|-----------|------------|--|--|
| PJ07W238- | operation considering | | PJ07W238- | Simulation | communication & coordination loads to manage R-FDCI | |
| V3-VALP- | (reactive) FDCI flights | | V3-VALP- | | is perceived as reduced for 5 participants out of 9, but | |
| H25-1 | involve a heavy | | H25-1 | | the others disagreed with this statement, which means | |
| | communication load | | | | the results from questionnaires on this point are not | |
| | (for AU, FMP and | | | | clear. | |
| | NMOC) when AU | | | | | |
| | operator needs to | | | | However, the feedback gathered during interview | |
| | negotiate the | | | | (during the runs and final debriefing) tend to confirm | |
| | exclusion of r-FDCI | | | | the expected reduction of workload to treat the R-FDCI. | |
| | flight of a regulation. | | | | | |
| | Thanks to the | | | | | |
| | proactive FDCI | | | | | |
| | information sharing, | | | | | |
| | FMP can exclude a p- | | | | | |
| | FDCI directly when | | | | | |
| | declaring the | | | | | |
| | regulation. This is | | | | | |
| | expected to reduce | | | | | |
| | the occurrence of r- | | | | | |
| | FDCI, and thus, reduce | | | | | |
| | the associated | | | | | |
| | communication load. | | | | | |
| | | | | | | |

Arg. 3.3.5: Team members can maintain a sufficient level of shared situation awareness.

| HP- | BENEFIT: Thanks to | Open | OBJ- | Real Time | FMPs and NM mainly agree on the improvement of | PJ.07-W2-38_AUO- | PJ.07-W2-38_AUO- |
|-----------|-----------------------|------|-----------|------------|--|-------------------|--------------------|
| PJ07W238- | the proactive FDCI | | PJ07W238- | Simulation | situational awareness provided by the P-FDCI | 0298_Reco_Design_ | 0208_REQ_Design_09 |
| V3-VALP- | information sharing, | | V3-VALP- | | information. | 20 | |
| H23-2 | the shared situation | | H23-2 | | | | |
| | awareness considering | | | | FMPs and NM highlighted that additional information | PJ.07-W2-38_AUO- | |
| | flight criticality is | | | | about the reason of criticality could be interesting | 0298_Reco_Design_ | |
| | expected to be | | | | (feature available in the prototype but difficult to | 21 | |
| | | | | | access), so as the maximum acceptable delay (CTOT | | |
| | | | | | | | |
| | | | | | | | |

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| improved for all actors (AUs, FMP & NM). | max), which allow them to take the most appropriate action. | |
|---|--|--|
| | When a flight is being managed whether by FMPs or NM it could be interesting to provide real time feedback on the current treatment status to other operators to avoid conflicting situation (simultaneous modification, waste of time,). It also helps to improve NM operator's situation awareness by giving them a clear picture of the flights that are actually managed by FMPs. In addition, locking mechanism should be used to avoid simultaneous modifications. | |

Arg. 4.1.1: Changes in roles and responsibilities are acceptable to the affected human actors.

| HP- PJ07W238- V3-VALP- H26-1 | ISSUE: Centrally and locally manage may induce confusion in roles and responsibilities between FMP and NMOC | Open | OBJ- PJ07W238- V3-VALP- H26-1 | Real Time Simulation | FMPs experienced some confusion with both locally and centrally management concepts. They were not fully aware of the implication of "Centrally managed" option. However, debriefing interviews showed that this confusion was mainly due to a lack of training on this point and FMPs mentioned no major risk of confusion as long as the ongoing option (local or central) is known and shared by all involved operators (NM and local FMPs). In addition, the concept of locally and centrally managed has mainly been rejected by the FMPs and NMOC in terms of operational needs. | |
|---------------------------------------|---|------|--|-------------------------|--|--|
| | | | | | NNIOC III terms of operational needs. | |

Common Issues/Benefits and associated objectives for AUO-0219 and AUO-0208

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| Issue ID HP issue / Benefit Issue/ HP/ Valid. activity Benefit Obj. ID conducted results / evidence recommendations requirements Status | Issue ID I | HP issue / Benefit Be St | HP Issue/ HP/ Valid. Benefit Obj. ID Status | activity conducted | results / evidence | recommendations | requirements |
|---|------------|-----------------------------|--|-----------------------|--------------------|-----------------|--------------|
|---|------------|-----------------------------|--|-----------------------|--------------------|-----------------|--------------|

Arg. 1.2.1: Operating methods cover operations in normal operating conditions.

| HD_ | ISSUE (common to AUO-0219 and | Onen | OBI- | Real Time | According to EMPs, the |
|-------------|---|------|---------------|------------|----------------------------------|
| PI07\N/238- | $\Delta (0, 0, 2) \otimes \Delta = EDC $ flight may be | open | PI07W/238- | Simulation | decision process could be |
| 1307 W230 | refiled in a protection botspot and | | 1 JO7 W 2 JO- | Simulation | evolution process could be |
| U21 1 | hocomo infringor | | U21 1 | | the penalization of flight in DH |
| H21-1 | become miringer. | | пэт-т | | |
| | According to the defined | | | | will occur only if there is an |
| | procedures, infringer flights should | | | | overload. If so, the FMP may |
| | be the first ones to be penalized | | | | apply MCP to mitigate the |
| | (e.g. with MCP) but, as a p-FDCI | | | | traffic peak. To do so, he will |
| | flight, it should be exempt from | | | | pick "non P-FDCI" flights in |
| | delay as much as possible leading | | | | priority. If it is not the most |
| | to a conflicting situation for NM | | | | appropriate, any P-FDCI flight |
| | and FMP that should manage the | | | | may be picked to get delay. |
| | TV | | | | |
| | | | | | This process is consistent with |
| | | | | | current operation and allows |
| | | | | | FMP to fully manage the TV |
| | | | | | loading. In accordance with the |
| | | | | | concent of P-EDCL the flight |
| | | | | | may be negatized but this |
| | | | | | additional information about |
| | | | | | flight criticality will be |
| | | | | | ingrit criticality will be |
| | | | | | considered during the FIVIP's |
| | | | | | decision making. |
| | | | | | |
| | | | | | NIVI operator has not been |
| | | | | | confronted to this situation but |
| | | | | | he agreed on the proposed way |
| | | | | | of handling the situation and |

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| | | | | | confirmed that the P-FDCI | |
|---------------------------------------|---|------|--|-------------------------|---|--|
| | | | | | matter. | |
| HP- PJ07W238- V3-VALP- H31-2 | ISSUE (common to AUO-0219 and AUO-0208): A p-FDCI flight may be refiled in a protection hotspot and become infringer. This conflicting situation may not be easy to manage locally or centrally, so it may be interesting to manage it directly at the AU level (e.g. refile out of PH, remove FDCI, etc.) | Open | OBJ- PJ07W238- V3-VALP- H31-2 | Real Time Simulation | AUs' operators are aware of the risk to be confronted to this situation. However, they highlighted that ideally, P-FDCI flight should be positively treated before any need to refile in a protection hotspot, so theoretically, this situation should rarely happen. Furthermore, the management of this situation will depend on several factors. Depending on the flight criticality, AU operator may try to refile out of the PH. The workload may also impact their decision. If there are subjected to high workload situation, they may try to avoid the PH as much as possible because in case of later TV saturation in the PH, they will not have time to manage the situation a second time. If the workload is acceptable, they may decide to keep the P-FDCI flight in the PH because they will have time to find an | |

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| | | alternative solution in case of penalization. | |
|--|--|---|--|
| | | | |

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4.2.4.2 Maturity of the Solution

The maturity of the solution is V2 and targets V3.





| Maturity checklist for finalising the V3 assessment | | | | | | | | |
|---|----------|--------|----------|--|--|--|--|--|
| ID | Question | Answer | Comments | | | | | |





| | | 1 | | |
|---|---|----------------------|------|---|
| 1 | Has a Human Performance Assessment Report been completed? Have all relevant arguments been addressed and appropriately supported? | Partial– Blocking | Non- | The HPAR and the HPAP were drafted in accordance with the SESAR process without any difficulty to report. Two Human Factors specialists were involved throughout the exercises, with the active participation of end users. The evidence from validation exercise demonstrated consistency of the task, procedures, and role of each actor of the project (FMPs, NM, AUs) that have been fully addressed. |
| | | | | No negative impact on human actors has been identify in the validated scenarios. |
| | | | | Based on the Change and Argument Identification section, 52 issues / benefits have been identified, covering all 4 HP arguments. These benefits / issues have been dispatched between the two operational concepts: |
| | | | | Enriched DCB information and Advanced What-If functionalities for AUs including "Protection Hotspot" (AUO-0219): 29 issues / benefits Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P-FDCI) (AUO-0208): 23 issues / benefits |
| | | | | The 4 high-level HP Arguments have been covered as described in the HP Log Appendix C. It concerned: |
| | | | | 1. Roles and Responsibilities 2. Human & System 3. Team & Communication 4. HP Related Transition Factors |
| | | | | 2nd level HP Arguments covered: |
| | | | | 1.1 Roles & Responsibilities 1.2 Operating methods 1.3 Tasks 2.1 Allocation of tasks (Human & System) 2.2 Performance of technical system 2.3 Machine Interface 3.1 Team composition 3.2 Allocation of tasks 3.3 Communication 4.1 Accentance & Job Satisfaction |





| | | | 4.2 Competence Requirements 4.3 Staffing Requirement & Staffing Levels |
|---|---|---------------------------|---|
| | | | All the arguments were addressed in PJ07-38 RTS. The results are documented in the HP Log Appendix C. |
| 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)? | Partial – Non Blocking | The HP issues and benefit were properly identified and reported in the "Issue-Objective-Outcome" sections of the HP Log Appendix C, and sufficiently addressed during HP validation activities. |
| | | | Degraded mode and abnormal situations are only partially addressed, so additional validation activites could be required. However, after discussion with the users, it turned out that the degraded and tested cases were well managed during the exercises, and did not cause any difficulties. |
| | | | All outcomes from HP validation activities have been detailed in the « Recommendations and Requirements » sections of the HP Log Appendix C. |
| 3 | Have all the parts of the solution/concept been considered? | Achieved | All parts of the solution / concept have been considered and fully described in the OSED [1]. Several functionalities have been explored as we considered abnormal cases. |
| 4 | Have potential interactions with related projects/concepts been considered and addressed? | Achieved | The list of projects the solution relates to is reported in OSED part I. |
| 5 | Is the level of human performance needed to achieve the desired system performance for the proposed solution consistent with human capabilities? | Achieved | The level of human performance needed to achieve the desired system performance has been assessed and confirmed as consistent with human capabilities. All outcomes from HP validation activities have been detailed in the « Recommendations and Requirements » sections of the HP Log Appendix C. |
| 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? | Achieved | The results obtained from a HP perspective are in line with the proposed targets as all HP related validation objectives have been successfully covered and mitigation were proposed for all issues where appropriate. Improved CDM Improved SA No noticeable negative impact |





| 7 | Has the proposed solution been tested with end-users and under sufficiently realistic conditions, including abnormal and degraded conditions? | Partial– Non Blocking | The operational concepts have been validated with end users. The tools used were not the same as those used in real conditions, and presented different characteristics (i.e.: smaller screen size during the validation exercises). The workload during the exercises was lower than in real condition because not all tasks could be played. Moreover, the actors involved in the loop were much more available than they would have been in a real situation (NM). |
|----|--|---------------------------|---|
| 8 | Do validation results confirm that the interactions between human and technology are operationally feasible, and consistent with agreed human performance requirements? | Achieved | Even if some limitations have been identified, the PJ.07-W38 RTS validation results confirm that the interactions between human and technology are operationally feasible and consistent with agreed HP requirements. For a detailed view on the identified issues and the results of the validations, please consult all sections related to AUO-0208 and AUO-0219 in the current HP Log Excel Appendix C. |
| 9 | Have all relevant SESAR documentation been updated according to the HP activities outcomes (SPR-INTEROP/OSED)? | Achieved | The relevant SESAR documentation had been updated i.e., SPR-Interop/OSED |
| 10 | Do the outcomes satisfy the HP issues/benefits in order to reach the expected KPA? | Achieved | The outcome of the PJ.07-38 with associated recommendations and requirements can be found in the "Issue-Objective-Outcome" and the "Recommendations and Requirements register" sections of the HP Log Appendix C. |
| 11 | Have HP recommendations and HP requirements correctly been considered in HMI design, procedures/documentation and training? | Partial – Non Blocking | HP recommendations were taken into consideration in the HMI design, procedures, and training. However, even if no blocking point points were found some improvements should be carried out before an actual implementation of the concept. The outcome of the PJ.07-38 with associated recommendations and requirements can be found in the "Issue-Objective-Outcome" and the "Recommendations and Requirements register" sections of the HP Log Appendix C. |
| 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? | Achieved | Transition factors have been addressed in the V3 exercises through associated objectives. The outcome of the PJ.07-38 with associated recommendations and requirements can be found in the "Issue-Objective-Outcome" and the "Recommendations and Requirements register" sections of the HP Log Appendix C. |





| 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. | Achieved | | No changes in roles and responsibilities and operating methods regarding the one currently implemented will require regulations changes. |
|----|--|---------------------|------|--|
| 14 | Has the next V-phase sufficiently been prepared (additional testing conditions, open HP issues to be addressed)? | Partial blocking | non- | Recommendations for future research concerning HP aspects have been identified and detailed in the "Recommendations and Requirements register" sections of the HP Log Appendix C. Abnormal cases have been predicted, and new features have been proposed. Recommendations and requirements offer guidelines to facilitate the implementation and industrialization of the tool. |









5 References

Human Performance

- [1] Validation Plan Part I
- [2] Validation Report Part I
- [3] SATI SHAPE Automation Trust Index
- [4] SASHA Situation Awareness for SHAPE





Appendix A – HP Recommendations Register

| | | HP R | ecommendations | Register | | | | | |
|--|-------------------------------|---|--|---|--|--|------------------------------|--------------------------------------|----------|
| Reference | Type of recommen dation | Recommendation | Rationale | Assessm ent source + Referen ce report | Scope (Air, Air/Gro und, Ground) | Concept/ solution Involved | Recommen dation status | Rationale in case of rejection | Comments |
| PJ.07-W2-38_AUC 0219_Reco_NewC ve_01 | New objective | Further study could be done to clearly identify which information could be interesting to help FMP to perform MCP. | If FMPs do not have enough information about infringers flight, including their identification and when they entered a PH- protected area, they will not be able to apply MCP optimally. | Real Time Simulati on | Air/Gro und | Enriched DCB information and Advanced What-If functionalities for AUs including "Protection Hotspot" (AUO-0219) | | | |
| PJ.07-W2- 38_AUO- | New objective | Further study could be done to ensure that AUs is protected by the system | Abnormal conditions have | Real Time | Air/Gro und | Enriched DCB information | | | |

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| 0219 Reco New | | from unexpected refilling on a PH, even | not been | Simulati | | and Advanced | | |
|----------------|--------|---|-------------------|----------|---------|-----------------|--|--|
| Objective 02 | | if the information related to the PH is | assessed | on | | What-If | | |
| , <u> </u> | | not available. | directly during | | | functionalities | | |
| | | | the evaluation. | | | for AUs | | |
| | | | Indeed, the | | | including | | |
| | | | platforms used | | | "Protection | | |
| | | | were not | | | Hotspot" | | |
| | | | modular | | | (AUO-0219) | | |
| | | | enough to be | | | · · · | | |
| | | | able to turn | | | | | |
| | | | off/on a specific | | | | | |
| | | | feature. | | | | | |
| | | | | | | | | |
| PJ.07-W2- | System | "AU platform shall integrate the PH in | AUs expose | Real | Air/Gro | Enriched DCB | | |
| 38_AUO- | design | their trajectory planning tool to | themselves to | Time | und | information | | |
| 0219_Reco_Desi | | propose route avoiding protection | MCPs if they file | Simulati | | and Advanced | | |
| gn_03 | | hotspot on user demand. | their aircrafts | on | | What-If | | |
| | | | through a PH. | | | functionalities | | |
| | | | The tool should | | | for AUs | | |
| | | | help them to | | | including | | |
| | | | establish their | | | "Protection | | |
| | | | reroutings by | | | Hotspot" | | |
| | | | offering | | | (AUO-0219) | | |
| | | | alternatives | | | | | |
| | | | allowing to | | | | | |
| | | | avoid PH. | | | | | |
| | | | Without this | | | | | |
| | | | help the | | | | | |
| | | | workload could | | | | | |
| | | | be increased to | | | | | |
| | | | manually search | | | | | |





| | | | for avoidance solutions and mistakes may be done. | | | | | |
|---|------------------|---|--|--------------------------------|----------------|--|--|--|
| PJ.07-W2- 38_AUO- 0219_Reco_Desi gn_04 | System design | Alert/confirmation step is suggested to inform AUs if a rerouting on a PH is performed could be evaluated in future assessment | Abnormal conditions have not been assessed directly during the evaluation. Indeed, the platforms used were not modular enough to be able to turn off/on a specific feature. | Real Time Simulati on | Air/Gro und | Enriched DCB information and Advanced What-If functionalities for AUs including "Protection Hotspot" (AUO-0219) | | |
| PJ.07-W2- 38_AUO- 0219_Reco_Syst emDesign_05 | New objective | In a future evaluation it would be interesting to test the alerting rules in order to find the best rule. | The way alerting was implemented in the interface was not clear to all operators. To have a common and shared vision, the alerting rules | Real Time Simulati on | Air/Gro und | Enriched DCB information and Advanced What-If functionalities for AUs including "Protection Hotspot" (AUO-0219) | | |





| | | | must be clearly defined. | | | | | |
|---|------------------|---|--|--------------------------------|----------------|--|--|--|
| PJ.07-W2- 38_AUO- 0219_Reco_Syst emDesign_06 | New objective | An interest has been expressed to see the traffic evolution, and this point has to be worked. | It was not easy for some FMPs to accurately assess the impact of MCP measures on unplanned flights. This is why additional information must be defined and provided to FMPs regarding unplanned flights. | Real Time Simulati on | Air/Gro und | Enriched DCB information and Advanced What-If functionalities for AUs including "Protection Hotspot" (AUO-0219) | | |
| PJ.07-W2- 38_AUO- 0219_Reco_Desi gn_07 | System design | Alerting feature is suggested to inform FMPs if they plan to apply MCP to "non infringer flight". | Abnormal conditions have not been assessed directly during the evaluation. We can however mention that situationnal awareness was sufficient to | Real Time Simulati on | Air/Gro und | Enriched DCB information and Advanced What-If functionalities for AUs including "Protection Hotspot" (AUO-0219) | | |





| | | | avoid mistakes. | | | | | |
|---|---|---|--|--------------------------------|----------------|--|--|--|
| | | | • | | | | | |
| PJ.07-W2- 38_AUO- 0219_Reco_New Objective_08 | New objective | Further study shall evaluate the "Traffic trend" feature to see if it improves FMP's situation awareness about the traffic evolution. | Abnormal conditions have not been assessed directly during the evaluation. Indeed, the platforms used were not modular enough to be able to turn off/on a specific feature. | Real Time Simulati on | Air/Gro und | Enriched DCB information and Advanced What-If functionalities for AUs including "Protection Hotspot" (AUO-0219) | | |
| PJ.07-W2- 38_AUO- 0219_Reco_OPS _09 | OPS (operating methods / procedures) | The rule to trigger an alert / identify TV of interest should be further studied to mitigate the risk of spurious activation and maximize the number of accurate "TV of interest" detected. | The relevance and the confidence of the FMPs with regard to the algorithm detecting TV of interest must be improved. To do this, rules must be further refine. | Real Time Simulati on | Air/Gro und | Enriched DCB information and Advanced What-If functionalities for AUs including "Protection Hotspot" (AUO-0219) | | |





| PJ.07-W2- 38_AUO- 0219_Reco_New Objective_10 | New objective | Due to the constraints of exercise, route proposals have been tested via text communication through online chat. Further study should assess route proposals integrated directly via B2B services in an efficient way to help operators to better manage their flights. | If the route proposals given are not good enough AUs would use their own tools. Also, route proposals had to be sent directly through the interface. | Real Time Simulati on | Air/Gro und | Enriched DCB information and Advanced What-If functionalities for AUs including "Protection Hotspot" (AUO-0219) | | |
|---|------------------|--|--|--------------------------------|----------------|---|--|--|
| PJ.07-W2- 38_AUO- 0208_Reco_Oth er_11 | Other | In case of future evaluation, the concept of "Centrally managed" and associated procedure should be clarified properly during the training sessions, prior to the exercise. | Following the training sessions, the only issue remaining with proposed solution was a need of clarification about process related to "Centrally managed*" | Real Time Simulati on | Air/Gro und | Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P- FDCI) (AUO- 0208 | | |
| PJ.07-W2- 38_AUO- 0208_Reco_Desi gn_12 | System design | To reduce the workload of AUs and the repetition of regular actions, a process for automating the declaration of P- FDCI should be considered and tested | Depending on their flight habits as well as various parameters, the identification of | Real Time Simulati on | Air/Gro und | Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay | | |





| | | with user | s in fut | ure validation | P-FDCI was | | | Criticality | | |
|---------------|-----------|------------|------------|----------------|-------------------|----------|---------|----------------|--|--|
| | | exercises. | | | more or less | | | Indicator, P- | | |
| | | | | | complex | | | FDCI) (AUO- | | |
| | | | | | depending on | | | 0209 | | |
| | | | | | the AU. In some | | | | | |
| | | | | | cases we were | | | | | |
| | | | | | faced with an | | | | | |
| | | | | | increase in the | | | | | |
| | | | | | workload to | | | | | |
| | | | | | identify the | | | | | |
| | | | | | PFDCls, in other | | | | | |
| | | | | | cases we were | | | | | |
| | | | | | dealing with | | | | | |
| | | | | | repetitive | | | | | |
| | | | | | actions." | | | | | |
| | | | | | | | | | | |
| PJ.07-W2- | New | Abnormal | conditions | s should be | Abnormal | Real | Air/Gro | Use of Simple | | |
| 38_AUO- | objective | evaluated | in futu | re validation | conditions have | Time | und | AU Preferences | | |
| 0208_Reco_New | | exercises. | | | not been | Simulati | | in DCB | | |
| Objective_13 | | | | | assessed | on | | Processes | | |
| | | | | | directly during | | | (Proactive | | |
| | | | | | the evaluation. | | | Flight Delay | | |
| | | | | | Indeed, the | | | Criticality | | |
| | | | | | platforms used | | | Indicator, P- | | |
| | | | | | were not | | | FDCI) (AUO- | | |
| | | | | | modular | | | 0210 | | |
| | | | | | enough to be | | | | | |
| | | | | | able to turn | | | | | |
| | | | | | off/on a specific | | | | | |
| | | | | | feature. | | | | | |
| | | | | | | | | | | |





| _ |
|---|





| PJ.07-W2- | New | This alerting feature, suggested to | Abnormal | Real | Air/Gro | Use of Simple | |
|---------------|-----------|--------------------------------------|------------------|----------|---------|-----------------|--|
| 38_AUO- | objective | identify and correct a human error, | conditions | Time | und | AU Preferences | |
| 0208_Reco_New | | could be evaluated in future | (missing | Simulati | | in DCB | |
| Objective 16 | | assessment. | feature) have | on | | Processes | |
| | | | not been | | | (Proactive | |
| | | | assessed | | | Flight Delay | |
| | | | directly during | | | Criticality | |
| | | | the evaluation. | | | Indicator. P- | |
| | | | Indeed. the | | | EDCI) (AUO- | |
| | | | platforms used | | | 0213 | |
| | | | were not | | | 0110 | |
| | | | modular | | | | |
| | | | enough to be | | | | |
| | | | able to turn | | | | |
| | | | able to turn | | | | |
| | | | facture | | | | |
| | | | feature. | | | | |
| PI.07-W2- | New | Updated FDCI status should be tested | Abnormal | Real | Air/Gro | Use of Simple | |
| 38 AUO- | objective | in further assessment to avoid | conditions | Time | und | All Preferences | |
| 0208 Reco New | objective | inappropriate actions and | (missing | Simulati | ana | in DCB | |
| Objective 17 | | misunderstanding and to manage | feature) have | on | | Processes | |
| objective_1/ | | operations related to FDCL and | not heen | 011 | | (Proactive | |
| | | efficiently support a collaborative | assessed | | | Elight Delay | |
| | | decision making | diractly during | | | Criticality | |
| | | decision making. | the evaluation | | | Indicator D | |
| | | | life evaluation. | | | | |
| | | | indeed, the | | | FDCI) (AUU- | |
| | | | plationis used | | | U214 | |
| | | | were not | | | | |
| | | | modular | | | | |
| | | | enough to be | | | | |
| | | | able to turn | | | | |





| | | | off/on a specific feature. | | | | | |
|---|------------------|---|---|--------------------------------|----------------|---|--|--|
| PJ.07-W2- 38_AUO- 0208_Reco_Desi gn_18 | System design | Alerting feature is suggested to inform operator when a pFDCI flight has been impacted by a regulation. | This feature was not implemented and have not been assessed directly during the evaluation. | Real Time Simulati on | Air/Gro und | Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P- FDCI) (AUO- 0215 | | |
| PJ.07-W2- 38_AUO- 0208_Reco_New Objective_19 | System design | Further study could be done to determine if users are interested to identify costly regulations. | During the evaluation, users didn't showed an interest for the identification of costly regulation. They explained the information as not easy to access in. With a better implementation this assumption | Real Time Simulati on | Air/Gro und | Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P- FDCI) (AUO- 0216 | | |





| | | | could be different. | | | | | |
|---|------------------|---|---|--------------------------------|----------------|---|--|--|
| PJ.07-W2- 38_AUO- 0208_Reco_Desi gn_20 | System design | When a flight is being handled by FMPs or NM, a real time feedback could be provided to inform other operators that they should avoid to work on it at the same time. | Confliction situation could happens when several operators are working at the same time on the same flight, which would lead to wasting time or frustration. | Real Time Simulati on | Air/Gro und | Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P- FDCI) (AUO- 0217 | | |
| PJ.07-W2- 38_AUO- 0208_Reco_Desi gn_21 | System design | Locking mechanism should be used to avoid simultaneous modification | Confliction situation could happens when several operators are working at the same time on the same flight, which would lead to wasting time or frustration. | Real Time Simulati on | Air/Gro und | Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P- FDCI) (AUO- 0218 | | |

Table 16: HP recommendations









Appendix B – HP Requirements Register

| | HP Requirements Register | | | | | | | | | |
|--|----------------------------|---|--|--|--|--|------------------------|--------------------------------------|----------|--|
| Reference | Type of requirem ent | Requirement | Rationale | Assess ment source + Refere nce report | Scope (Air, Air/Ground, Ground) | Concept/ solution Involved | Requireme nt status | Rationale in case of rejection | Comments | |
| PJ.07-W2- 38_AUO- 0219_REQ_ Design_01 | System design | The NM interface shall integrate the information relating to the PH to improve NM's situation awareness and avoid unexpected RRPs in a PH. | NM had no PH information. This is why it proposed RRPs there, causing the FMP to lose exclusive control of the PH The proper functionality was not implemented in the NMVP tool | Real Time Simula tion | Air/Ground | Enriched DCB information and Advanced What-If functionalities for AUs including "Protection Hotspot" (AUO-0219) | | | | |





| PJ.07-W2- 38_AUO- 0219_REQ_ Design_02 | System design | AU platform shall integrate the PH in their trajectory planning tool to propose an optimal route. | During the year, we were unable to test the major automation solution. | Real Time Simula tion | Air/Ground | Enriched DCB information and Advanced What-If functionalities for AUs including "Protection Hotspot" (AUO-0219) | | |
|--|------------------|--|---|--------------------------------|------------|--|--|--|
| PJ.07-W2- 38_AUO- 0219_REQ_ Design_03 | System design | "The main guidelines for future HMI implementation may be summarized as the following statements: Flight planning tool should be able to consider PH in its route computation Flight planning tool should allow user to generate routes with "avoid PH" option AUs planning tool should allow user to display PH easily in its tool to get better situation awareness and support flight planning operations AUs tool should be able to inform them when a flight is identified as "infringer" | Even if the objectives were not focused on the interface itself, the data collected during the sessions allows us to propose guidelines for future developments . They concern the implementati on of certain data that lacked | Real Time Simula tion | Air/Ground | Enriched DCB information and Advanced What-If functionalities for AUs including "Protection Hotspot" (AUO-0219) | | |





| | | The rule behind the identification of Tv of interest / alerting for FMP should be improved and HMI reviewed to make it more noticeable for the user FMP tool should support them to quickly identify infringers NM tool should integrate protection hotspot" | optimization resulting in a loss of time to perform action. | | | | | |
|--|------------------|---|---|--------------------------------|------------|---|--|--|
| PJ.07-W2- 38_AUO- 0208_REQ_ Design_04 | System design | The remaining quota shall be available and easy to access at any time to allow AUs operators to monitor and manage it. The quota of P-FDCI flight available shall be a fixed percentage of AU's flights per day. | During the sessions, operators insisted on the usefulness of having a P- FDCI quota. It was specified by FMPs that this quota have to be correctly determined in order to avoid having too many to the detriment of the concept. | Real Time Simula tion | Air/Ground | Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P- FDCI) (AUO- 0208 | | |





| PJ.07-W2- 38_AUO- 0208_REQ_ Design_05 | System design | Automation shall not be imposed, but offered as a service that AUs can use or not depending on their flight routines | Depending on their flight habits as well as various parameters, the identification of P-FDCI was more or less complex depending on the AU. In some cases we were faced with an increase in the workload to identify the PFDCIs, in other cases we were dealing | Real Time Simula tion | Air/Ground | Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P- FDCI) (AUO- 0209 | | |
|--|------------------|--|--|--------------------------------|------------|---|--|--|
| | | | were dealing with repetitive actions. | | | | | |
| PJ.07-W2- 38_AUO- 0208_REQ_ Design_06 | System design | Ideally, the system shall support P- FDCI candidate identification by providing appropriate information, for example: •Applicable curfew | Depending on their flight habits as well as various parameters, the identification | Real Time Simula tion | Air/Ground | Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality | | |

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| | | Aircraft assignment constraints | of P-FDCI was | | | Indicator, P- | | |
|-----------|--------|---|-----------------|--------|------------|----------------|--|--|
| | | | more or less | | | FDCI) (AUO- | | |
| | | Planned maintenance | complex | | | 0210 | | |
| | | · Crow time information | depending on | | | | | |
| | | •Crew time information | the AU. In | | | | | |
| | | •Commercial limitations (PAX | some cases we | | | | | |
| | | operations). | were faced | | | | | |
| | | | with an | | | | | |
| | | The system shall support P-FDCI | increase in the | | | | | |
| | | declaration with easy to use feature | workload to | | | | | |
| | | and allow either "one by one" | identify the | | | | | |
| | | declaration or "multiple" declaration. | PFDCls, in | | | | | |
| | | | other cases we | | | | | |
| | | | were dealing | | | | | |
| | | | with repetitive | | | | | |
| | | | actions. | | | | | |
| | | | | | - | | | |
| PJ.07-W2- | System | The system shall provide to the NMF | The FMPs | Real | Air/Ground | Use of Simple | | |
| 38_AUO- | design | the "P-FDCI" indication directly (no | warned that if | Time | | AU | | |
| 0208_REQ_ | | user action required) to efficiently | there were | Simula | | Preferences in | | |
| Design_07 | | support the user. | too many | tion | | DCB Processes | | |
| | | | PFDCIs to deal | | | (Proactive | | |
| | | | with they | | | Flight Delay | | |
| | | | might have to | | | Criticality | | |
| | | | make choices | | | Indicator, P- | | |
| | | | among them | | | FDCI) (AUO- | | |
| | | | to apply the | | | 0211 | | |
| | | | MCPs which | | | | | |
| | | | can lead to a | | | | | |
| | | | decrease of | | | | | |
| | | | the | | | | | |





| | | | acceptability of the concept and an increase of the workload. | | | | | |
|---|------------------|--|---|--------------------------------|------------|---|--|--|
| PJ.07-W2- 38_AUO- 0208_REQ_ Design_8 | System design | The remaining quota shall be available and easy to access at any time to allow AUs operators to monitor and manage it. | In order to better manage quotas, AUs have repeatedly expressed the need for real- time feedback of the remaining quota. | Real Time Simula tion | Air/Ground | Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P- FDCI) (AUO- 0212 | | |
| PJ.07-W2- 38_AUO- 0208_REQ_ Design_9 | System design | The P-FDCI indication and associated information (criticality, reason, maximum delay acceptable) shall be easily accessible and always available (e.g. on demand). | Some information about the type of critically has been described as interesting but actually missing. Adding additional | Real Time Simula tion | Air/Ground | Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P- FDCI) (AUO- 0213 | | |





| | | | information could help NM ad FMPs to take the most appropriate action. | | | | | |
|--|------------------|---|--|--------------------------------|------------|---|--|--|
| PJ.07-W2- 38_AUO- 0208_REQ_ Design_10 | System design | The system shall provide an easy and clear way to identify any flight without any ambiguity, which will mitigate the risk of selecting the wrong flight during P-FDCI declaration. Ideally, the system used to declare P- FDCI should provide all relevant information to support decision making without the necessity to refer to a third-party application. | To support their decision making regarding P- FDCI declaration, AUs had to use additional operational platform. Neither Dassault, SWISS or Metron gathered all relevant data to support operator's decision making. | Real Time Simula tion | Air/Ground | Use of Simple AU Preferences in DCB Processes (Proactive Flight Delay Criticality Indicator, P- FDCI) (AUO- 0214 | | |
| PJ.07-W2- | New | Users seemed not interested by this | Users didn't | Real | Air/Ground | Use of Simple | | |
| 38_AUO- | objective | information, further evaluation | use the costly | Time | | AU Droforoncos in | | |
| | | | regulation | | | FIELEILES III | | |

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| 0208_REQ_ | should be performed on "identify | information. | Simula | DCB Processes |
|-----------|----------------------------------|-----------------|--------|---------------|
| Design_11 | costly regulation" use cases. | The way to | tion | (Proactive |
| | | acess on it was | | Flight Delay |
| | | not efficient | | Criticality |
| | | because it | | Indicator, P- |
| | | forced users | | FDCI) (AUO- |
| | | to switch | | 0215 |
| | | between the | | |
| | | tabs. | | |
| | | | | |

Table 17: HP Requirement





Appendix C – HP Log



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Appendix D – Additionnal documents



shape_questionnair e_SASHA_print.pdf







SASHA_scoring shape_questionnair e_SATI_print.pdf







-END OF DOCUMENT-





Insert beneficiary's logos below, if required and remove this sentence





