



SESAR Solution 02-01 SPR/INTEROP-OSED for V3 - Part IV - Human Performance Assessment Report

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PJ02 EARTH

INCREASED RUNWAY AND AIRPORT THROUGHPUT

This SESAR Solution 02-01 SPR-INTEROP/OSED Part IV Human Performance Assessment Report (HPAR) is part of a project PJ.02-01 EARTH that has received funding from the SESAR Joint Undertaking under grant agreement No 731781 under European Union's Horizon 2020 research and innovation programme.



Abstract

This document contains the Human Performance (HP) assessment report for the SESAR 2020 Wave 1 SESAR Solution 02-01 (Wake Turbulence Separation Optimisation) 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. The scope of this report embraces all three solution concepts (WDS-D, PWS-D and OSD, WDS-A, PWS-A and ORD) assessed by NATS, EUROCONTROL, DLR and ENAIRE. A set of desk-top exercises, workshops with partners and end-users were utilised as the source of the information for the HP assessment, as well as Real Time Simulations, where findings were tested, analysed, and appropriate recommendations identified.

The following is a list of activities conducted:

- Partner workshop for all concepts held in Madrid in July 2018
- NATS internal user WebEx, November 2018
- Partner workshop for all concepts held in Bretigny in October 2018
- EUROCONTROL Real Time Simulations (RTS)
- Pilot- ATCO Workshop conducted by EUROCONTROL in Paris in January 2019
- NATS Real Time Simulations (RTS) 5
- Post-RTS5 workshop held at Heathrow in March 2019
- ENAIRE RTS 6
- Post-validation workshop held at NATS in July 2019

These activities were focused on the identification of Human Performance-related hazards and benefits associated with all concepts. Evidence was gathered via qualitative and quantitative methods using subjective and objective data-capture.

The criteria of the V3 Maturity assessment have been met.

Table of Contents

| | |
|--|-----------|
| Abstract | 5 |
| 1 Executive Summary..... | 8 |
| 2 Introduction..... | 11 |
| 2.1 Purpose of the document..... | 11 |
| 2.2 Intended readership | 15 |
| 2.3 Scope of the document | 15 |
| 2.4 Human performance work schedule within the Solution..... | 16 |
| 2.5 Structure of the document..... | 17 |
| 2.6 Acronyms and Terminology | 18 |
| 3 The Human Performance Assessment Process: Objective and Approach..... | 21 |
| 4 Human Performance Assessment | 22 |
| 4.1 Arrivals Concepts Solutions..... | 22 |
| 4.2 Departures Concepts Solutions | 37 |
| 4.3 Wake Risk Monitoring Concept Solution..... | 52 |
| 4.4 Wake Decay Enhancing Concept Solution | 56 |
| 5 References..... | 57 |
| Appendix A – Additional HP activities conducted..... | 58 |
| A.1 Arrivals Concepts Solutions..... | 58 |
| A.2 Departures Concepts Solutions | 58 |
| A.3 Wake Risk Monitoring Concept Solution..... | 58 |
| A.4 Wake Decay Enhancing Concept Solution | 58 |
| Appendix B – HP Recommendations Register..... | 59 |
| B.1 Arrivals Concepts Solutions..... | 59 |
| B.2 Departures Concepts Solutions | 59 |
| B.3 Wake Risk Monitoring Concept Solution..... | 59 |
| B.4 Wake Decay Enhancing Concept Solution | 59 |
| Appendix C – HP Requirements Register | 60 |
| C.1 Arrivals Concepts Solutions..... | 60 |
| C.2 Departures Concepts Solutions..... | 60 |
| C.3 Wake Risk Monitoring Concept Solution | 60 |

| | |
|---|-----------|
| C.4 Wake Decay Enhancing Concept Solution | 60 |
| Appendix D – HP Log | 61 |
| D.1 Arrivals Concepts Solutions | 61 |
| D.2 Departures Concepts Solutions | 61 |
| D.3 Wake Risk Monitoring Concept Solution | 61 |
| D.4 Wake Decay Enhancing Concept Solution | 61 |

List of Tables

| | |
|---|----|
| Table 1: Acronyms and terminology | 20 |
| Table 2: Summary of the HP results and recommendations/ requirements for each identified issue & related argument | 25 |
| Table 3: Description of Activity 1 | 38 |
| Table 4: Description of Activity 2 | 38 |
| Table 5: Summary of the HP results and recommendations/ requirements for each identified issue & related argument | 44 |

List of Figures

| | |
|--|----|
| Figure 1: Steps of the HP assessment process | 21 |
|--|----|

1 Executive Summary

This document contains the Human Performance Assessment for the application of the SESAR Solution 02-01 (Wake Turbulence Separation Optimisation) in capacity constrained European Airports including Heathrow, Charles De Gaulle, Vienna and Barcelona. The report presents the assurance that the Human Performance Requirements for the V1-V3 phases are complete, correct and realistic, thereby providing all material to adequately inform the SESAR Solution 02-01 development and validation.

This Human Performance Assessment Report (HPAR) is contributing to the Operational Service and Environment Definition (OSED), Safety and Performance Requirements (SPR), Interoperability (INTEROP) Requirements, and Technical Specifications (TS), and Interface Requirement Specifications (IRS).

This document specifies the SESAR Solution 02-01 human performance assessment results in the scope of the operational scenarios designed and validated by ENAIRE, EUROCONTROL, DLR and NATS, which took place between February 2018 and July 2019.

This Human Performance Assessment Report aggregates the main Solution scenarios of the SESAR Solution 02-01 as follows:

- Departures Concepts Solutions:
 - Pairwise Separations for Departures (PWS-D) with Optimised Separation Delivery (OSD) tool support;
 - Weather Dependent Separations for Departures (WDS-D) with WDS-D tool support and Enhanced OSD tool support;
 - RECAT-EU separation for Departures with OSD support tool.
- Arrivals Concepts Solutions:
 - Static Pairwise Separations (S-PWS) - Wake turbulence separations for arrivals based on static aircraft characteristics (AO-0306);
 - Weather Dependent Separations (WDS) - weather dependant reductions of wake turbulence separations on the final approach (AO-0310);
 - Optimised Runway Delivery (ORD) - a controller tool to support the application of static pairwise separations and weather dependent separations on the final approach (AO-0328);
 - Wake Risk Monitoring (WRM) – reduction of wake turbulence risk considering wake monitoring (AO-0327);
 - Wake Decay Monitoring (WDM) – although this latter solution was a part of PJ.02-01, no human performance assessment was required.

Internal and external workshops with end users were held to identify areas of Human performance where changes were expected. Together with the related issues or benefits, these were recorded and categorised within the Human Performance argument structure, which subsequently formed a basis for a list of Objectives for Real Time Simulations and Post-simulation workshops, where the relevant subject-matter experts participated.

The Issues and/or Benefits were identified within all the four HP Arguments (and their sub-categories), which are listed as follows:

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

The following is the summary of the findings for all departures concepts:

A satisfactory number of data-points were collected during NATS RTS5, EUROCONTROL and ENAIRE Validation exercises for each scenario, with the majority of the HP areas covered in accordance with the Issues and Benefits previously identified within the four High-level HP arguments. The only area that was not covered in the NATS RTS 5 simulation exercise was the Airport Tower Supervisor role and their responsibilities with respect to the application of the WDS-D Solution. This was due to the limitations in the NATS Aerodrome Simulator environment.

No major detrimental impact on HP was found in the RECAT-EU, PWS-D and WDS-D scenarios compared to the reference scenario. A clear benefit of the employed of the OSD/Enhanced tool was identified with respect to controller mental workload, time management and task organisation.

However, the dynamic application of the Weather-dependent solutions (WDS-D) may result in the controller investing effort on optimising the departure sequence without the reduced separation benefits being realised as meteorological conditions could change with little predictability.

The identified HP issue, which is applicable to all solutions with the use of the OSD tool, the controller following the countdown timer and omitting to account for higher SID separation rules materialised during the RTS5 exercise and during the PostRTS5 stakeholder workshop. This issue will be addressed in future project activities – the generated Recommendations and Requirements specify details. It is foreseen that after the mandatory Requirements and feasible Recommendations have been completed, HP risks will be mitigated to an acceptable level.

A set of Recommendations and Requirements has been identified. It is foreseen that after the mandatory Requirements and feasible Recommendations have been completed, HP risks will be mitigated to an acceptable level.

A variety of activities yielded evidence for human performance. Limitations within the V3 phase of this project were in:

- The Real Time simulation environment (i.e. no live data from operations);
- Lack of availability of Tower Supervisor role;
- Lack of availability of Airline representatives.

In accordance with the Issues and Benefits previously identified within the four High-level HP arguments, evidence was gathered and a set of Recommendations and Requirements was produced, where applicable.

No major detrimental impact on HP was found in the solution scenarios in comparison to the Reference scenario.

When the Departures concept is being considered, prior to industrialisation, a more detailed investigation will be required with respect to:

- Clarifying the Tower Supervisor's responsibilities, in particular for the WDS-D solution;
- OSD Tool + Enhanced OSD Tool assurance;
- Final HMI design;
- Controller training;
- Airline engagement.

A clear benefit of the OSD/Enhanced OSD tool was identified within all scenarios with respect to improving controller mental workload, time management and task organisation.

The following is a summary of the findings for all arrivals concepts:

The validation activities performed encompassing a task analysis review, prototyping sessions, real time simulations and workshops have thoroughly addressed the HP issues formulated as part of the Human Performance Assessment Plan, covering the 4 level HP Arguments. As a result, all HP issues/benefits formulated for the three arrivals related OIs have been clarified and closed and all three OIs have been identified as reaching a V3 maturity level.

No negative impact of the solution scenarios proposed was identified compared to the reference scenarios. A clear benefit of the ORD concept was identified with respect to controller mental workload, time management, team situational awareness and task organisation. For an in depth understanding of the findings of the validation activities, please refer to the HP Log comprising the list of HP activities conducted and the corresponding requirements and recommendations. These are accompanied by a rationale- explaining the reason behind the formulation of the requirements and recommendations. The PJ.02-01 VALR [7] and the workshop notes (Appendix A) should be consulted in order to have a full picture of the validation activities conducted.

The HP Log for Arrivals [Appendix D.1] assesses separately all three OIs related to the arrival concept:

- WDS-A- (AO-0310);
- PWS-A- (AO-0306);
- ORD- (AO-0328).

A set of Recommendations and Requirements has been identified (HP Arrivals HP Log). It is foreseen that after the mandatory Requirements and feasible Recommendations have been implemented, the HP risks will be mitigated to an acceptable level.

2 Introduction

2.1 Purpose of the document

The purpose of this document ¹is to describe the result of the activities conducted according to the Human Performance (HP) assessment process [2] in order to derive the HP assessment report for PJ.02-01 Wake Turbulence Separation Optimisation in the frame of SESAR 2020 including requirements and recommendations.

PJ.02-01 encompasses the following operational improvements:

- WDS-A (using ORD)
- WDS-D (using OSD)
- PWS-A (using ORD)
- PWS-D (using OSD)
- Wake Risk Monitoring

2.1.1 Human Performance Assessment Threads

The SESAR Solution PJ.02-01 design and validation work is organized according to five main threads, defined via the following operational scenarios:

EUROCONTROL Thread

- RTS1: WDS-A with ORD for Arrivals, on single Runway (RWY) in segregated mode, for Paris CDG airport (encompassing transition from/to Distance or Time Based (DBS or TBS) standard separations);
- RTS3a: PWS-A with ORD for Arrivals, and PWS-D with OSD for Departures, on single RWY in mixed mode, for Vienna airport;
- RTS3b: PWS-A with ORD for Arrivals, on single RWY segregated, for Copenhagen airport;
- RTS4a: PWS-A with ORD for Arrivals, and PWS-D with OSD for Departures, on a single RWY in mixed mode, for Vienna airport;
- RTS4b: PWS-A and WDS-A with ORD for Arrivals, and PWS-D and WDS-D with OSD for Departures, on CSPR RWYs in segregated and mixed mode, for Paris CDG airport.

¹ The opinions expressed herein reflect the authors view only. Under no circumstances shall the SESAR Joint Undertaking be responsible for any use that may be made of the information contained herein.

NATS Thread

- RTS5: PWS-D with OSD, WDS-D with OSD and RECAT-EU with OSD for Departures, on dependent parallel RWYs in segregated mode, with a small number of arrivals landing on the departure runway under tactically enhanced arrival management, and encompassing transition in case of degraded mode, for London Heathrow airport.

ENAIRE Thread

- RTS6: WDS-D with OSD for Departures, focused on Departures (no validation for ARR, just impact via workload, go around interactions etc.), for Barcelona airport.

AIRBUS Thread

- LT8: The Wake Risk Monitoring concept solution will be applied to a dataset of flight test data continuing a series of known wake turbulence encounters, as well as a larger dataset not including known wake turbulence encounters to assess the performance of the solution.

DLR Thread

- LT10: A live trail will be conducted by DLR in Vienna airport to assess the application of a wake decay enhancing device in the Vienna airport environment.

The above work share threads integrate back into the concepts threads as below. For more information about the concepts, please see Section 3.2 in this document or Section 3 in the SPR-INTEROP/OSED Part I.

2.1.2 Arrivals Concepts Solutions

The arrivals concepts solutions consist of Wake Turbulence Separations for Arrivals based on the static characteristics of the arriving aircraft (Static Pairwise Separations - PWS-A -AO-0306) and time-based weather dependent separations based on the cross-wind concept (WDS-A- AO-0310), using the ORD tool (AO-0328).

The ORD concept and in particular the Separation Delivery tool supports the Controllers in delivering the required separation or spacing on final approach to the runway landing threshold. The Separation Delivery tool calculates and displays Target Distance Indicators (TDIs) on the Approach and Tower CWP. The TDIs include an FTD indicator which displays the required separation / spacing to be delivered to the required delivery point and an Initial Target Distance (ITD) indicator which displays the required spacing to deliver at the DF to support the Controller in delivering the required separation / spacing.

All details about the functionalities of the ORD tool can be found in chapter 3.3.2.1.1 of the OSED:

- Approach Arrivals Sequence Input
- Separation and Spacing (WT Separation; Managing compression on Final APP; MRS; ROT)
- Wind Input
- Additional Tool Inputs (e.g. call signs, a/c type)

- Final Target Distance
- Initial Target Distance
- Indicator Support and Turn-on Support
- Modes of Operation (e.g. DBS with ORD; S-PWS with ORD & WDS with ORD)
- Monitoring and Alerting
- Controller Procedures for ORD
- Airspace Users Procedures for ORD
- Coordination between TWR and APP ATC for Transition between Modes of Operations
- Transition to Degraded mode
- ORD in Mixed mode operations
- Insertion of Gap

PWS-A

PWS-A (AO-0306) is the efficient aircraft type pairwise wake separation rules for final approach consisting of both the 96 x 96 aircraft type based pairwise wake separation minima and the 20-CAT wake category-based wake separation minima for arrival pairs involving other aircraft types. The PWS-A concept proposes wake separation minima based on the aircraft type of the lead and follower aircraft on the final approach, as opposed to the wake vortex category.

WDS-A

The WDS-A concept (AO-0310) proposes to relax or reduce separation as a function of the total wind or crosswind component. This is on the basis that under the pre-defined wind conditions the wake turbulence generated by the lead aircraft is either wind transported out of the path of the follower aircraft on the initial departure path or has decayed sufficiently to be acceptable to be encountered by the follower aircraft. As WDS are applicable to wake separations then benefit would be seen at airports with at least 5/10% Heavy traffic, the same as for S-PWS.

ORD concept

As the separations under S-PWS and WDS for arrivals will be reduced compared to current operations and also vary as a function of the aircraft type of the lead and follower aircraft and / or the wind respectively, controllers will require a tool to support the application of these new separation schemes. ORD consists of a controller tool to support the application of PWS-A and WDS-A concepts. The ORD tool will enable consistent and efficient delivery of the required separation or spacing between arrival pairs whatever separation scheme is applied on the final approach.

2.1.3 Departures Concepts Solutions

The departures concepts solutions consist of Wake Turbulence Separations for Departure based on Static Aircraft Characteristics (AO-0323), Optimised Separation Delivery for Departure (AO-0329) and Weather-Dependent Reductions of Wake Turbulence Separation for Departure (AO-0304).

The Optimised Separation Delivery for Departure is the controller tool support to facilitate the Tower Runway Controller to consistently and efficiently deliver to the more efficient wake turbulence separations that have been developed and are under approval by EASA through the re-categorisation

programme by the RECAT-EU-PWS activities. These more efficient wake turbulence separations currently consist of the time-based seven wake category (7-CAT) based wake separation minima, or the distance-based 96 x 96 aircraft type based pairwise wake separation minima in conjunction with the 20 wake category-based (20-CAT) wake separation minima for departure pairs involving other aircraft types. Also, under development is the time-based variant of the 96 x 96 aircraft type based pairwise wake separation minima together in conjunction with the development of the time-based variant of the 20-CAT wake category-based wake separation minima (although this has now been deferred to SESAR 2020 Wave 2). The time-based seven wake category (7-CAT) PWS based wake separation minima will be applied (AO-0323). The PWS for departures will be supported by Optimised Separation Delivery (OSD - AO-0329) tool.

The Weather Dependent Reduction of Wake Turbulence Separation for Departure is the conditional reduction or suspension of the wake separation minima for departure operations, applicable under pre-defined wind conditions. This is on the basis that under the pre-defined wind conditions the wake turbulence generated by the lead aircraft is either wind transported out of the path of the follower aircraft on the initial departure path or has decayed sufficiently to be acceptable to be encountered by the follower aircraft on the initial departure path. Two pre-defined wind conditions are under consideration, a minimum of 6 knots to 10 knots crosswind to provide for crosswind transport with 90s reduced wake separation minima, and a minimum of a 10 knots wind speed in conjunction with 60s reduced wake separation minima (or more likely a delta reduction of the wake separation) provided there is either sufficient wake decay or transport of the wake vortices. Additionally, different rotation positions and climb profiles are also being considered with respect to facilitating wake avoidance. Initial analysis of data indicated that the currently-operated different rotation positions and climb profiles are not sufficiently consistent to ensure wake avoidance.

The main development and validation needs include the specification and approval of the wake separation rules with particular focus on the safety assurance evidence, the development and validation of the controller tool support with particular focus on the human performance and safety assurance evidence, and the development and validation of the business case with particular focus on the benefits evidence.

2.1.4 Wake Risk Monitoring Concept Solution

The wake risk monitoring concept being developed and validated is an improved detection and monitoring of wake turbulence encounters occurring in day-to-day operation. It represents an automated and objective means to identify wake turbulence encounters in daily operations, based on the analysis of recorded operational data available from on-board the aircraft, and additional traffic information from ADS-B Out messages.

This tool is supposed to provide objective and statistically meaningful information about the frequency of occurrence of wake turbulence encounters, both within the operating method proposed by SESAR Solution PJ02-01 as well as under pre-SESAR operating methods. It furthermore allows to identify severe wake turbulence encounters (those which are expected to lead e.g. to an associated Reportable Occurrence) as well as non-severe wake encounters which normally cause no disruption of the normal flight. This new capability will facilitate in-service safety monitoring of the wake turbulence encounter risk of the deployed new wake turbulence separation optimisation regulations

The new operating method for wake turbulence risk monitoring will include an objective and automated tool for identification and reporting of wake turbulence encounters. This solution can replace the manual reporting of the previous operating method. In the new operating method, wake turbulence encounters in daily operation are automatically identified based on aircraft avionics data and traffic data. The tool automatically creates a report in a digital format without any interaction by the flight crew necessary. These reports can be collected and stored in a common database. Such a process can thus satisfy the recommendation of ICAO note AN 13/4-07/67.

The detection and monitoring tool will typically run during the Post-execution phase, without any direct influence on any Execution phase activities. The results can for example be used to verify and monitor that the level of safety concerning wake turbulence encounters is maintained after a change of wake separation rules, or to support adjustment and optimisation of the wake separation rules.

2.1.5 Wake Decay Enhancing Concept Solution

Wake decay enhancing concepts is a completely passive method for the acceleration of wake vortices that does not require any human performance assessment, thus input is not applicable for this document.

2.2 Intended readership

Stakeholders are to be found among:

- ANS providers;
- ATM infrastructure and equipment suppliers;
- Airspace users;
- Airport owners/providers;
- Affected NSA;
- Affected employee unions;

Furthermore, the intended readership is the SESAR Solution PJ02-01 project members, the other solutions in SESAR Project PJ02 Increased Runway and Airport Throughput, the related solutions in SESAR Project PJ01 Enhanced Arrivals and Departures, the related solutions in SESAR Project PJ04 Total Airport Management, the related solutions in SESAR Project PJ09 Advanced Demand & Capacity Balancing, the related transversal SESAR Projects PJ19 and PJ22, and all impacted and interested stakeholders.

2.3 Scope of the document

This is the Human Performance Assessment Report for SESAR Solution PJ02-01 for the V3 pre-industrial development & integration maturity phase, encompassing the following scope:

Arrivals Concepts Solutions

- Pairwise Separations for Arrivals (PWS-A) with ORD tool support;
- Weather Dependent Separations for Arrivals (WDS-A) with ORD tool support;
- RECAT-EU separation for Arrivals (reference scenarios);
- ICAO separation for Arrivals (reference scenarios).

Departures Concepts Solutions

- Pairwise Separations for Departures (PWS-D) with Optimised Separation Delivery (OSD) tool support;
- Weather Dependent Separations for Departures (WDS-D) with WDS-D tool support and Enhanced OSD tool support;
- RECAT-EU separation for Departures with OSD support tool.

Wake Risk Monitoring Concept Solution

Please see chapter 2.1.4

Wake Decay Enhancing Concept Solution

Please see chapter 2.1.5

2.4 Human performance work schedule within the Solution

Arrivals Concepts Solutions

The Human Performance Assessment for the PJ.02-01 Solution was conducted according to the PJ.02-01 Validation Plan and Human Performance Assessment Plan.

Human Performance activities started in 2017 and finished in Summer2019, for Wave 1. For a full detailed on the prototyping sessions and real time simulations findings, please refer to the PJ.02-01 VALR [7].

Departures Concepts Solutions

The Human Performance Assessment for the PJ.02-01 Solution was conducted according to the Validation Plan, HPAP.

The actual work schedule for the HP Assessment activities has diverted slightly from the HPAP due to partner and end-user availability. The following table lists the conducted activities and dates:

| Activity | Dates | Place |
|---|--|----------------------------------|
| EUROCONTROL Workshop on PJ.02-01 Solution | 29-30 October 2018 | EEC Bretigny, France |
| NATS Heathrow WebEx | 28 November 2018 | NATS/WebEx |
| Real Time Simulations 5 (RTS5) | 12 days in total between January 18, 2019 and February | NATS CTC, E2 Aerodrome Simulator |

| | | |
|---|---------------|------------------|
| | 11, 2019 | |
| Post-Simulation Workshop – internal | 21 March 2019 | NATS CTC |
| Post-Simulation Workshop with external participants | 28 March 2019 | Heathrow Airport |

Wake Risk Monitoring Concept Solution

N/A

Wake Decay Enhancing Concept Solution

N/A

2.5 Structure of the document

This section describes the content of the different chapters

The Part IV - HPAR of the SESAR Solution PJ.02-01 SPR-INTEROP/OSED consists of four main sections and four appendices. Each section, and appendix, addresses each of the SESAR Solution PJ.02-01 Wake Turbulence Separation Optimisation concepts solutions; the Arrivals Concepts Solutions, the Departures Concepts Solutions, the Wake Risk Monitoring Concept Solution, and the Wake Decay Enhancing Concepts Solutions.

- **Section 1:** Executive Summary of the brief description of the concepts solutions and the associated research needs gaps and issues;
- **Section 2:** Introduction covering the purpose of the document, the scope, the intended readership and the glossary of terms and the list of acronyms;
- **Section 3:** The Human Performance Assessment Process: Objective and Approach detailing the HP assessment process;
- **Section 4:** Human Performance Assessment collecting the evidences of each step of the process for the different concepts;
- **Appendix A:** Additional HP activities conducted for each concept, including the output or reports from HP activities conducted that are not described in the main body;
- **Appendix B:** HP Recommendations Register including the list of HP recommendations gathered in the project for each concept;
- **Appendix C:** HP Requirements Register including the list of HP Requirements gathered in the project for each concept;
- **Appendix D:** HP Log including the HP Log of each concept in the project scope.

2.6 Acronyms and Terminology

| Term | Definition |
|---------------|--|
| a/c | Aircraft |
| ADIS | Airport Display Information System |
| ANSP | Air Navigation Service Provider |
| ATC | Air Traffic Control |
| ATCO | Air Traffic Controller |
| ATS | Air Traffic Services |
| CREDOS | Crosswind Reduced Separations for Departure Operations |
| EARTH | Enhanced Runway Throughput |
| EFPS | Electronic Flight Progress Strips |
| FDE | Flight Data Entry |
| HMI | Human Machine Interface |
| HPAP | Human Performance Assessment Plan |
| HPAR | Human Performance Assessment Report |
| LOS | Loss of Separation |
| MRS | Minimum Radar Separation |
| N/A | Not applicable/ Not Available |
| NBAT | Not-Before-Airborne-Time |
| NBTOT | Not-Before-Take-Off-Time |
| Nm | Nautical Mile |
| OBJ | Objectives |
| OI | Operational Improvement |
| ORD | Optimised Runway Delivery |
| OSD | Optimised Separation Delivery |

| | |
|-------------------------------|--|
| OSED | The Operational Service and Environment Definition |
| PJ | Project |
| PWS-A | Pairwise Separation on Arrivals |
| PWS-D | Pairwise Separation on Departure |
| RSVA | Reduced Separation in the Vicinity of an Airfield |
| RTS | Real Time Simulation |
| RWY | Runway |
| SESAR | Single European Sky ATM Research |
| SID | Standard Instrument Departure |
| SPR | Safety and Performance Requirements |
| TBD | To be Defined |
| TEAM | Tactically Enhanced Arrivals Mode |
| TMA | Terminal Manoeuvring Area |
| TWR | Tower |
| VALP | Validation Plan |
| WDS-A | Weather-Dependant Separation on Arrival |
| WDS-D | Weather-Dependant Separation on Departure |
| WSTOT | Wake Separation Take-Off Time |
| WV | Wake Vortex |
| 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 focussing on the variables that determine Human Performance. |
| Human Performance (HP) | HP is used to denote the human capability to successfully accomplish tasks and meet job requirements. In this way, “Human Performance” can be considered as focussing on the observable result of human activity in a work context. Human Performance is a function of Human Factors (see above). It also depends on aspects related to Recruitment, Training, Competence, and Staffing (RTCS) as well |

as Social Factors and Change Management.

| | |
|------------------------------|---|
| HP activity | An HP activity is an evidence-gathering activity carried out as part of Step 3 of the HP assessment process. An HP activity can relate to, among others, task analyses, cognitive walkthroughs, and experimental studies. |
| HP assessment | An HP assessment is the documented result of applying the HP assessment process to the SESAR Solution-level. HP assessments provide the input for the HP case. |
| HP assessment process | The HP assessment process is the process by which HP aspects related to the proposed changes in SESAR are identified and addressed. The development of this process constitutes the scope of Project 16.04.01. It covers the conduct of HP assessments on the Solution-level as well as the HP case building over larger clusters of Solutions. |
| HP Argument | An HP argument is an HP claim that needs to be proven through the HP Assessment Process. |
| 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 issue | An HP issue relates to those aspects in the ATM concept that need to be resolved before the proposed change can deliver the intended positive effects on Human Performance. |
| HP impact | An HP impact relates to the effect of the proposed solution on the human operator. Impacts can be positive (i.e. leading to an increase in Human Performance) or negative (leading to a decrease in Human Performance). |
| HP recommendations | HP recommendations propose means for mitigating HP issues related to a specific operational or technical change. HF recommendations are proposals that require additional analysis (i.e. refinement and validation). Once this additional analysis is performed, HF recommendations may be transformed into HF requirements. |
| HP requirements | HP requirements are statements that specify required characteristics of a solution from an HF point of view. HP requirements should be integrated into the DOD, OSED, SPR, or specifications. HF requirements can be seen as the stable result of the HF contribution to the Solution, leading to a redefinition of the operational concept or the specification of the technical solution. |

Table 1: Acronyms and terminology

3 The Human Performance Assessment Process: Objective and Approach

The purpose of the HP Assessment process is described in detail in [1] 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.

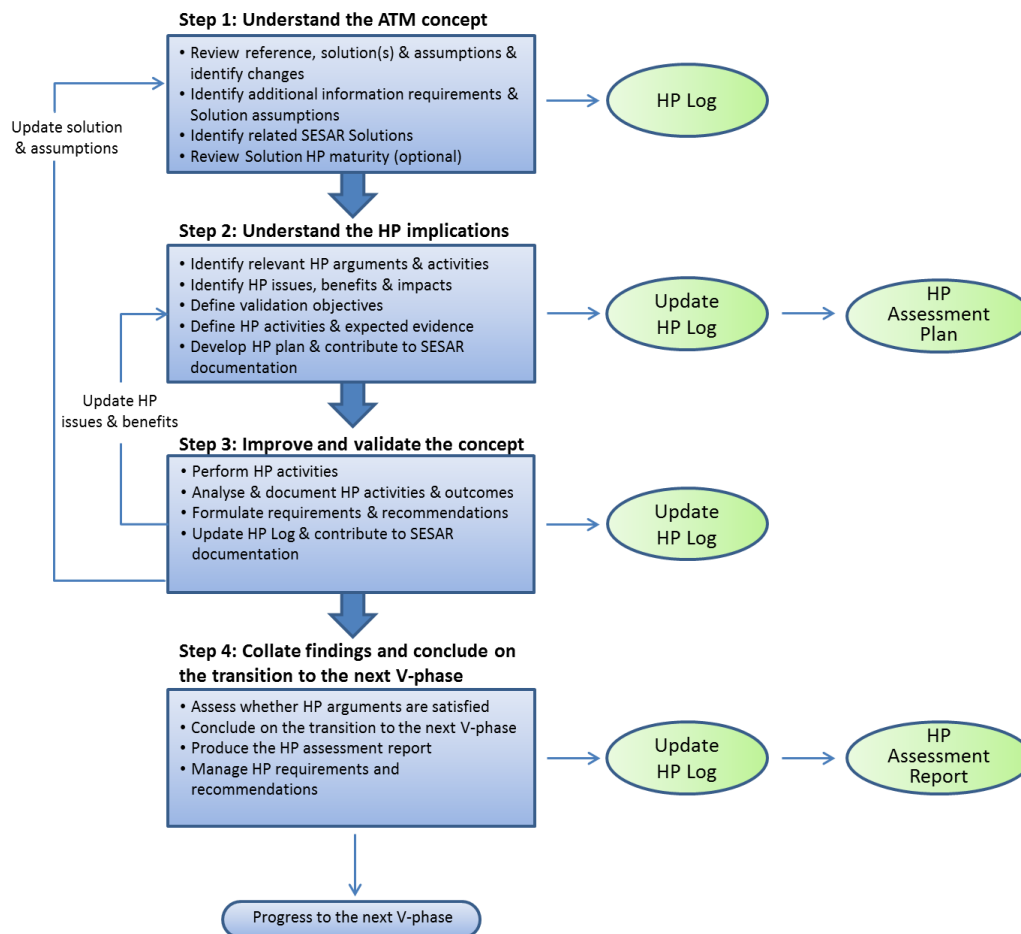


Figure 1: Steps of the HP assessment process

The HP assessment process is a four-step process. Figure 1 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). In addition, an HP Log for each of the concepts is maintained throughout the lifecycle of the Solution in which all the data/ information obtained from all HP activities conducted as part of the HP assessment is documented. The HP Logs [Appendix A] are a living document that are continuously updated and / or added to as the SESAR Solution progresses.

4 Human Performance Assessment

This section is split in 4 subsections providing Step 1, Step 2, Step 3 and Step 4 for:

- Arrivals Concepts Solutions in section 4.1;
- Departures Concepts Solutions in section 4.2;
- Wake Risk Monitoring Concept Solution in section 4.3;
- Wake Decay Enhancing Concept Solution in section 4.4 (however, it should be noted that this section contains no sub-sections or information as there was no human performance assessment carried out).

4.1 Arrivals Concepts Solutions

4.1.1 Step 1 Understand the ATM concept of the Arrivals Concepts Solutions

The HP Material presented below focuses on Arrivals primarily however includes possible departures; hence the assessment entails Mixed-mode operations.

4.1.1.1 Description of reference scenario

The description of the reference scenario can be found in the Arrivals HP Log (Solution & Concept Info tab) (Appendix D.1).

4.1.1.2 Description of solution scenario

The description of the solution scenario can be found in the Arrivals HP Log (Solution & Concept Info tab).

4.1.1.3 Consolidated list of assumptions

The consolidated list of assumptions can be found in the Arrivals HP Log (Solution & Concept Info tab).

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

The description of the related SESAR solutions can be found in the Arrivals HP Log (Solution & Concept Info tab).

4.1.1.5 Identification of the nature of the change

The description of the nature of change can be found in the Arrivals HP Log (WDS-A/PWS-A Change & Argument Identification tab).

4.1.2 Step 2 Understand the HP implications of the Arrivals Concepts Solutions

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

The list of relevant arguments, HP issues and benefits of HP activities can be found in the Arrivals HP Log (Issue-Objective Outcome tabs for solutions).

4.1.3 Step 3 Improve and validate the concept of the Arrivals Concepts Solutions

4.1.3.1 Description of HP activities conducted

This section forms the actual HP plan of activities. It outlines the HP activities that have been selected on the basis of the relevant arguments and HP issues and benefits. Table 3 below contains the overview of these activities and their priority together with deadlines which are in line with the other solution deliverables.

| HP activity | By when |
|----------------------|-----------|
| Task Analysis | June 2019 |
| Stakeholder Workshop | June 2019 |
| Prototyping Session | June 2019 |
| Real Time Simulation | June 2019 |

Table 3: Table of proposed HP activities and their priority

Table 4 and 5 (Activity 1 and 2) have been left blank intentionally.

For a detailed view on the planned activities, please read the “Issue-Objective-Outcome” in the corresponding HP Logs, [Appendix A]: HP log for Arrivals- for WDS-A and PWS-A; HP Log for Departures for WDS-D, PWS-D; and HP Log for Wake Monitoring, in Annex A.

4.1.4 Step 4 Collate findings & conclude on transition to next V-phase of the Arrivals Concepts Solutions

4.1.4.1 Summary of HP activities results & recommendations / requirements

As mentioned in Chapter 1, all PJ.02-01 Arrival concepts have been extensively detailed in the HP Log.

Please refer to the HP Log for Arrivals, Appendix A- [0], the Issue-Objective-Outcome tabs and Recommendations Register and Requirements Register provide the summary of activities and their results with corresponding evidence, followed by the lists of Recommendations and Requirements, which have been defined in order to mitigate HP risks.

| Issue ID | HP issue / Benefit | HP Issue/ Benefit Status | HP/ Valid. Obj. ID | Activity Conducted | Results / Evidence | Recommendations | Requirements |
|---|--------------------|--------------------------|--------------------|--------------------|--------------------|-----------------|--------------|
| Arg. 1.1.1: The description of roles & responsibilities cover all affected human actors. | | | | | | | |
| | | | | | | | |
| Arg. 1.1.2: The description of roles & responsibilities cover all tasks to be performed by a human actor. | | | | | | | |
| | | | | | | | |
| Arg. 1.1.3: Roles and responsibilities are clear and consistent (in V1: non-contradictory). | | | | | | | |
| | | | | | | | |
| Arg. 1.2.1: Operating methods cover operations in normal operating conditions. | | | | | | | |
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Table 2: Summary of the HP results and recommendations/ requirements for each identified issue & related argument

4.1.4.2 Maturity of the Solution

The V3 Maturity checklist in all HP Logs, Appendix A and Annex A provide details. Criteria of the V3 stage have been fulfilled for three OIs related to the arrival concept.

Maturity-V3 WDS-A

| Maturity checklist for finalising the V3 assessment WDS-A | | | |
|--|---|--------|---|
| ID | Question | Answer | Comments |
| 1 | Has a Human Performance Assessment Report been completed? Have all relevant arguments been addressed and appropriately supported? | Yes | <p><i>Based on the Change and Argument Identification section, 167 issues have been identified, covering all 4 HP Arguments. For a detailed view on the issues, consult the WDS-A-Issue-Objective-Outcome section of this Excel list.</i></p> <p><i>All 4 high-level HP Arguments have been covered. 2nd level HP Arguments covered:</i></p> <ul style="list-style-type: none"> - Argument 1.1.Roles and Responsibilities - Argument 1.2. Operating Methods - Argument 1.3. Tasks - Argument 2.1 Allocation of tasks (between the human and the machine) - Argument 2.2. Performance of the technical systems - Argument 2.3. Human-machine interface - Argument 3.2. Allocation of tasks (between human actors) - Argument 3.3. Communication - Argument 4.1. Acceptance and job satisfaction - Argument 4.2. Competence requirements - Argument 4.5. Training <p><i>Based on the validation activities (task analysis, prototyping sessions, RTS - EXE.PJ02.01-VALP-RTS1 and workshops) all aforementioned arguments have been properly addressed in relation to the expected evidence for a V3 maturity level.</i></p> <p><i>The outcomes of the validation activities are documented in the Recommendation and Requirement registers (as part of this Excel document) where all requirements and recommendations are accompanied by a rationale that details the reasons behind them. As soon as the findings of any of the aforementioned validation activities were considered relevant in answering any of the arguments addressed, they have been formulated in recommendations and requirements, ensuring the information is properly documented.</i></p> |
| 2 | Are the benefits and issues in terms of human performance and operability related to the proposed solution sufficiently assessed (i.e. on the level required for V3)? | yes | <p><i>All issues/benefits have been thoroughly assessed in the validation activities and as soon as the evidence expected for the V3 maturity level have been met, the corresponding issues/benefits have been closed. The assessment has always included the participation of operational experts either through validation exercises or through workshop activities.</i></p> <p><i>See question 1 above and the WDS-A-Issue-Objective-Outcome section of the Excel list for a detailed view on the formulated issues corresponding to all 4 Arguments.</i></p> |

| | | | |
|---|--|-----|---|
| | | | <p><i>Detailed in the WDS-A-Issue-Objective-Outcome section of the Excel document.</i></p> <p><i>All Outcomes have been detailed in the Recommendations and Requirements Registers where in addition; the rationale columns offer a more in depth explanation on the findings.</i></p> |
| 3 | <p>Have all the parts of the solution/concept been considered?</p> | yes | <p><i>All parts of the solution/concept have been considered, on the basis of the change and argument identification step- which represented the starting point of the HP activities.</i></p> <p><i>For a detailed description of the solution/concept and related assumptions, please refer to the "Solution and Concept Info" sheet of this Excel document, where all arrival related OIs have been documented.</i></p> <p><i>For the list of assumptions that have a link with the HP activities, please refer to the "Solution and Concept Info" sheet of this Excel document</i></p> <p><i>The detailed list of issues/benefits and associated validation objectives for WDS-A is to be found in the "WDS-A-Issue-Objective-Outcome" sheet of this Excel document.</i></p> |
| 4 | <p>Have potential interactions with related projects/concepts been considered and addressed?</p> | yes | <p><i>The list of the related projects/solutions has been identified - as documented in the OSED and the HP Plan- Part IV of the VALP.</i></p> <p><i>List of related projects:</i></p> <ul style="list-style-type: none"> • <i>SESAR Project PJ.02 Increased Runway and Airport Throughput</i> • <i>SESAR Project PJ.01 Enhanced Arrivals and Departures</i> • <i>SESAR Project PJ.04 Total Airport Management</i> • <i>SESAR Project PJ.09 Advanced Demand & Capacity Balancing</i> • <i>Related transversal SESAR Projects PJ.19 and PJ.22</i> <p><i>E.g. sequencing tool - AMAN/DMAN (PJ.02-08).</i></p> <p><i>Validation activities of PJ02.01 have been merged with PJ.02-02 and PJ.02-03 validation activities and all potential interactions have been documents, if any. With PJ.02-08 a potential interaction has been identified with regard to the sequencing tool and the use of the AMAN/DMAN- no common activities have been performed.</i></p> <p><i>For PJ.04 and PJ.09 no common HP activities have been performed.</i></p> |
| 5 | <p>Is the level of human performance needed to achieve the desired system performance for the proposed solution consistent with human capabilities?</p> | yes | <p><i>The level of human performance needed to achieve the desired system performance has been assessed and confirmed as consistent with human capabilities.</i></p> <p><i>Detailed in Arg. 1 and Arg. 2</i></p> |
| 6 | <p>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?</p> | yes | <p><i>Please check the "WDS-A-Issue-Objective-Outcome" section for a detailed view on the assessment methodology envisaged for PJ.02-01- WDS-A concept. The results obtained from an HP perspective are in line with the proposed targets as all HP related validation objectives have been successfully covered.</i></p> |

| | | | |
|----|---|-----|---|
| 7 | Has the proposed solution been tested with end-users and under sufficiently realistic conditions, including abnormal and degraded conditions? | yes | <p><i>The validation activities were built and conformed to experimental design principles, ensuring realistic conditions and allowing the participants to get sufficiently familiar with the new concept through various training sessions and prototyping sessions before the real time simulation was conducted. For all the issues that were not fully covered during RTS due to simulation limitations, the workshop discussions have ensured an in depth coverage of the remaining open issues that have been closed based on "expert judgement" of both operational experts and HP experts.</i></p> <p><i>The validation activities were built based on the relevant information from SESAR 1, ensuring a transversal approach (HP, safety, validation and operational experts) in validation activities-prototyping sessions and RTS.</i></p> |
| 8 | Do validation results confirm that the interactions between human and technology are operationally feasible, and consistent with agreed human performance requirements? | yes | <p><i>The 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 WDS-A in the current Excel document.</i></p> |
| 9 | Have all relevant SESAR documentation been updated according to the HP activities outcomes (OSED, SPR)? | yes | <p><i>Following the identification of HP issues and benefits, all 4 high level HP Arguments have been included in the VALP, ensuring the success criteria fully covers HP needs. Consequently the VALR embedded the HP report made following the real time simulation that has documented HP findings in relation to the validation objectives. Once the list of recommendations and requirements has been finalised from an HP perspective, they have been checked against the safety requirements and commonly agreed with the OSED leader, Validation expert and Safety expert and they have been included in part I of the OSED - categorised as HP requirements. It has been commonly agreed that the "should" requirements or the recommendations will not be included in Part I of the OSED as they are not "mandatory" for implementation and hence the reader should consult the current HP Log/HP report for all the identified HP recommendations.</i></p> |
| 10 | Do the outcomes satisfy the HP issues/benefits in order to reach the expected KPA? | yes | <p><i>The outcome of the HP activities is to be found in the Recommendations and Requirements register sections of this Excel document.</i></p> <p><i>For the identified Arguments, please refer to the "WDS-A-Issue-Objective-Outcome" section.</i></p> <p><i>For the identified Issues/Benefits please refer to the "WDS-A-Issue-Objective-Outcome" section.</i></p> <p><i>The outcome of the HP activities is to be found in the Recommendations and Requirements register sections of this Excel document.</i></p> |
| 11 | Have HP recommendations and HP requirements correctly been considered in HMI design, procedures/documentation and training? | yes | <p><i>The requirements formulated based on the HP activities have been documented in part I of the OSED.</i></p> <p><i>The outcome of the HP activities is to be found in the Recommendations and Requirements register sections of this Excel document.</i></p> |

| | | | |
|----|--|-----|---|
| 12 | Have the major factors that can influence the transition feasibility (e.g. changes in competence requirements, recruitment and selection, training needs, staffing requirements, and relocation of the workforce) been addressed? Are there any ideas on how to overcome any issues? | yes | <p><i>Please refer to Arg. 4 -issues/benefits in the "WDS-A-Issue-Objective-Outcome" section of the Excel document and correspondingly in the Recommendations and Requirements sections.</i></p> <p><i>Argument 2 and Argument 4 have covered issues/benefits with regard to the task allocation human-machine and impacts on the organisational level</i></p> <p><i>Please check the Recommendation and Requirements section for the outcome of the HP activities.</i></p> |
| 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. | yes | <p><i>Please refer to Arg. 1 and Arg. 2 for corresponding issues and benefits identified in the "WDS-A-Issue-Objective-Outcome" section of the Excel document.</i></p> <p><i>All related recommendations and requirements relevant to changes in roles & responsibilities, competence requirements, or the task allocation between human & machine, are to be found in the Recommendations and Requirements sections.</i></p> |
| 14 | Has the next V-phase sufficiently been prepared (additional testing conditions, open HP issues to be addressed)? | yes | <p><i>Please refer to the "WDS-A-Issue-Objective-Outcome" section of the Excel document.</i></p> <p><i>All identified issues and benefits have been closed for WDS-A.</i></p> <p><i>The requirements formulated based on the HP activities have been documented in part I of the OSED.</i></p> |

Maturity-V3 PWS-A

| Maturity checklist for finalising the V3 assessment PWS-A | | | |
|---|---|--------|--|
| ID | Question | Answer | Comments |
| 1 | Has a Human Performance Assessment Report been completed? Have all relevant | Yes | <i>Based on the Change and Argument Identification section, 120 issues have been identified, covering all 4 HP Arguments for PWS-A-segregated mode. For a detailed view on the issues, consult the PWS-A-Issue-Objective-Outcome section of this Excel list.</i> |

| | | | |
|---|--|------------|--|
| | <p>arguments been addressed and appropriately supported?</p> | | <p><i>All 4 high-level HP Arguments have been covered. 2nd level HP Arguments covered:</i></p> <ul style="list-style-type: none"> - <i>Argument 1.1. Roles and Responsibilities</i> - <i>Argument 1.2. Operating Methods</i> - <i>Argument 1.3. Tasks</i> - <i>Argument 2.1 Allocation of tasks (between the human and the machine)</i> - <i>Argument 2.2. Performance of the technical systems</i> - <i>Argument 2.3. Human-machine interface</i> - <i>Argument 3.3. Communication</i> - <i>Argument 4.1. Acceptance and job satisfaction</i> - <i>Argument 4.2. Competence requirements</i> - <i>Argument 4.5. Training</i> <p><i>Based on the validation activities (task analysis, prototyping sessions, RTS and workshops) all aforementioned arguments have been properly addressed in relation to the expected evidence for a V3 maturity level.</i></p> <p><i>RTS:</i> <i>EXE.PJ.02-01-VALP-RTS2</i> <i>EXE.PJ.02-01-VALP-RTS3a</i> <i>EXE.PJ.02-01-VALP-RTS4a</i> <i>EXE.PJ.02-01-VALP-RTS4b</i></p> <p><i>The outcomes of the validation activities are documented in the Recommendation and Requirement registers (as part of this Excel document) where all requirements and recommendations are accompanied by a rationale that details the reasons behind them. As soon as the findings of any of the aforementioned validation activities were considered relevant in answering any of the arguments addressed, they have been formulated in recommendations and requirements, ensuring the information is properly documented.</i></p> |
| 2 | <p>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)?</p> | <p>yes</p> | <p><i>All issues/benefits related to PWS-A (segregated mode) have been thoroughly assessed in the validation activities and as soon as the evidence expected for the V3 maturity level have been met, the corresponding issues/benefits have been closed. The assessment has always included the participation of operational experts either through validation exercises or through workshop activities.</i></p> <p><i>See question 1 above and the PWS-A-Issue-Objective-Outcome section of the Excel list for a detailed view on the formulated issues corresponding to all 4 Arguments.</i></p> <p><i>Detailed in the PWS-A-Issue-Objective-Outcome section of the Excel document.</i></p> <p><i>All Outcomes have been detailed in the Recommendations and Requirements Registers where in addition; the rationale columns offer a more in depth explanation on the findings.</i></p> |
| 3 | <p>Have all the parts of the solution/concept been considered?</p> | <p>yes</p> | <p><i>All parts of the solution/concept have been considered, on the basis of the change and argument identification step- which represented the starting point of the HP activities.</i></p> <p><i>For a detailed description of the solution/concept and related assumptions, please refer to the "Solution and Concept Info" sheet of this Excel document, where all arrival related OIs have been documented.</i></p> |

| | | | |
|---|--|-----|---|
| | | | <p><i>For the list of assumptions that have a link with the HP activities, please refer to the "Solution and Concept Info" sheet of this Excel document</i></p> <p><i>The detailed list of issues/benefits and associated validation objectives for PWS-A is to be found in the "PWS-A-Issue-Objective-Outcome" sheet of this Excel document.</i></p> |
| 4 | <p>Have potential interactions with related projects/concepts been considered and addressed?</p> | yes | <p><i>The list of the related projects/solutions has been identified - as documented in the OSED and the HP Plan- Part IV of the VALP.</i></p> <p><i>List of related projects:</i></p> <ul style="list-style-type: none"> <i>• SESAR Project PJ.02 Increased Runway and Airport Throughput</i> <i>• SESAR Project PJ.01 Enhanced Arrivals and Departures</i> <i>• SESAR Project PJ.04 Total Airport Management</i> <i>• SESAR Project PJ.09 Advanced Demand & Capacity Balancing</i> <i>• Related transversal SESAR Projects PJ.19 and PJ.22</i> <p><i>E.g. sequencing tool - AMAN/DMAN (PJ.02-08).</i></p> <p><i>Validation activities of PJ.02-01 have been merged with PJ.02-02 and PJ.02-03 validation activities and all potential interactions have been documented, if any. With PJ.02-08 a potential interaction has been identified with regard to the sequencing tool and the use of the AMAN/DMAN- no common activities have been performed. For PJ.04 and PJ.09 no common HP activities have been performed.</i></p> |
| 5 | <p>Is the level of human performance needed to achieve the desired system performance for the proposed solution consistent with human capabilities?</p> | yes | <p><i>The level of human performance needed to achieve the desired system performance has been assessed and confirmed as consistent with human capabilities.</i></p> <p><i>Detailed in Arg. 1 and Arg. 2</i></p> |
| 6 | <p>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?</p> | yes | <p><i>Please check the "PWS-A-Issue-Objective-Outcome" section for a detailed view on the assessment methodology envisaged for PJ.02-01- PWS-A concept (segregated mode). The results obtained from an HP perspective are in line with the proposed targets as all HP related validation objectives have been successfully covered.</i></p> |
| 7 | <p>Has the proposed solution been tested with end-users and under sufficiently realistic conditions, including abnormal and degraded conditions?</p> | yes | <p><i>The validation activities were built and conformed to experimental design principles, ensuring realistic conditions and allowing the participants to get sufficiently familiar with the new concept through various training sessions and prototyping sessions before the real time simulation was conducted. For all the issues that were not fully covered during RTS due to simulation limitations, the workshop discussions have ensured an in depth coverage of the remaining open issues that have been closed based on "expert judgement" of both operational experts and HP experts.</i></p> <p><i>The validation activities were built based on the relevant information from SESAR 1, ensuring a transversal approach (HP, safety, validation and operational experts) in validation activities- prototyping sessions and RTS.</i></p> |
| 8 | <p>Do validation results confirm that the interactions between human and technology are operationally feasible, and consistent with agreed</p> | yes | <p><i>The 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 PWS-A in the current Excel document.</i></p> |

| | | | |
|----|--|-----|--|
| | human performance requirements? | | |
| 9 | Have all relevant SESAR documentation been updated according to the HP activities outcomes (OSED, SPR)? | yes | <i>Following the identification of HP issues and benefits, all 4 high level HP Arguments have been included in the VALP, ensuring the success criteria fully covers HP needs. Consequently the VALR embedded the HP report made following the real time simulation that has documented HP findings in relation to the validation objectives. Once the list of recommendations and requirements has been finalised from an HP perspective, they have been checked against the safety requirements and commonly agreed with the OSED leader, Validation expert and Safety expert and they have been included in part I of the OSED - categorised as HP requirements. It has been commonly agreed that the "should" requirements or the recommendations will not be included in Part I of the OSED as they are not "mandatory" for implementation and hence the reader should consult the current HP Log/HP report for all the identified HP recommendations.</i> |
| 10 | Do the outcomes satisfy the HP issues/benefits in order to reach the expected KPA? | yes | <i>The outcome of the HP activities is to be found in the Recommendations and Requirements register sections of this Excel document. For the identified Arguments, please refer to the "PWS-A-Issue-Objective-Outcome" section. For the identified Issues/Benefits please refer to the "PWS-A-Issue-Objective-Outcome" section. The outcome of the HP activities is to be found in the Recommendations and Requirements register sections of this Excel document.</i> |
| 11 | Have HP recommendations and HP requirements correctly been considered in HMI design, procedures/documentation and training? | yes | <i>The requirements formulated based on the HP activities have been documented in part I of the OSED. The outcome of the HP activities is to be found in the Recommendations and Requirements register sections of this Excel document.</i> |
| 12 | Have the major factors that can influence the transition feasibility (e.g. changes in competence requirements, recruitment and selection, training needs, staffing requirements, and relocation of the workforce) been addressed? Are there any ideas on how to overcome any issues? | yes | <i>Please refer to Arg. 4 -issues/benefits in the "PWS-A-Issue-Objective-Outcome" section of the Excel document and correspondingly in the Recommendations and Requirements sections. Argument 2 and Argument 4 have covered issues/benefits with regard to the task allocation human-machine and impacts on the organisational level Please check the Recommendation and Requirements section for the outcome of the HP activities.</i> |
| 13 | Have any impacts been identified that may require changes to regulation in the area of HP/ATM? This includes changes in roles | yes | <i>Please refer to Arg. 1 and Arg. 2 for corresponding issues and benefits identified in the "PWS-A-Issue-Objective-Outcome" section of the Excel document.</i> |

| | | | |
|----|--|-----|--|
| | & responsibilities, competence requirements, or the task allocation between human & machine. | | <i>All related recommendations and requirements relevant to changes in roles & responsibilities, competence requirements, or the task allocation between human & machine, are to be found in the Recommendations and Requirements sections.</i> |
| 14 | Has the next V-phase sufficiently been prepared (additional testing conditions, open HP issues to be addressed)? | yes | <p><i>Please refer to the "PWS-A-Issue-Objective-Outcome" section of the Excel document.</i></p> <p><i>All identified issues and benefits have been closed for PWS-A.</i></p> <p><i>The requirements formulated based on the HP activities have been documented in part I of the OSED.</i></p> |

Maturity-V3 ORD

| Maturity checklist for finalising the V3 assessment ORD | | | |
|--|---|--------|---|
| ID | Question | Answer | Comments |
| 1 | Has a Human Performance Assessment Report been completed? Have all relevant arguments been addressed and appropriately supported? | Yes | <p><i>146 issues related to the use of the ORD tool have been identified, following the evaluation of the change assessment for WDS-A and PWS-A, where the use of the ORD tool was included as well in the validation activities in addition to the reduced separations proposed.</i></p> <p><i>The purpose of the HP assessment was to validate the ORD concept in segregated mode, mixed mode and CSPR operations. For a detailed view on the issues, consult the ORD-Issue-Objective-Outcome section of this Excel list.</i></p> <p><i>All 4 high-level HP Arguments have been covered.</i> <i>2nd level HP Arguments covered:</i></p> <ul style="list-style-type: none"> - Argument 1.1. Roles and Responsibilities - Argument 1.2. Operating Methods - Argument 1.3. Tasks - Argument 2.1 Allocation of tasks (between the human and the machine) - Argument 2.2. Performance of the technical systems - Argument 2.3. Human-machine interface - Argument 3.2. Allocation of tasks (between human actors) - Argument 3.3. Communication - Argument 4.1. Acceptance and job satisfaction - Argument 4.2. Competence requirements - Argument 4.5. Training <p><i>Based on the validation activities (task analysis, prototyping sessions, RTS and workshops) all aforementioned arguments have been properly addressed in relation to the expected evidence for a V3 maturity level.</i></p> <p><i>RTS:</i> <i>EXE.PJ.02-01-VALP-RTS1:</i> <i>EXE.PJ.02-01-VALP-RTS2</i> <i>EXE.PJ.02-01-VALP-RTS3a</i> <i>EXE.PJ.02-01-VALP-RTS4a</i> <i>EXE.PJ.02-01-VALP-RTS4b</i></p> |

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| | | | <p><i>The outcomes of the validation activities are documented in the Recommendation and Requirement registers (as part of this Excel document) where all requirements and recommendations are accompanied by a rationale that details the reasons behind them. As soon as the findings of any of the aforementioned validation activities were considered relevant in answering any of the arguments addressed, they have been formulated in recommendations and requirements, ensuring the information is properly documented. I</i></p> |
| 2 | <p>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)?</p> | yes | <p><i>All issues/benefits related to the ORD concept have been thoroughly assessed in the validation activities and as soon as the evidence expected for the V3 maturity level have been met, the corresponding issues/benefits have been closed. The assessment has always included the participation of operational experts either through validation exercises or through workshop activities.</i></p> <p><i>See question 1 above and the ORD-Issue-Objective-Outcome section of the Excel list for a detailed view on the formulated issues corresponding to all 4 Arguments.</i></p> <p><i>Detailed in the ORD-Issue-Objective-Outcome section of the Excel document.</i></p> <p><i>All Outcomes have been detailed in the Recommendations and Requirements Registers where in addition; the rationale columns offer a more in depth explanation on the findings.</i></p> |
| 3 | <p>Have all the parts of the solution/concept been considered?</p> | yes | <p><i>All parts of the solution/concept have been considered (ORD in segregated/ mixed mode and CSPR operations).</i></p> <p><i>For a detailed description of the solution/concept and related assumptions, please refer to the OSED.</i></p> <p><i>For the list of assumptions that have a link with the HP activities, please refer to the "Solution and Concept Info" sheet of this Excel document</i></p> <p><i>The detailed list of issues/benefits and associated validation objectives for ORD is to be found in the "ORD-Issue-Objective-Outcome" sheet of this Excel document.</i></p> |
| 4 | <p>Have potential interactions with related projects/concepts been considered and addressed?</p> | yes | <p><i>The list of the related projects/solutions has been identified - as documented in the OSED and the HP Plan- Part IV of the VALP.</i></p> <p><i>List of related projects:</i></p> <ul style="list-style-type: none"> <i>• SESAR Project PJ.02 Increased Runway and Airport Throughput</i> <i>• SESAR Project PJ.01 Enhanced Arrivals and Departures</i> <i>• SESAR Project PJ.04 Total Airport Management</i> <i>• SESAR Project PJ.09 Advanced Demand & Capacity Balancing</i> <i>• Related transversal SESAR Projects PJ.19 and PJ.22</i> <p><i>E.g. sequencing tool - AMAN/DMAN (PJ.02-08).</i></p> <p><i>Validation activities of PJ.02-01 have been merged with PJ.02-02 and PJ.02-03 validation activities and all potential interactions have been documents, if any. With PJ.02-08 a potential interaction has been identified with regard to the sequencing tool and the use of the AMAN/DMAN- no common activities have been performed. For PJ.04 and PJ.09 no common HP activities have been performed.</i></p> |
| 5 | <p>Is the level of human performance needed to achieve the desired</p> | yes | <p><i>The level of human performance needed to achieve the desired system performance has been assessed and confirmed as consistent with human capabilities.</i></p> |

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| | system performance for the proposed solution consistent with human capabilities? | | <i>Detailed in Arg. 1 and Arg. 2</i> |
| 6 | Are the assessments results in line with what is targeted for that concept? If not, has the impact on the overall strategic performance objectives/targets been analysed? | yes | <i>Please check the "ORD-Issue-Objective-Outcome" section for a detailed view on the assessment methodology envisaged for validating the ORD concept in segregated mode, mixed mode and CSPR operations. The results obtained from an HP perspective are in line with the proposed targets as all HP related validation objectives have been successfully covered.</i> |
| 7 | Has the proposed solution been tested with end-users and under sufficiently realistic conditions, including abnormal and degraded conditions? | yes | <i>The validation activities were built and conformed to experimental design principles, ensuring realistic conditions and allowing the participants to get sufficiently familiar with the new concept through various training sessions and prototyping sessions before the real time simulation was conducted. For all the issues that were not fully covered during RTS due to simulation limitations, the workshop discussions have ensured an in depth coverage of the remaining open issues that have been closed based on "expert judgement" of both operational experts and HP experts. <i>The validation activities were built based on the relevant information from SESAR 1, ensuring a transversal approach (HP, safety, validation and operational experts) in validation activities-prototyping sessions and RTS.</i></i> |
| 8 | Do validation results confirm that the interactions between human and technology are operationally feasible, and consistent with agreed human performance requirements? | yes | <i>The 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 ORD in the current Excel document.</i> |
| 9 | Have all relevant SESAR documentation been updated according to the HP activities outcomes (OSED, SPR)? | yes | <i>Following the identification of HP issues and benefits, all 4 high level HP Arguments have been included in the VALP, ensuring the success criteria fully covers HP needs. Consequently the VALR embedded the HP report made following the real time simulation that has documented HP findings in relation to the validation objectives. Once the list of recommendations and requirements has been finalised from an HP perspective, they have been checked against the safety requirements and commonly agreed with the OSED leader, Validation expert and Safety expert and they have been included in part I of the OSED - categorised as HP requirements. It has been commonly agreed that the "should" requirements or the recommendations will not be included in Part I of the OSED as they are not "mandatory" for implementation and hence the reader should consult the current HP Log/HP report for all the identified HP recommendations.</i> |
| 10 | Do the outcomes satisfy the HP issues/benefits in order to reach the expected KPA? | yes | <i>The outcome of the HP activities is to be found in the Recommendations and Requirements register sections of this Excel document. <i>For the identified Arguments, please refer to the "ORD-Issue-Objective-Outcome" section. <i>For the identified Issues/Benefits please refer to the "ORD-Issue-Objective-Outcome" section.</i></i></i> |

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| | | | <i>The outcome of the HP activities is to be found in the Recommendations and Requirements register sections of this Excel document.</i> |
| 11 | Have HP recommendations and HP requirements correctly been considered in HMI design, procedures/documentation and training? | yes | <i>The requirements formulated based on the HP activities have been documented in part I of the OSED. The outcome of the HP activities is to be found in the Recommendations and Requirements register sections of this Excel document.</i> |
| 12 | Have the major factors that can influence the transition feasibility (e.g. changes in competence requirements, recruitment and selection, training needs, staffing requirements, and relocation of the workforce) been addressed? Are there any ideas on how to overcome any issues? | yes | <i>Please refer to Arg. 4 -issues/benefits in the "ORD-Issue-Objective-Outcome" section of the Excel document and correspondingly in the Recommendations and Requirements sections. Argument 2 and Argument 4 have covered issues/benefits with regard to the task allocation human-machine and impacts on the organisational level Please check the Recommendation and Requirements section for the outcome of the HP activities.</i> |
| 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. | yes | <i>Please refer to Arg. 1 and Arg. 2 for corresponding issues and benefits identified in the "ORD-Issue-Objective-Outcome" section of the Excel document. All related recommendations and requirements relevant to changes in roles & responsibilities, competence requirements, or the task allocation between human & machine, are to be found in the Recommendations and Requirements sections.</i> |
| 14 | Has the next V-phase sufficiently been prepared (additional testing conditions, open HP issues to be addressed)? | yes | <i>Please refer to the "ORD-Issue-Objective-Outcome" section of the Excel document. All identified issues and benefits have been closed for the ORD concept. The requirements formulated based on the HP activities have been documented in part I of the OSED.</i> |

4.2 Departures Concepts Solutions

4.2.1 Step 1 Understand the ATM concept for Departures Concepts Solutions

4.2.1.1 Description of reference scenario

The description of the reference scenario can be found in the Departures HP Log (Solution & Concept Info tab), Appendix D.2

4.2.1.2 Description of solution scenario

The description of the solution scenarios can be found in the Departures HP Log (Solution & Concept Info tab), Appendix D.2

4.2.1.3 Consolidated list of assumptions

The consolidated list of assumptions can be found in the Departures HP Log (Solution & Concept Info tab), Appendix D.2

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

The list of related SESAR solutions can be found in the Departures HP Log (Solution & Concept Info tab) Appendix D.2

4.2.1.5 Identification of the nature of the change

The identification of nature of change can be found in the Departures HP Log (Change & Argument Identification tab). Step 2 Understand the HP implications for Departures Concepts Solutions, Appendix D.2

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

The list of relevant arguments, HP issues and benefits of HP activities can be found in the Departures HP Log (Issue-Objective Outcome tabs for solutions), Appendix D.2.

4.2.2 Step 3 Improve and validate the concept for Departures Concepts Solutions

4.2.2.1 Description of HP activities conducted

- Partner workshop for all concepts held in Madrid in July 2018;
- NATS internal user WebEx, November 2018;
- Partner workshop for all concepts held in Bretigny in October 2018;
- EUROCONTROL Real Time Simulations (RTS4a);
- EUROCONTROL Real Time Simulations (RTS4b);
- NATS Validation Real Time Simulations (RTS5);
- Post-RTS5 workshop held at Heathrow in March 2019;
- ENAIRE RTS 6;
- Post-validation workshop held at NATS in July 2019.

| Activity 1. Madrid Workshop | |
|---|--|
| Description | NATS, ECTL and ENAIRE workshop |
| Arguments & related issues addressed | HP Arg. 1-4 |
| HP objectives | See HP Log for a full list of objectives (e.g. Appendix D.2) |
| Tools / Methods selected out of the HP repository | Subject matter expert review of HP objectives and proposed validation methods |
| Summary of the HP activity | Solution tool HMI design review, proposal of validation methods and data collection to collect human performance data/validate HP objectives |

Table 3: Description of Activity 1

| ACTIVITY 2. | |
|--|---|
| Description | WebEx with Solution lead, HP Lead and Heathrow tower controller |
| Related Arguments | HP Arg. 1-4 Supervisor role discussed Toll benefits clarified |
| HP objectives | See HP Log Appendix A, relevant objectives in Argument 1 and 2 |
| Issues to be addressed / investigated from issues analysis | Argument 1 – In specific the role of the Supervisor was discussed with respect to their current high workload, Task analysis detailed, tool benefits clarified with respect to WL |
| Tools/Methods selected out of the HP repository | Semi-structured interview with end user |
| Summary of the HP activity | See HP Log Appendix D.2, Recommendation All tab and Requirements All tab |

Table 4: Description of Activity 2

| ACTIVITY 3. | |
|--|---|
| Bretigny partner workshop October 2018 | |
| Description | NATS, ECTL workshop with the participation of ATCO's (AUSTROCONTROL, EUROCONTROL) |
| Related Arguments | HP Arg. 1-4 |
| HP objectives | See HP Log Appendix A, relevant objectives in Argument 1 -4 |
| Issues to be addressed / investigated from issues analysis | Hazards with respect to early take-off – loss of WV separation or SID separation |
| Tools/Methods selected out of the HP repository | Semi-structured interview with end users, expert input from NATS and EUROCONTROL Safety and HP See columns R to U in the HP Log, Tab Issue-Objective-Outcome |
| Summary of the HP activity | See HP Log Appendix A, Recommendation All tab and Requirements All tab |

| ACTIVITY 4. | |
|--|---|
| NATS RTS 5 | |
| Description | Validation activity in a high-fidelity simulation environment, see column T in the Issue-Objective-Outcome tabs in the HP log, Appendix D.2 for details |
| Related Arguments | HP Arg. 1-4 |
| HP objectives | See HP Log Appendix D.2, relevant objectives in Argument 1 -4 |
| Issues to be addressed / investigated from issues analysis | The entire list of Issues identified in the Issue-Objective-Outcome tabs in the HP Log, Appendix D.2 HMI feedback |
| Tools/Methods selected out of the HP repository | See columns R to U in the HP Log, Tab Issue-Objective-Outcome |
| Summary of the HP activity | See HP Log Appendix D.2, Recommendation All tab and Requirements All tab |

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| ACTIVITY 5. | Post-RTS5 workshop held at Heathrow in March 2019 |
| Description | Safety and Human Performance post-RTS5 workshop. |
| Related Arguments | See Appendix A2 for details |
| HP objectives | To provide HP assurance for outstanding hazards identified in RTS5. |
| Issues to be addressed / investigated from issues analysis | See Appendix A2 for details |
| Tools/Methods selected out of the HP repository | HAZID workshop using Bowtie method. |
| Summary of the HP activity | See Appendix A2 for details |

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| ACTIVITY 6. | EUROCONTROL RTS4a |
| Description | Activity assessed the application of Static Pairwise Separations (S-PWS) - wake turbulence separations for departing aircraft based on static aircraft characteristics (AO-0323) integrated in a realistic environment in mixed mode runway operations. |
| Related Arguments | HP Arg.1-4 |
| HP objectives | <p>Ref. Scenario- The wake turbulence separation scheme applied in the reference scenario for the arriving and departing aircraft was the current wake turbulence separation scheme used in the Vienna approach and tower environment, i.e. Distance Based ICAO wake turbulence separation scheme:</p> <p>For aircraft category pairs with no defined WT separation then the MRS was applied. This was typically 3 NM although can be 2.5 NM under certain conditions prescribed in ICAO Doc 4444 [41] or as prescribed by the appropriate ATS authority.</p> <p>No visual separations were allowed.</p> |
| Issues to be addressed / investigated from issues analysis | Controller ability to apply 2.5MN Minimum Radar Separation. |
| Tools/Methods selected out of the HP repository | Observations, questionnaires |
| Summary of the HP activity | For this simulation, it was considered that the conditions were met such that 2.5NM MRS was applied. |

| ACTIVITY 7. | | EUROCONTROL RTS4b |
|--|---|--------------------------|
| Description | <p>The first aim was to assess the operational feasibility of time-based static Pairwise Separation (S-PWS-A - AO-0310) with Optimised Runway Delivery (ORD - AO-0328) for arriving aircraft in a Closely Spaced Parallel Runway (CSPR) environment. The second aim was to assess the operational feasibility of the static Pairwise Separations for departing aircraft (S-PWS) based on static aircraft characteristics (AO-0323) under partially segregated runway departure operations with Optimised Separation Delivery (OSD - AO-0329).</p> <p>Arrivals: The wake turbulence separation scheme applied in the reference scenario was the current wake turbulence separation scheme used in the Paris CDG approach environment, i.e. Distance Based RECAT-EU. Departures: For departures, the ICAO time-based wake turbulence separation scheme was applied with no tool support as is done in current operations.</p> | |
| Related Arguments | HP Arg.1-4 | |
| HP objectives | Please see the HP Log, Appendix D.1 | |
| Issues to be addressed / investigated from issues analysis | Please see the HP Log, Appendix D.1 | |
| Tools/Methods selected out of the HP repository | Observations, questionnaires | |
| Summary of the HP activity | Please see the HP Log, Appendix D.1 | |
| ACTIVITY 8. | | ENAIRES RTS6 |
| Description | ENAIRES RTS 6 5 measured runs, 3 controllers, 50 min | |
| Related Arguments | HP Arg. 1-4 | |
| HP objectives | Please see the HP Log, Appendix D.2 | |
| Issues to be addressed / investigated from issues analysis | Please see the HP Log, Appendix D.2 | |
| Tools/Methods selected out of the HP repository | Observations, questionnaires | |
| Summary of the HP activity | Please see the HP Log, Appendix D.2 | |

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| ACTIVITY 9. | Partner workshop at NATS July 2019 |
| Description | Presentation of findings |
| Related Arguments | HP Arg. 1-4 |
| HP objectives | All relevant under HP Arguments 1-4 HP findings Formal agreements |
| Issues to be addressed / investigated from issues analysis | Review and submission to SJU |
| Tools/Methods selected out of the HP repository | n/a |
| summary of the HP activity | VALR, HPAR, SAR and PAR update, SJU template use coordination |

4.2.3 Step 4 Collate findings & conclude on transition to next V-phase for Departures Concepts Solutions

4.2.3.1 Summary of HP activities results & recommendations / requirements

See Appendix D.2 for details

Please see Appendix D.2 for HP logs, tabs Issue-Objective-Outcome, Recommendations Register and Requirements Register

| Issue ID | HP Benefit | Issue / | HP Issue/ Benefit Status | HP/ Valid. Obj. ID | Activity Conducted | Results / Evidence | Recommendations | Requirements |
|---|------------|---------|--------------------------|--------------------|--------------------|--------------------|-----------------|--------------|
| Arg. 1.1.1: The description of roles & responsibilities cover all affected human actors. | | | | | | | | |
| | | | | | | | | |
| Arg. 1.1.2: The description of roles & responsibilities cover all tasks to be performed by a human actor. | | | | | | | | |
| | | | | | | | | |
| Arg. 1.1.3: Roles and responsibilities are clear and consistent (in V1: non-contradictory). | | | | | | | | |
| | | | | | | | | |
| Arg. 1.2.1: Operating methods cover operations in normal operating conditions. | | | | | | | | |
| | | | | | | | | |

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

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Arg. 1.2.3: Operating methods cover degraded modes of the ATM system.

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

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Table 5: Summary of the HP results and recommendations/ requirements for each identified issue & related argument

4.2.3.2 Maturity of the Solution

See the HP Log, solution Tab V3 Maturity checklists, Appendix D.2.

Copies of the solution maturity assessments are also provided below, for WDS-D, PWS-D and OSD 6.

| Maturity checklist for finalising the V3 assessment (WDS-D) | | | |
|---|---|--------|---|
| ID | Question | Answer | Comments |
| 1 | Has a Human Performance Assessment Report been completed? Have all relevant arguments been addressed and appropriately supported? | Yes | <i>Based on the Change and Argument Identification section, issues have been identified, covering all 4 HP Arguments. For a detailed view on the issues, consult the WDS-D-Issue-Objective-Outcome section of this Excel list.</i> |
| | | | <i>Yes, all arguments have been addressed and supported in the HP Log (please see the WDS-D Issue-Objective-Outcome section of this excel list), with the exception of the Tower supervisor role – this will be addressed in the future stages of the project.</i> |
| 2 | Are the benefits and issues in terms of human performance and operability related to the proposed solution sufficiently assessed (i.e. on the level required for V3)? | Yes | <i>The assessment of the benefits and issues in terms of human performance was considered to be sufficient at this level of maturity. No further gaps were identified in terms of issues/benefits (with the exception of the Tower supervisor role). Please see the Issue-Benefit-outcome tab in the HP Log for the WDS-D solution scenario</i> |
| 3 | Have all the parts of the solution/concept been considered? | Yes | <i>The parts of solution are considered in the VALP (Sections 3 and 4), OSED and the HP table which is included in the HP Log). The HP Log considers HP benefits and issues, along with the evidence and resulting requirements or recommendations generated for that particular argument, for the WDS-D solution.</i> |
| 4 | Have potential interactions with related projects/concepts been considered and addressed? | Yes | <i>Interactions were considered with the following projects: Solution PJ.02 (Increased Runway Throughput - Arrivals), PJ.01 (Enhanced Arrivals and Departures).PJ.04 (Total Airport Management), PJ.09 (Advanced Demand & Capacity Balancing), as well as related transversal SESAR Projects (PJ.19 and PJ.22). Also, legacy requirements and recommendations from the CREDOS project have been considered - please see Recommendations register and Requirements Register in the HP Log. However, there were no dependencies identified between the abovementioned projects. In the case of tool development for Arrivals and Departures for PJ.02, to be used within one operation environment, the tool design and HMI principles should be coordinated.</i> |
| 5 | Is the level of human performance needed to achieve the desired system performance for the proposed solution consistent with human capabilities? | Yes | <i>Validation and subsequent findings outlined in the HPAP have not identified that human performance required for desired system performance exceeded human capabilities. The Issue-Objective-Outcome tab for WDS-D solution in the HP log provides evidence gathered via the relevant activities; All objectives have been met; HP evidence does not reveal major impact on Human Performance. Where outstanding issues have been found, they have been addressed in the Requirements and Recommendations Registers.</i> |

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| 6 | Are the assessments results in line with what is targeted for that concept? If not, has the impact on the overall strategic performance objectives/targets been analysed? | Yes | <i>Yes, the concept explored and collected HP evidence in relation to the arguments presented in Section 4.4, which were captured appropriately.</i> |
| 7 | Has the proposed solution been tested with end-users and under sufficiently realistic conditions, including abnormal and degraded conditions? | Yes | <p><i>Overall, the conditions of the Departures RTS were considered to be realistic, based on the ATCO evaluations and debrief session findings. See VALR for further details</i></p> <p><i>One non-nominal scenario was explored during the Departures RTS, which was the go-around. During this scenario, a tool issue was encountered, where the tool timer included the incoming flight as a wake separation and therefore jumped ahead to the next aircraft. However, no procedural or HMI change is required as a result. Requirements and Recommendations have been established in order to address degraded modes - suspension of the application of reduced separation.</i></p> |
| 8 | Do validation results confirm that the interactions between human and technology are operationally feasible, and consistent with agreed human performance requirements? | No | <p><i>The specific elements of interaction between humans and technology are addressed in the HP Log (please see the WDS-D section), where the evidence has also assessed that such interactions are deemed operationally feasible, and as consistent with agreed human performance requirements.</i></p> <p><i>The role of the TWR Supervisor in the authorisation of WDS-D</i></p> <p><i>Further research is recommended with regards to the operation the optimisation of the departure sequence might not materialise</i></p> <p><i>As a result, the V3 "on-going" status is more feasible.</i></p> |
| 9 | Have all relevant SESAR documentation been updated according to the HP activities outcomes (OSED, SPR)? | Yes | <i>The findings presented in the HP Log have been reflected in the relevant SESAR documentation for PJ.02-01 (e.g. traceability for the SPR-INTEROP Requirements, OSED Part I).</i> |
| 10 | Do the outcomes satisfy the HP issues/benefits in order to reach the expected KPA? | Yes | <p><i>Validation outcomes have been considered satisfactory in supporting the presented HP issues and benefits outlined in the HP Log (please see the WDS-D section).</i></p> <p><i>- Arguments addressed and associated evidence - All issues/benefits identified within relevant HP argument has been assessed and Requirements or Recommendations assigned</i></p> <p><i>Outcomes of HP activities generated a list of Requirements and Recommendations</i></p> |
| 11 | Have HP recommendations and HP requirements correctly been considered in HMI design, procedures/documentation and training? | Yes | <p><i>All HP activities (pre-sim WebEx, documentation research, RTS5, post-simulation workshop) have focused on all 4 high-level HP arguments (Roles, HMI, Teamwork, Transition/Training)</i></p> <p><i>Set of Requirements and Recommendations has been produced</i></p> |

| | | | |
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| 12 | Have the major factors that can influence the transition feasibility (e.g. changes in competence requirements, recruitment and selection, training needs, staffing requirements, and relocation of the workforce) been addressed? Are there any ideas on how to overcome any issues? | Yes | <i>Transition factors as part of the HP Argument structure have been considered and assessed. Relevant training and competency recommendations and requirements have been identified.</i> |
| | | | <i>No impact at organisational level. Impact on TWR controller responsibilities, Supervisor responsibilities are being defined. HMI changes and automation levels are being gauged.</i> |
| | | | <i>For details, see sections of Argument no. 4 in all solution tabs in the HP Logs.</i> |
| 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. | Yes | <i>No impact at regulation level. Additional and changed responsibilities have been identified and assessed, risks mitigated in the form of Recommendations and Requirements. Please see Arguments 1 and 2 within WDS-D solution concept in the HP Log.</i> |
| | | | <i>Please see Arguments 1 and 2 within WDS-D solution concept in the HP Log.</i> |
| 14 | Has the next V-phase sufficiently been prepared (additional testing conditions, open HP issues to be addressed)? | Yes | <i>The HP Logs- Recommendation and Requirement registers list all Recommendations and Requirements generated via the HP Assessment activities in V3.</i> |
| | | | <i>The role of the TWR Supervisor in the authorisation of WDS-D remains unaddressed as well as the input of airlines to certain areas of HP.</i> |
| | | | <i>Further research is recommended with regards to the operational and HP benefits of WDS-D; due to the dynamic nature of the concepts, controller planning an effort into the optimisation of the departure sequence might not materialise as the meteorological conditions might change with little predictability.</i> |

| Maturity checklist for finalising the V3 assessment (PWS-D) | | | |
|---|---|--------|--|
| ID | Question | Answer | Comments |
| 1 | Has a Human Performance Assessment Report been completed? Have all relevant arguments been addressed and appropriately supported? | Yes | <i>Based on the Change and Argument Identification section, issues have been identified, covering all 4 HP Arguments. For a detailed view on the issues, consult the PWS-D-Issue-Objective-Outcome section of this Excel list.</i> |
| | | | <i>Yes, all arguments have been addressed and supported in the HP Log (please see the PWS-D section), with the exception of the Tower supervisor role – this will be addressed in the future stages of the project.</i> |

| | | | |
|---|---|-----|--|
| 2 | Are the benefits and issues in terms of human performance and operability related to the proposed solution sufficiently assessed (i.e. on the level required for V3)? | Yes | <i>The assessment of the benefits and issues in terms of human performance was considered to be sufficient at this level of maturity. No further gaps were identified in terms of issues/benefits (with the exception of the Tower supervisor role). Please see the Issue-Benefit-outcome tab in the HP Log for the PWS-D solution scenario</i> |
| 3 | Have all the parts of the solution/concept been considered? | Yes | <i>The parts of solution are considered in the VALP (Sections 3 and 4), OSED and the HP table which is included in the HP Log). The HP Log considers PWS-D HP benefits and issues, along with the evidence and resulting requirements or recommendations generated for that particular argument.</i> |
| 4 | Have potential interactions with related projects/concepts been considered and addressed? | Yes | <i>Interactions were considered with the following projects: Solution PJ.02 (Increased Runway Throughput - Arrivals), PJ.01 (Enhanced Arrivals and Departures), PJ.04 (Total Airport Management), PJ.09 (Advanced Demand & Capacity Balancing), as well as related transversal SESAR Projects (PJ.19 and PJ.22). Also, legacy requirements and recommendations from the CREDOS project have been considered - please see Recommendations register and Requirements Register in the HP Log. However, there were no dependencies identified between the abovementioned projects. In the case of tool development for Arrivals and Departures for PJ.02, to be used within one operation environment, the tool design and HMI principles should be coordinated.</i> |
| 5 | Is the level of human performance needed to achieve the desired system performance for the proposed solution consistent with human capabilities? | Yes | <i>Validation and subsequent findings outlined in the HPAP have not identified that human performance required for desired system performance exceeded human capabilities. The Issue-Objective-Outcome tab for PWS-D solution in the HP log provides evidence gathered via the relevant activities; All objectives have been met; HP evidence does not reveal major impact on Human Performance. Where outstanding issues have been found, they have been addressed in the Requirements and Recommendations Registers.</i> |
| 6 | Are the assessments results in line with what is targeted for that concept? If not, has the impact on the overall strategic performance objectives/targets been analysed? | Yes | <i>Yes, the concept explored and collected HP evidence in relation to the arguments presented in Section 4.4, which were captured appropriately.</i> |
| 7 | Has the proposed solution been tested with end-users and under sufficiently realistic conditions, including abnormal and degraded conditions? | Yes | <i>Overall, the conditions of the Departures RTS were considered to be realistic, based on the ATCO evaluations and debrief session findings. See VALR for further details One non-nominal scenario was explored during the Departures RTS, which was the go-around. During this scenario, a tool issue was encountered, where the tool timer included the incoming flight as a wake separation and therefore jumped ahead to the next aircraft. However, no procedural or HMI change is required as a result. Requirements and Recommendations have been established in order to address degraded modes - suspension of the application of reduced separation.</i> |

| | | | |
|----|--|-----|---|
| 8 | Do validation results confirm that the interactions between human and technology are operationally feasible, and consistent with agreed human performance requirements? | Yes | <i>The specific elements of interaction between humans and technology are addressed in the HP Log (please see the PWS-D section), where the evidence has also assessed that such interactions are deemed operationally feasible, and as consistent with agreed human performance requirements.</i> |
| 9 | Have all relevant SESAR documentation been updated according to the HP activities outcomes (OSED, SPR)? | Yes | <i>The findings presented in the HP Log have been reflected in the relevant SESAR documentation for PJ.02-01 (e.g. traceability for the SPR-INTEROP Requirements, OSED Part I).</i> |
| 10 | Do the outcomes satisfy the HP issues/benefits in order to reach the expected KPA? | Yes | <i>Validation outcomes have been considered satisfactory in supporting the presented HP issues and benefits outlined in the HP Log (please see the PWS-D section).</i> <i>- Arguments addressed and associated evidence - All issues/benefits identified within relevant HP argument has been assessed and Requirements or Recommendations assigned</i> <i>Outcomes of HP activities generated a list of Requirements and Recommendations</i> |
| 11 | Have HP recommendations and HP requirements correctly been considered in HMI design, procedures/documentation and training? | Yes | <i>All HP activities (pre-sim WebEx, documentation research, RTS5, post-simulation workshop) have focused on all 4 high-level HP arguments (Roles, HMI, Teamwork, Transition/Training)</i> <i>Set of Requirements and Recommendations has been produced</i> |
| 12 | Have the major factors that can influence the transition feasibility (e.g. changes in competence requirements, recruitment and selection, training needs, staffing requirements, and relocation of the workforce) been addressed? Are there any ideas on how to overcome any issues? | Yes | <i>Transition factors as part of the HP Argument structure have been considered and assessed. Relevant training and competency recommendations and requirements have been identified.</i> <i>No impact at organisational level. Impact on TWR controller responsibilities, Supervisor responsibilities are being defined. HMI changes and automation levels are being gauged.</i> <i>For details, see sections of Argument no. 4 in all solution tabs in the HP Logs.</i> |
| 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. | Yes | <i>No impact at regulation level. Additional and changed responsibilities have been identified and assessed, risks mitigated in the form of Recommendations and Requirements. Please see Arguments 1 and 2 within PWS-D solution concept in the HP Log.</i> <i>Please see Arguments 1 and 2 within PWS-D solution concept in the HP Log.</i> |
| 14 | Has the next V-phase sufficiently been prepared (additional testing conditions, open HP issues to be addressed)? | Yes | <i>The HP Logs- Recommendation and Requirement registers list all Recommendations and Requirements generated via the HP Assessment activities in V3.</i> |

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| | | | <i>The input of airlines to certain areas of HP remains unaddressed.</i> |
|--|--|--|--|

| Maturity checklist for finalising the V3 assessment (OSD 6) | | | |
|---|---|--------|--|
| ID | Question | Answer | Comments |
| 1 | Has a Human Performance Assessment Report been completed? Have all relevant arguments been addressed and appropriately supported? | Yes | <i>Based on the Change and Argument Identification section, issues have been identified, covering all 4 HP Arguments. For a detailed view on the issues, consult the OSD 6-Issue-Objective-Outcome section of this Excel list.</i> |
| | | | <i>Yes, all arguments have been addressed and supported in the HP Log (please see the OSD 6 section), with the exception of the Tower supervisor role – this will be addressed in the future stages of the project.</i> |
| 2 | Are the benefits and issues in terms of human performance and operability related to the proposed solution sufficiently assessed (i.e. on the level required for V3)? | Yes | <i>The assessment of the benefits and issues in terms of human performance was considered to be sufficient at this level of maturity. No further gaps were identified in terms of issues/benefits (with the exception of the Tower supervisor role). Please see the Issue-Benefit-outcome tab in the HP Log for OSD 6 solution scenario</i> |
| 3 | Have all the parts of the solution/concept been considered? | Yes | <i>The parts of solution are considered in the VALP (Sections 3 and 4), OSED and the HP table which is included in the HP Log). The HP Log considers HP benefits and issues, along with the evidence and resulting requirements or recommendations generated for that particular argument.</i> |
| 4 | Have potential interactions with related projects/concepts been considered and addressed? | Yes | <i>Interactions were considered with the following projects: Solution PJ.02 (Increased Runway Throughput - Arrivals), PJ.01 (Enhanced Arrivals and Departures), PJ.04 (Total Airport Management), PJ.09 (Advanced Demand & Capacity Balancing), as well as related transversal SESAR Projects (PJ.19 and PJ.22). Also, legacy requirements and recommendations from the CREDOS project have been considered - please see Recommendations register and Requirements Register in the HP Log. However, there were no dependencies identified between the abovementioned projects. In the case of tool development for Arrivals and Departures for PJ.02, to be used within one operation environment, the tool design and HMI principles should be coordinated.</i> |
| 5 | Is the level of human performance needed to achieve the desired system performance for the proposed solution consistent with human capabilities? | Yes | <i>Validation and subsequent findings outlined in the HPAP have not identified that human performance required for desired system performance exceeded human capabilities. The Issue-Objective-Outcome tab for OSD 6 solution in the HP log provides evidence gathered via the relevant activities; All objectives have been met; HP evidence does not reveal major impact on Human Performance. Where outstanding issues have been found, they have been addressed in the Requirements and Recommendations Registers.</i> |

| | | | |
|----|---|-----|--|
| 6 | Are the assessments results in line with what is targeted for that concept? If not, has the impact on the overall strategic performance objectives/targets been analysed? | Yes | <i>Yes, the concept explored and collected HP evidence in relation to the arguments presented in Section 4.4, which were captured appropriately.</i> |
| 7 | Has the proposed solution been tested with end-users and under sufficiently realistic conditions, including abnormal and degraded conditions? | Yes | <p><i>Overall, the conditions of the Departures RTS were considered to be realistic, based on the ATCO evaluations and debrief session findings. See VALR for further details</i></p> <p><i>One non-nominal scenario was explored during the Departures RTS, which was the go-around. During this scenario, a tool issue was encountered, where the tool timer included the incoming flight as a wake separation and therefore jumped ahead to the next aircraft. However, no procedural or HMI change is required as a result. Requirements and Recommendations have been established in order to address degraded modes - suspension of the application of reduced separation.</i></p> |
| 8 | Do validation results confirm that the interactions between human and technology are operationally feasible, and consistent with agreed human performance requirements? | Yes | <i>The specific elements of interaction between humans and technology are addressed in the HP Log (please see the OSD 6 section), where the evidence has also assessed that such interactions are deemed operationally feasible, and as consistent with agreed human performance requirements.</i> |
| 9 | Have all relevant SESAR documentation been updated according to the HP activities outcomes (OSED, SPR)? | Yes | <i>The findings presented in the HP Log have been reflected in the relevant SESAR documentation for PJ.02-01 (e.g. traceability for the SPR-INTEROP Requirements, OSED Part I).</i> |
| 10 | Do the outcomes satisfy the HP issues/benefits in order to reach the expected KPA? | Yes | <p><i>Validation outcomes have been considered satisfactory in supporting the presented HP issues and benefits outlined in the HP Log (please see the OSD 6 section).</i></p> <p><i>- Arguments addressed and associated evidence - All issues/benefits identified within relevant HP argument has been assessed and Requirements or Recommendations assigned</i></p> <p><i>Outcomes of HP activities generated a list of Requirements and Recommendations</i></p> |
| 11 | Have HP recommendations and HP requirements correctly been considered in HMI design, procedures/documentation and training? | Yes | <p><i>All HP activities (pre-sim WebEx, documentation research, RTS5, post-simulation workshop) have focused on all 4 high-level HP arguments (Roles, HMI, Teamwork, Transition/Training)</i></p> <p><i>Set of Requirements and Recommendations has been produced</i></p> |
| 12 | Have the major factors that can influence the transition feasibility (e.g. changes in competence | Yes | <i>Transition factors as part of the HP Argument structure have been considered and assessed. Relevant training and competency recommendations and requirements have been identified.</i> |

| | | | |
|----|--|-----|--|
| | 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? | | <p><i>No impact at organisational level. Impact on TWR controller responsibilities, Supervisor responsibilities are being defined. HMI changes and automation levels are being gauged.</i></p> <p><i>For details, see sections of Argument no. 4 in OSD 6 solution tab in the HP Log.</i></p> |
| 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. | Yes | <p><i>No impact at regulation level. Additional and changed responsibilities have been identified and assessed, risks mitigated in the form of Recommendations and Requirements. Please see Arguments 1 and 2 within OSD 6 solution concept in the HP Log.</i></p> <p><i>Please see Arguments 1 and 2 within OSD 6 solution concept in the HP Log.</i></p> |
| 14 | Has the next V-phase sufficiently been prepared (additional testing conditions, open HP issues to be addressed)? | Yes | <p><i>The HP Logs- Recommendation and Requirement registers list all Recommendations and Requirements generated via the HP Assessment activities in V3.</i></p> <p><i>The input of airlines to certain areas of HP remains unaddressed.</i></p> |

4.3 Wake Risk Monitoring Concept Solution

See chapter 2.1.4

4.3.1 Step 1 Understand the ATM concept for Wake Risk Monitoring Concept Solution

4.3.1.1 Description of reference scenario

The description of the solution scenario can be found in the Wake Risk Monitoring HP Log (Solution & Concept Info tab).

4.3.1.2 Description of solution scenario

The description of the solution scenario can be found in the Wake Risk Monitoring HP Log (Solution & Concept Info tab).

4.3.1.3 Consolidated list of assumptions

The description of the solution scenario can be found in the Wake Risk Monitoring HP Log (Solution & Concept Info tab).

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

The description of the solution scenario can be found in the Wake Risk Monitoring HP Log (Solution & Concept Info tab).

4.3.1.5 Identification of the nature of the change

The description of the solution scenario can be found in the Wake Risk Monitoring HP Log (Solution & Concept Info tab). Step 2 Understand the HP implications for Wake Risk Monitoring Concept Solution

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

N/A

4.3.2 Step 3 Improve and validate the concept for Wake Risk Monitoring Concept Solution

4.3.2.1 Description of HP activities conducted

N/A

4.3.3 Step 4 Collate findings & conclude on transition to next V-phase for Wake Risk Monitoring Concept Solution

4.3.3.1 Summary of HP activities results & recommendations / requirements

N/A

4.3.3.2 Maturity of the Solution

The Wake Risk Monitoring solution has been assessed against V2 and V3 maturity criteria. Based on the validation findings, they apply at V3 criteria, however the overall maturity of the concept in terms of human performance is considered to be V2 on-going, as some key elements are missing (please See the HP Log, Tabs V2 and V3 Maturity Checklist, Appendix D.3). The table below thus considers the V2 maturity assessment.

| Maturity checklist for finalising the V2 assessment | | | |
|---|---|--------|--|
| ID | Question | Answer | Comments |
| 1 | Have relevant arguments for V2 been addressed and appropriately supported? | yes | <i>Refer to relevant sections of the HP table or HP assessment report, e.g.:</i> An HP scoping have been performed at the beginning of the HPAP to assess the relevant HP arguments for all V level maturity (1 to 3). Refer to "change & Argument Identification tab". |
| 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 V2)? | yes | <i>Refer to relevant sections of the HP table or HP assessment report, e.g.:</i> WM function is an additional mean compare to current situation and expect to improve the current situation by providing, a posteriori, objective data linked to a WVE. |

| | | | |
|----|--|-----|--|
| 3 | Have potential interactions with related projects/concepts started to be considered? | yes | <i>Refer to relevant sections of the HP table or HP assessment report, e.g.:</i> The different analysis showed some strong interaction with the e-WTR project and the EU regulation No 376/2014 regarding the incident reporting. |
| 4 | In case of different options of the proposed solution, is the decision for a specific option(s) based on the consideration of HP benefits and issues? | yes | <i>Refer to the relevant sections of the HP table or HP assessment report, e.g.:</i> There is only one option for WM function. Nevertheless different use cases were candidate at the beginning of the V phase, then the discussion, analysis and reference to the EU regulation No 376/2014 identified the more relevant Use Case. Indeed the "on demand" use case model seems to be the more relevant so far. |
| 5 | Is the level of human performance needed to achieve the desired system performance for the proposed solution consistent with human capabilities? | yes | <i>Refer to relevant sections of the HP table or HP assessment report:</i> WM function is an additional mean compare to current situation. |
| 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? | n/a | <i>Refer to relevant sections of the HP table or HP assessment report:</i> - Arguments addressed and associated actual evidence |
| 7 | Has the proposed solution been tested with end-users and started to be tested under sufficiently realistic conditions, including certain abnormal and degraded conditions? | no | <i>Refer to relevant sections of the HP table or HP assessment report:</i> The use of WM function is a posteriori and support the post analysis phase of a suspected WVE by users expert of the system. The use of WM function is a posteriori and support the post analysis phase of a suspected WVE by users expert of the system. Nevertheless, the use of the function is "on demand" and the way to perform this "on demand" is not yet defined. |
| 8 | Are the outcomes based on the solution assessment mature enough to start V3? | yes | As the use of the function is "on demand" the end user will be expert of the function. So the main part of the maturity level of the function will be based on system performance. |
| 9 | Have all relevant SESAR documentation been updated according to the HP activities outcomes (OSED, SPR)? | yes | Dedicated HP log has been completed. |
| 10 | Have the major factors that can influence the transition feasibility (e.g. changes in automation level, changes in staff requirements, such as competence, staffing levels) been considered? Are there any ideas on how to overcome any such issues? | yes | <i>Refer to relevant sections of the HP table or HP assessment report e.g.:</i> WM function is an additional mean compare to current situation. There is no expected transition. Additionally there is no change in automation expected. |
| 11 | 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. | yes | <i>Refer to relevant sections of the HP table or HP assessment report e.g.:</i> There is no change in regulation expected. Additionally current EU regulation No 376/2014 covers and describe the main way to use the function. |
| 12 | Has the next V-phase sufficiently been prepared (additional testing conditions, | no | <i>Refer to relevant sections of the HP assessment report, e.g.:</i> |

| | | | |
|--|----------------------------------|--|--|
| | open HP issues to be addressed)? | | The expected model to use the WM Function is "on demand". So the mean to perform this "on demand" have to be designed but this does not seem to be challenging. Then the direct use of the function will be performed by expert of the system. |
|--|----------------------------------|--|--|

4.4 Wake Decay Enhancing Concept Solution

N/A

5 References

Human Performance

- [1] SESAR Human Performance Assessment Process V1 to V3 (including VLDs)
- [2] 16.04.01 Evolution from the ATM HF case to a HP Case Methodology for SESAR, HP assessment process for projects in V1, V2 or V3. D10-001, 00.01.00
- [3] 06.09.03 D05.1 Single Remote Tower Validation Plan – Appendix Human Performance Assessment Plan
- [4] 16.06.05 D 27 HP Reference Material D27
- [5] 16.04.02 D04 e-HP Repository - Release note
- [6] Bretigny partner workshop minutes October 2018, EUROCONTROL

PJ.02-01 Data Pack

- [7] D1.1.04 – PJ02-01 VALR (Final) – 01.00.00
- [8] D1.1.01 – PJ02-01 OSED-SPR-INTEROP (Final) Part I – 01.00.00
- [9] D1.1.01 – PJ02-01 OSED-SPR-INTEROP (Final) Part II – 01.00.00
- [10] D1.1.01 – PJ02-01 OSED-SPR-INTEROP (Final) Part V – 01.00.00
- [11] D1.1.02 – PJ02-01 TS/IRS (Final) – 01.00.00
- [12] D1.1.03 – PJ02-01 VALP (Final) Part I – 00.01.00
- [13] D1.1.03 – PJ02-01 VALP (Final) Part II – 00.01.00
- [14] D1.1.03 – PJ02-01 VALP (Final) Part IV – 00.01.00
- [15] D1.1.05 – PJ02-01 CBA – 01.00.00

Appendix A – Additional HP activities conducted

This section contains the outputs from the HP activities conducted for the Solution.

A.1 Arrivals Concepts Solutions



Workshop 1

PJ02-01 and PJ02-03.questions pilots anc



Workshop Pj02

A.2 Departures Concepts Solutions



Minutes for PJ02-01
Departure Concepts

A.3 Wake Risk Monitoring Concept Solution

N/A

A.4 Wake Decay Enhancing Concept Solution

N/A

Appendix B – HP Recommendations Register

B.1 Arrivals Concepts Solutions

The Arrivals Concepts Solutions Recommendations Register addresses the recommendations generated from the EUROCONTROL and ENAIRE Arrivals RTS exercises. The relevant recommendations can be found in the embedded HP Log “*HP LOG PJ02_01 Arrivals ECTL and ENAIRE Consolidated Final*” in Appendix D.1.

B.2 Departures Concepts Solutions

The Departures Concepts Solutions Recommendations Register addresses the recommendations generated from the NATS and ENAIRE Departures RTS exercises. The relevant recommendations can be found in the embedded HP Log for Departures in Appendix D.2.

B.3 Wake Risk Monitoring Concept Solution

The Wake Risk Monitoring Concept Solutions Recommendations Register addresses the recommendations generated from AIRBUS RTS exercises. The relevant recommendations can be found in the embedded HP Log for Wake Risk Monitoring in Appendix D.3.

B.4 Wake Decay Enhancing Concept Solution

N/A

Appendix C – HP Requirements Register

C.1 Arrivals Concepts Solutions

The Arrivals Concepts Solutions Requirements Register addresses the requirements generated from the EUROCONTROL and ENAIRE Arrivals RTS exercises. The relevant requirements can be found in the embedded HP Log “*HP LOG PJ02_01 Arrivals ECTL and ENAIRE Consolidated Final*” in Appendix D.1.

C.2 Departures Concepts Solutions

The Departures Concepts Solutions Requirements Register addresses the requirements generated from the NATS and ENAIRE Departures RTS exercises and other activities. The relevant requirements can be found in the embedded HP Log in Appendix D.2.

C.3 Wake Risk Monitoring Concept Solution

The Wake Risk Monitoring Solutions Requirements Register addresses the requirements generated from the Airbus RTS exercises. The relevant requirements can be found in the embedded HP Log in Appendix D.3.

C.4 Wake Decay Enhancing Concept Solution

N/A

Appendix D– HP Log

This section contains HP Logs for the PJ.02-01 Solutions.

D.1 Arrivals Concepts Solutions

The combined EUROCONTROL and ENAIRE Arrivals Concepts Solutions HP Log is embedded below.



Arrivals PJ02-01
OSED-SPR-INTEROP

D.2 Departures Concepts Solutions



Departures HP Log
PJ0201 NATS et ENAI

D.3 Wake Risk Monitoring Concept Solution



Wake%20Risk%20M
onitoring%20HP%2C

D.4 Wake Decay Enhancing Concept Solution

N/A

-END OF DOCUMENT-

