

PJ.02-W2-14.2 SPR- INTEROP/OSED - Part IV - Human Performance Assessment Report for V3

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AART

AIRPORT, AIRSIDE AND RUNWAY THROUGHPUT

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Abstract

The scope of the HP Assessment Report (HPAR) is to ensure all relevant HP aspects have been identified and considered for the operational and technical development of solution PJ.02-W2-14.2 – “Second runway aiming point (SRAP)”, in accordance with the HP Assessment Process [1].

PJ.02-W2-14.2 aims to improve airport performances on the Environmental Sustainability and Capacity Key Performance Areas by introducing the SRAP concept, AO-0319. The concept was already investigated within SESAR1 Programme and SESAR 2020 PJ.02-02 in Wave 1, but as an outcome of this previous R&D Programme, it did not achieve full V3 maturity. PJ.02-W2-14.2 aims to completing the validation activities on SRAP concept, so that they can be moved to the next phase of the validation cycle.

The addressed OI for the validation activities was:

- AO – 0319 - Second Runway Aiming Point (SRAP).

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1 Executive Summary

PJ.02-W2-14.2 aims to improve airport performances on the Environmental Sustainability and Capacity Key Performance Areas by introducing the SRAP concept, AO-0319. The concept was already investigated within SESAR1 Programme and SESAR 2020 PJ.02-02 in Wave 1, but as an outcome of this previous R&D Programme, it did not achieve full V3 maturity. PJ.02-W2-14.2 aims to completing the validation activities on SRAP concept, so that they can be moved to the next phase of the validation cycle.

The HP Assessment Report (HPAR) ensures that relevant Human Performance (HP) aspects have been identified and considered for the operational and technical development of PJ.02 Airport & Airside and Runway Throughput (AART) concepts, based on the HP Assessment Process [1] methodology. The HPAR is built on the structure of the HP Arguments which are “HP claims that need to be proven”, according to the HP Reference Material. In a first step – the scoping and change assessment- the arguments that are relevant for the concept were identified. A full description of SRAP can be found in the final PJ.02-W2-14.2 OSED/SPR-INTEROP Part I (D4.2.002) [2].

Up to date several validation activities were conducted to assess the SRAP Enhanced Arrival Procedure, with the use of the Optimal Runway Delivery (ORD) tool using the Paris CDG airport, with an approach environment for:

- AO – 0319 - Enhanced Arrival procedures using Secondary Runway Aiming Points (SRAP).

These Validation exercises were conducted to cover gaps identified following PJ.02-02 validation activities, which were about:

1. The management of non-nominal situations from ATC side (go-around/missed approaches, interception of wrong glide, loss of LORD tool in heavy traffic situations). One simulation covered these points;
2. Ground aids (runway marking, runway lighting and the PAPI) for the pilots. Runway marking and PAPI were covered by one simulation and the lighting by two.

The objective of the validation exercises was to assess:

- The usability and acceptability of the SRAP enhanced arrival procedure;
- The usability and acceptability of the sequencing and separation tool (ORD);
- The impact of the enhanced arrival procedures on communication exchanges/ phraseology;
- The usability of the HMI;
- The acceptability of the number of a/c flying enhanced arrival procedures.

The conclusions of the ATC real-time simulation is that the proposed ways to manage the non-nominal situations are acceptable and manageable by the controllers.

The following arguments were identified as being relevant for the concept:

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

Arg. 4: Human Performance related transition factors are considered.

The HPAR presents the outcome of the human performance activities conducted in order to adequately inform the development and validation of SESAR Solution PJ.02-W2-14.2 to full V3 maturity.

With regard to human performance activities, the new operational concept was assessed in terms of situational awareness, workload, trust in the HMI, acceptability of procedures and system, usability and utility of the system and teamwork and communication.

A total of 26 potential HP issues/ benefits have been identified, on the basis of which three HP activities were proposed:

1. User workshops (with relevant experts – ATCOs, SUPs);
2. Real time simulations and debriefs;
3. Flight deck simulations.

The above activities have been executed by applying the following data collection methods:

- Objective measurements (R/T frequency occupancy, number of clearances, sector load etc.);
- Subjective data (questionnaires, ISA recordings, debrief notes and expert observations).

These activities were defined in order to cover the HP objectives that have been included in the Validation Plan. The output of these activities has been integrated in the list of requirements and recommendations that are described in Chapter 4, and related to:

- Future validation exercises covering SRAP procedures;
- The operational concept and related procedures;
- The technical system and the design of the HMI;
- The training of the end users.

2 Introduction

2.1 Purpose of the document

The purpose of the HPAR is to describe the final status of the HP issues and HP objectives identified on according to the Human Performance (HP) assessment process [1] are defined.

The SESAR Solution Development Life Cycle aims to structure and perform the work at project level and progressively increase SESAR Solution maturity, with the final objective of delivering a SESAR Solution data-pack for industrialisation and deployment. The Part IV of the OSED is a supporting document to the Part I, which is a key part of this SESAR Solution data-pack.

2.2 Intended readership

The intended audience for this document are primarily all the partners involved in SESAR 2020 PJ.02-W2-14.2.

Stakeholders are to be found among:

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

2.3 Structure of the document

The PJ.02-W2-14.2 OSED consists of five parts:

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

Part IV of the SESAR Solution PJ.02-W2-14.2 OSED consists of four main sections:

- Section 1: Executive Summary of the brief description of the solution and the associated HP implications;

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

2.4 Acronyms and Terminology

Term	Definition
AFS	Automatic Flight System
AFS CP	Automatic Flight System Control Panel
ANS	Air Navigation Service(s)
AP/FD	Autopilot/flight director
APM	Approach Path Monitoring
APP	Approach
ASS	Assumption
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATS	Air Traffic Services
CAT	Category
CDG	Charles De Gaulle airport
CSPR ST	Closely Spaced Parallel Runways Staggered Threshold
CWP	Controller Working Position
DCB	Demand Capacity Balancing
DOD	Detailed Operational Description
EAP	Enhanced Arrival Procedures
EUROCONTROL	European Organisation for the Safety of Air Navigation
EXE	Exercise
FAP	Final Approach Point
FCOM	Flight Crew Operating Manual
FTD	Final Target Distance
GBAS	Ground Based Augmentation System
HMI	Human Machine Interface
HPAP	Human Performance Assessment Plan
HPAR	Human Performance Assessment Report
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IGS	Increased Glide Slope
ILS	Instrument Landing System
INI	Initial Approach Controller
INTEROP	Interoperability
ISA	Instantaneous Self-Assessment
ITD	Initial Target Distance
ITM	CDG Approach sector
KPA	Key Performance Area
LORD	Landing with Optimised Runway Delivery
NOTAM	Notice to Airmen

OBJ	Objective
OI	Operational Improvement
OPS	Operations
ORD	Optimised Runway Delivery
OSED	Operational Service and Environment Definition
PAPI	Precision Approach Path Indicator
RAP	Runway Aiming Point
REQ	Requirement
RNAV	Area Navigation
ROT	Runway Occupancy Time
RTCS	Recruitment, Training, Competence, and Staffing
RTS	Real-Time Simulation
SASHA	Situational Awareness for SHAPE
SATI	SHAPE Automation Trust Index
SBAS	Satellite-Based Augmentation System
SESAR	Single European Sky ATM Research
SJU	SESAR Joint Undertaking
SPR	Safety and Performance Requirements
SRAP	Secondary Runway Aiming Point
STAR	Standard Arrival Route
STQ	SHAPE Teamwork Questionnaire
TLX	Task Load Index
TMA	Terminal Manoeuvring Area
TOD	Top Of Descent
TRN	Training
TWR	Tower
VALP	Validation Plan
VALR	Validation Report
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rules

Table 1: Acronyms table

Term	Description
Human Factors (HF)	HF is used to denote aspects that influence a human's capability to accomplish tasks and meet job requirements. These can be external to the human (e.g. light & noise conditions at the 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, OSD, 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 2: Terminology table

3 The Human Performance Assessment Process: Objective and Approach

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

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

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

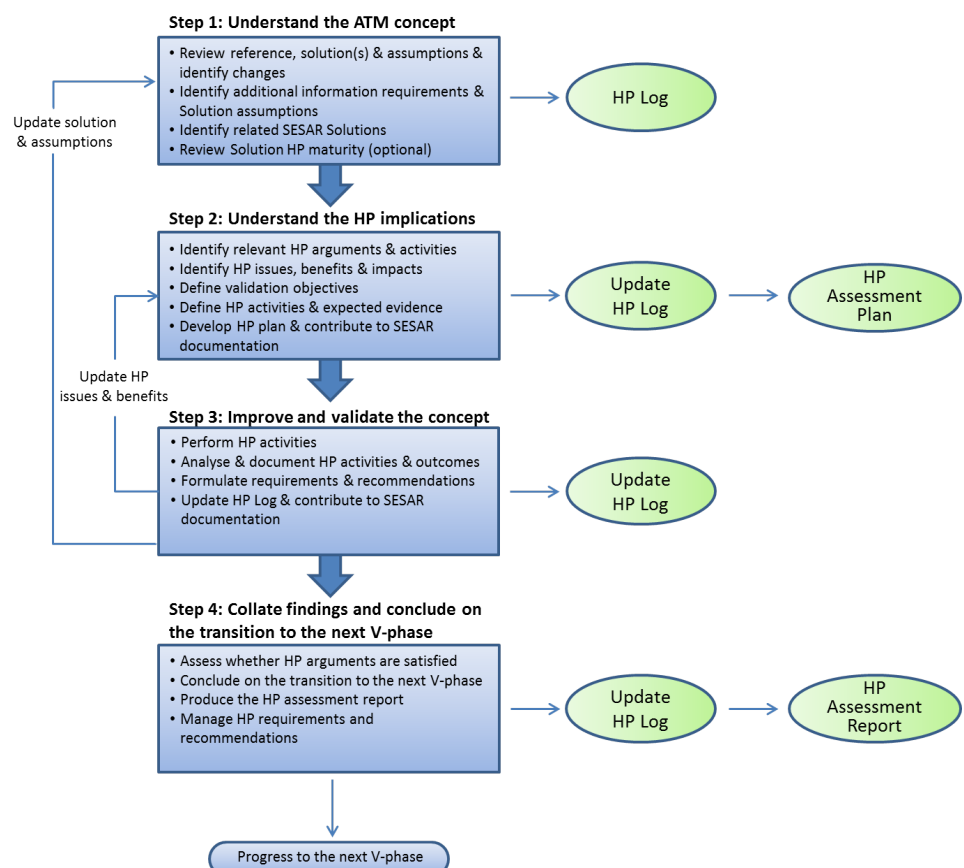


Figure 1: Steps of the HP assessment process

4 Human Performance Assessment

4.1 Step 1 Understand the ATM concept

4.1.1 Description of reference scenario

The **reference scenario** is represented by the current final approach operations conducted with a nominal (3°) and continuous glide path angle, with a non-displaced threshold, based on the various available technologies: Instrument Landing System (ILS), GBAS CAT I, Area Navigation (RNAV) or Satellite-Based Augmentation System (SBAS).

4.1.2 Description of solution scenario

AO-0319	Enhanced Arrival Procedures using a Second Runway Aiming Point (SRAP)	Full
Enhanced arrival procedures using a Second Runway Aiming Point (SRAP) will allow inbound aircraft reducing noise footprint impact in the surrounding areas of the airport and possibly runway occupancy time and/or taxi-in time, while also allowing potential increased runway capacity (via optimized wake separations). The SRAP concept is a published approach procedure, enabling aircraft to land on a second further runway aiming point (with associated runway ground markers, lights and visual aids). The SRAP procedure is designed with a glide slope parallel to the nominal one operated for the first aiming point. Choosing a SRAP approach (over the conventional one) could be the result of the best compromise between available runway length, preferential runway exit use, noise, wake turbulence separation constraints, and the runway occupancy time.		

4.1.3 Consolidated list of assumptions

Identifier	Title	Description	Justification	Impact on Assessment
R01-ASS-01	Aircraft equipage capabilities	92% of the aircraft in the traffic sample are able to fly SRAP enabled by a specified system: RNAV or GBAS. 56% are planned for an RNAV or GBAS approach.	To be in line with the forecast for 2030	HIGH
R01-ASS-02	Separation standards and responsibilities	The minimum radar separation and runway related spacing constraints have to be respected if the ORD tool is not available.	For realistic simulation environment	HIGH



Identifier	Title	Description	Justification	Impact on Assessment
R01-ASS-03	No wind conditions	There will be no wind conditions simulated	This will not influence the results as the ORD tool considers the wind in the separation that it provides and the controllers will follow the chevrons provided by the ORD tool.	N/A
R01-ASS-04	Traffic Sample	Observed traffic figures have been augmented to represent traffic in 2030.	This is required to understand the feasibility of the concepts during the expected implementation time.	HIGH
R01-ASS-05	Runway Occupancy Times (ROT)	The same runway occupancy times are used for both runway thresholds.	This will not influence the results as the ORD tool considers the ROT in the separation that it provides and the controllers will follow the chevrons provided by the ORD tool.	N/A
R01-ASS-06	Go-Arounds and Missed Approaches	Aircraft performing a go-around or a missed approach are not re-introduced into the sequence, but are "killed".	The purpose of the simulation is to assess how the missed approach or go-around is managed at the moment that they occur. Once managed, the controller returned to nominal situation.	LOW
R01-ASS-07	No crossing Traffic	The simulation only includes North arrivals. No departures or traffic from other surrounding airports.	The simulation environment is supposed to be generic for all airports. This is also required to understand the feasibility of the concepts during the expected implementation time.	LOW
R01-ASS-08	Aircraft General Characteristics	All aircraft have the same nominal characteristics.	For a realistic simulation environment	HIGH
R01-ASS-09	Airspace Organisation	European airspace will be based on current ICAO ATS classifications, regulations and applicable rules, including VFR and IFR.	For a realistic simulation environment	HIGH





Identifier	Title	Description	Justification	Impact on Assessment
R01-ASS-10	Actor Compliance	General Compliance by all actors with existing standards and guidelines.	For a realistic simulation environment	HIGH
R01-ASS-11	Standards	Airport standards and responsibilities are unchanged.	For a realistic simulation environment	HIGH
R01-ASS-12	Training	All staff have appropriate training and competencies. Even though the traffic level at Paris CDG has decreased significantly due to the COVID-19 pandemic, it is assumed that controllers are still able to manage the level of traffic.	For a realistic simulation environment	HIGH
EXE03-ASS1	SRAP landing minima	Pilots are expected to use the landing minima from the charts (no increase to be applied by pilots).	As per SRAP concept definition, if there is an impact on landing minima for SRAP, it should be transparent for the pilots.	MEDIUM

Table 3: Assumptions overview

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

N/A



4.1.5 Identification of the nature of the change

The following table is used to help systematically identify and capture the nature of the change that may result due to the introduction of the concept(s) under investigation in terms of, the ATM actors impacted as well as the potential changes to their work.

The HP argument branches of the table cover the second level of HP arguments in Appendix A of [1] and so it is not only used to help identify and capture changes to ATM actors work but can also be used to help screen and scope the HP assessment. Therefore, the table helps narrow down and focus the list of HP arguments that need to be investigated in the next step of the HP assessment. Furthermore, if there are no changes identified that relate to any of the HP argument branches in the table then no HP assessment is required on the Solution.

Note: the numbering of the argument branches in the table is in line with the numbering of the HP arguments in Appendix A of [1].

HP argument branch	Change & affected actors
1. ROLES & RESPONSIBILITIES	
1.1 ROLES & RESPONSIBILITIES	For both air & ground there are no role changes foreseen in the project. What could occur is a different task sharing between existing roles, with the same responsibilities
1.2 OPERATING METHODS	Operators and pilots intending to conduct any approach operations should fill the appropriate flight plan suffixes and the on board navigation data must be current and include the appropriate procedures, including the new SRAP (that must be selectable from a valid navigation database (NavDB) and not prohibited by a company instruction or Notice to Airmen (NOTAM)). Aircraft capability to fly to second runway aiming points shall be indicated in flight plan so that the capability can be considered in the Demand Capacity Balancing (DCB) process. Note the SRAP procedure emphasizes the specificities regarding the landing distance. On a destination airport with multiple runways and/or multiple runway aiming points, the landing distance computation at dispatch may be performed on the longest landing runway with no wind. If the runway condition changes at landing (wind, dry/wet, contaminated etc.), the flight crew must perform a new landing distance computation. With SRAP, once informed by ATC of the intended approach procedure which defines the requested landing runway and runway aiming point, the flight crew may perform an in-flight landing performance assessment if the landing conditions changed compared with the landing computation at dispatch, or if they have not prepared the intended approach procedure at dispatch. For SRAP, the crew has to respect the Standard Operational Procedure defined for the corresponding SRAP flown if any (described in the Flight Crew Operating Manual FCOM). That concerns particularly the aircraft configurations deployment

	in order to be stabilized in speed and thrust level no later than 1000ft. The crew must also comply with the ATC speed constraints if any. ATCO manages the landing sequence of the a/c flying a mix of different standard approach procedures and SRAP. ATC tools are enhanced to support ATCOs. TMA/APP ATCO through ATIS informs a/c about the SRAP in use; instructs a/c to fly STAR or they receive clearances by ATC to follow radar-vectoring instructions. In SRAP the descent profile should contain at least one fix, where pilots compare the actual crossing altitude with the required crossing altitude. With SRAP aircraft may commence its final descent when aircraft passes the new descent point (FAP).
1.3 TASKS	Before capturing the final approach segment, the flight crew must verify the correctness of the SRAP data from the Navigation Database, crosschecking them with the approach chart. Moreover, the crew must verify that there is no any failure (e.g. faulty slats/flaps...) affecting the aircraft performance and especially impairing the aircraft deceleration capability. On most modern avionics, following ATC clearance to fly final approach, the crew arms the approach guidance modes on the Automatic Flight System Control Panel (AFS CP) and then the aircraft captures and flies the final approach path down to the runway. In addition to the standard info, the ATCO provides the a/c with the leading a/c precision approach segment; At TOD ATCO requests to fly SRAP. If refused by a/c – the standard ILS precision segment is instructed; Ground controller needs to know where an SRAP flight is most likely to leave the runway in order to plan an optimised ground flow and avoid unforeseen conflicts on the taxiways (Check if there's a difference between the standard procedure and SRAP). The responsible ATCO can change the request before 15 NM to the airport.
2. HUMAN & SYSTEM	
2.1 ALLOCATION OF TASKS (HUMAN & SYSTEM)	The approach can be flown with various levels of automation: with Autopilot/flight director (AP/FD), with FD only and without AP/FD (using only the raw data). For the ATCO changes are foreseen in relation to the separation tool that is providing the ATCO with an indicator of the desired separation taking the approach and the wake category of the aircraft into account. The tool is available on the approach and tower positions. The target distance indicators will be displayed in order to help the ATCOs determine and achieve the required a/c spacing /separation. The ORD support tool will provide the minimum distance to be maintained down to threshold (the final target distance indicator). In addition, the HMI will also present the compression effect to help ATCOs deliver the required minimum separation at threshold (the initial target distance indication).

	This means that the system, and not the ATCO, is now calculating the required spacing between different a/c pairs. The tool proposes not only the separation but also the optimal sequence, while the separation cannot be overwritten by the ATCO the sequence can.
2.2 PERFORMANCE OF TECHNICAL SYSTEM	A/C trajectory, performance and status are shared between a/c and ground via the conformance monitoring tool; glide path monitor. On-board system may need to be improved in order to ensure safe approach and landing operations in automatic and manual mode. On the visual segment below the minima, additional flight deck aids may be provided to the pilot to achieve correctly the manual flare manoeuvre. However, tailwind conditions may have a negative impact on aircraft deceleration capabilities (impact is under study). Therefore, before performing an SRAP approach, flight crew would also need to check from ATIS reports or in coordination with ATC if the weather condition on the arrival airport allows performing safe SRAP. Pilots need access to accurate information to be able to analyse it differently than today to ensure SRAP flyability. Generally, low visibility is a concern for GBAS SRAP.
2.3 HUMAN – MACHINE INTERFACE	The ATCO has the indication that the aircraft flies a SRAP approach on the human machine interface. The tower controller has additionally also an indication of the location of the SRAP on his working position. There are additional options of flexibly highlighting the runway aiming point the landing aircraft is aiming at.
3. TEAMS & COMMUNICATION	
3.1 TEAM COMPOSITION	No change
3.2 ALLOCATION OF TASKS	No change
3.3 COMMUNICATION	Aircraft that are approaching an aerodrome are informed about the SRAP in use, in addition to the standard final approach instrument procedure, through the automatic terminal information service (ATIS and NOTAM). The introduction of the SRAP functions could imply (e.g. in case of rejection, more information etc.) additional communications between flight crew and controllers.
4. HP RELATED TRANSITION FACTORS	
4.1 ACCEPTANCE & JOB SATISFACTION	No changes foreseen but assessed
4.2 COMPETENCE REQUIREMENTS	An understanding of aircraft behaviour when following SRAP is needed and take this into account when setting up sequence and spacing. The controllers also need

	to understand the technology the enablers for SRAP (GBAS; RNAV/ SBAS) is built on and how that differs from for example ILS system.
4.3 STAFFING REQUIREMENTS & STAFFING LEVELS	No changes
4.4. RECRUITMENT AND SELECTION	No changes
4.5. TRAINING NEEDS	The ATCO training shall include training of the ORD tool (if in use) and the related changes in operating methods, procedures and the technology that enables SRAP.

Table 4: Description of the change

4.2 Step 2 Understand the HP implications

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

Given that the development of the current HPAP was done at an early stage when the OSD was not yet finalised, some of the HP issues might be updated or new ones might be integrated in the next iteration of the VALP.

Arg.	Issue ID	HP issue / Benefit	HP/Valid. Obj. ID	HP validation objective	Recommended activity/ies
Arg.1.2.1	HPI Arg 1.2.1_SRAP02	SRAP procedures are not accepted by pilots	SRAP -HP- OBJ 02	Assess acceptability of SRAP procedures by pilots	Workshop Flight Sim
Arg.1.2.2	HPI Arg 1.2.2_SRAP01	The procedures for abnormal situations are not acceptable.	SRAP -HP- OBJ 03	Define and assess procedures for consecutive go-arounds	Workshop RTS
			SRAP -HP- OBJ 04	Define and assess procedures for sequence break out.	RTS
	HPI Arg 1.2.2_SRAP02	The transition procedures from normal to abnormal conditions are not acceptable.	SRAP -HP- OBJ 05	Clear procedures for the transition from for non-nominal modes of operations shall be defined (e.g. until which phase of flight can the transition mode take place?) and assessed	Workshop RTS
	HPI Arg 1.2.2_SRAP03	The pilot intends to fly to the second threshold but due to abnormal situation (heavy rain) he does not see the second threshold once passes	SRAP -HP- OBJ 06	Assess the air crew procedures for abnormal situations	Flight Sim
Arg.1.2.3	HPI Arg 1.2.3_SRAP01	Transition procedures for degraded modes are not acceptable	SRAP -HP- OBJ 07a	Assess procedures in case of tool loss (revert to conventional procedures)	Workshop

					RTS
	HPI Arg 1.2.3_SRAP02	Following a failure of the sequencing and separation tool, the ATCO fails to accurately and efficiently perform the tasks	SRAP -HP- OBJ 07b	Asses ATCOs ability to revert to conventional procedures as a result of a tool failure	Workshop RTS
Arg.1.3.1	HPI Arg 1.3.1_SRAP01a	The ATCO does not detect that the aircraft intercepts the wrong glide slope	SRAP -HP- OBJ 08a	ATCO tool in place to mitigate this issue; Assess the usability of the tool.	Workshop RTS
	HPI Arg 1.3.1_SRAP01b	The ATCO does not detect in due time that one of the a/c in the sequence is performing a go-around.	SRAP -HP- OBJ 08b	ATCO tool (alert) to mitigate this issues. Assess the timeliness of the detection from the ATCOs (for both cases in which the go-around is identified by the ATCOs first and the cases in which the go-around is only acknowledged upon FC information).	Workshop RTS
	HPI Arg 1.3.1_SRAP02	The pilot confuses the thresholds in the switching scenario	SRAP -HP- OBJ 09	Assess landing visual aid references in flight simulator in the switching scenario, (at the time of the landing clearance the “correct” runway has to be illuminated and switching should be finished latest at around 1000ft. This is the “gate” at which also in the flight deck everything must be stable (aircraft fully configured, at the correct approach speed and approach path and with stable thrust settings)) Need for an adapted external visual aid: It is recommended to provide to the crew an adapted external visual aid (VASI/PAPI)	Flight Sim

				for IGS approach operations in order to avoid pilot's confusion	
	HPI Arg 1.3.1_SRAP03	Flight crew is not supported by appropriate landing visual aid references for their flown approach procedure (e.g. specific PAPIs) , down to CAT I minima resulting in a unstable approach	SRAP -HP- OBJ 10a	Assess the acceptability of the landing visual aid references in flight simulator	Flight Sim
	HPI Arg 1.3.1_SRAP04	Flight Crew is disoriented by (virtual or physical?) the several available runway markers and lighting indicators and lands on a RAP different from the one cleared for.	SRAP -HP- OBJ 11	Assess usability and efficiency of runway markers and lighting indicators.	Flight Sim
Arg.1.3.2	HPI Arg 1.3.2_SRAP01	When the a/c on the lower glide is going on missed approach / instructed to Go-around, the ATCO (APP or TWR) does not success to compare the actual separation to the standard separation.	SRAP -HP- OBJ 12	Assess the feasibility of procedure (ATCO to crosscheck information in high workload conditions).	RTS
Arg.1.3.3	HPI Arg 1.3.3_SRAP01	In case of multiple go-arounds the ATCOs workload increases to unacceptable levels (once detected the 1 st go-around, check if follower is on the higher slope or not, check against standard minima & coordinate TWR/APP).	SRAP -HP- OBJ 13	Assess ATCO workload in non-nominal situations	RTS
	HPI Arg 1.3.3_SRAP03	The ATCOs fail to instruct the second a/c flying a SRAP to execute a missed approach (instruction "turn left/right	SRAP -HP- OBJ 14	Assess ATCO workload in non-nominal situations	RTS

		immediately”) or to ensure that the follower is maintained above the lead traffic (taking into account sufficient climb performance), when a lead a/c is executing a missed approach.			
Arg.1.3.5	HPI Arg 1.3.5_SRAP01	The ATCO perception of the aircraft position in relation to the SRAP is ambiguous	SRAP -HP- OBJ 15	Assess acceptability of SRAP by the ATCO (out of the window view- display of SRAP in the system)	RTS
	HPI Arg 1.3.5_SRAP02	The ATCO cannot easily identify the SRAP through the out of the window view.	SRAP -HP- OBJ 16	Assess the SRAP procedure from a realistic tower position	RTS
	HPI Arg 1.3.5_SRAP03	Due to the more complex procedures and a higher traffic sample, the ATCOs might have a reduced level of SA and in case of degraded mode of operation they would not be aware of all the details of the traffic	SRAP -HP- OBJ 17	Assess the situational awareness of ATCOs in degraded conditions and abnormal situations.	RTS
	HPI Arg 1.3.5_SRAP04	In case of multiple go-arounds the ATCOs situational awareness is decreased and has a potential safety impact.	SRAP -HP- OBJ 18	Assess ATCO situational awareness in non-nominal situations	RTS
Arg.2.1.2	HPI Arg 2.1.2_SRAP01	The ATCO becomes over-reliant on the ORD tool and fails to revert easily to working without the tool (degraded mode).	SRAP -HP- OBJ 19	Assess how the changed in the allocation of task between the human and the machine impact human performance.	Workshop RTS
Arg.2.3.4	HPI Arg 2.3.4_SRAP01	The glide alert improves the monitoring and the implementation of SRAP	SRAP -HP- OBJ 20	Assess usability of the HMI (glide alert)	Workshop RTS

Arg.2.3.6	HPI 2.3.6_SRAP01	Arg	The usability of the glide alert is poor, not intuitive nor easy to use/interpret and reduces situation awareness	SRAP -HP- OBJ 21	Assess usability and acceptability of the glide alert	Workshop RTS
Arg.3.3.1	HPI 3.3.1_SRAP01	Arg	Phraseology needs to be revised for both normal and abnormal operating conditions	SRAP -HP- OBJ 22	Assess phraseology needs for abnormal conditions	Workshop RTS Flight Sim
Arg.3.3.4	HPI 3.3.4_SRAP01	Arg	Multiple go-arounds management requires additional coordination between APP and TWR (especially in the case in which the lead a/c is in contact with the TWR and the follower in contact with APP (ITM).	SRAP -HP- OBJ 23	Assess communication load	Workshop RTS
	HPI 3.3.1_SRAP02	Arg	The potential case of multiple go-arounds require additional coordination between the ATCOs and FC, which might have a negative impact on workload.	SRAP -HP- OBJ 24	Assess communication load and its impact on the workload of the ATCOs and FC.	RTS
Arg.4.1.1	HPI 4.1.1_SRAP01	Arg	The new abnormal procedures could have an impact on acceptability for both ATCOs and pilots.	SRAP -HP- OBJ 25	Assess acceptability of procedures	Workshop RTS
Arg.4.5.1	HPI 4.5.1_SRAP01	Arg	ATCOs and pilots are not sufficiently familiar with the novel SRAP operations and associated changes (e.g. runway marking and lighting, glide alerts, abnormal conditions).	SRAP -HP- OBJ 26	Assess training needs	Workshop RTS

Table 5: HP Arguments, related HP issues and benefits, and proposed HP activity

4.3 Step 3 Improve and validate the concept

4.3.1 Description of HP activities conducted

Activity 1. Workshop	
Description	The workshop was planned to cover the non-nominal situations that were not covered sufficiently in Wave 1 (e.g. coping with sudden loss of the ATC ORD separation tool, consecutive go-arounds and wrong glide alert interception) as well as the marking proposals for SRAP.
Arguments & related issues addressed	HPI Arg 1.2.1_SRAP02 HPI Arg 1.2.2_SRAP01 HPI Arg 1.2.2_SRAP02 HPI Arg 1.2.3_SRAP01 HPI Arg 1.2.3_SRAP02 HPI Arg 1.3.1_SRAP01a HPI Arg 1.3.1_SRAP01b HPI Arg 2.1.2_SRAP01 HPI Arg 2.3.4_SRAP01 HPI Arg 2.3.6_SRAP01 HPI Arg 3.3.1_SRAP01 HPI Arg 3.3.4_SRAP01 HPI Arg 4.1.1_SRAP01 HPI Arg 4.5.1_SRAP01
HP objectives	- Define and assess procedures for consecutive go-arounds - Clear procedures for the transition from for non-nominal modes of operations to be discussed - Discuss procedures in case of tool loss (revert to conventional procedures) - Discuss the usability of the ATCO tool. (ATCO tool to indicate wrong glide slope interception in place to mitigate this issue)
Tools / Methods selected out of the HP repository	User workshop
Summary of the HP activity	This activity was not conducted as planned in Wave 2 due to time and effort resource limitations.

Table 6: Description of Activity 1 – Workshop

ACTIVITY 2.	Real Time Simulation
Description	A Real Time Simulation (RTS) was used to validate complex airspace organisations, new tools or concepts in a realistic simulated Air Traffic Management environment. The simulator replayed real traffic data and the ATCO worked as they would in real life. The RTS covered only non-nominal situations and the evaluation of ATCO acceptability of the new glide alert and how it should be managed.
Arguments & related issues addressed	HPI Arg 1.2.2_SRAP01 HPI Arg 1.2.2_SRAP01 HPI Arg 1.2.2_SRAP02 HPI Arg 1.2.3_SRAP01 HPI Arg 1.2.3_SRAP02 HPI Arg 1.3.1_SRAP01a HPI Arg 1.3.1_SRAP01b HPI Arg 1.3.2_SRAP01 HPI Arg 1.3.3_SRAP01 HPI Arg 1.3.3_SRAP03 HPI Arg 1.3.5_SRAP01 HPI Arg 1.3.5_SRAP02 HPI Arg 1.3.5_SRAP03 HPI Arg 1.3.5_SRAP04 HPI Arg 2.1.2_SRAP01 HPI Arg 2.3.4_SRAP01 HPI Arg 2.3.6_SRAP01 HPI Arg 3.3.1_SRAP01 HPI Arg 3.3.4_SRAP01 HPI Arg 3.3.1_SRAP02 HPI Arg 4.1.1_SRAP01 HPI Arg 4.5.1_SRAP01
HP objectives	• Assess acceptability of SRAP by ATCOs • Define and assess procedures for consecutive go-arounds • Define and assess procedures for sequence break out. • Clear procedures for the transition from for non-nominal modes of operations shall be defined (e.g. until which phase of flight can the transition mode take place?) and assessed • Assess procedures in case of tool loss (revert to conventional procedures) • Assess the usability of the ATCO tool. (ATCO tool to indicate wrong glide slope interception in place to mitigate this issue) • Assess acceptability of SRAP by the ATCO (out of the window view- display of SRAP in the system) • Assess the SRAP procedure from a realistic tower position • Assess the situational awareness of ATCOs in degraded conditions and abnormal situations.
Tools/Methods selected out of the HP repository	SATI Bedford scale China Lakes SASHA

	NASA TLX Etc.
Summary of the HP activity	The aim of this exercise was to assess: - the impact on controllers of go around/missed approach; - the impact on controllers of a glide alert when an aircraft does not intercept the glide it is cleared to; - the impact on controllers of the loss of the separation assistance tool.

Table 7: Description of Activity 2 – RTS

ACTIVITY 3. Flight simulations	
Description	The flight simulations were used to validate concept elements that relate to the airside. Specifically the runway lighting system, runway marking and the visual aid system were assessed under different visibility and weather conditions.
Arguments & related issues addressed	HPI Arg 1.2.1_SRAP02 HPI Arg 1.2.2_SRAP03 HPI Arg 1.3.1_SRAP02 HPI Arg 1.3.1_SRAP03 HPI Arg 1.3.1_SRAP04 HPI Arg 3.3.1_SRAP01
HP objectives	- Assess acceptability of SRAP procedures by pilots - Assess landing visual aid references in flight simulator in the steady and switching scenarios, (at the time of the landing clearance the “correct” runway has to be illuminated and switching should be finished latest at around 1000ft. This is the “gate” at which also in the flight deck everything must be stable (aircraft fully configured, at the correct approach speed and approach path and with stable thrust settings)) Need for an adapted external visual aid: It is recommended to provide to the crew an adapted external visual aid (VASI/PAPI) for SRAP approach operations in order to avoid pilot’s confusion - Assess the acceptability of the landing visual aid references in flight simulator. Assess transition procedures from the flight crew perspective
Tools/Methods selected out of the HP repository	No specific tool, open question questionnaires shall be used
Summary of the HP activity	EXE-14.2-V3-VALP-R10 - Runway lighting Further assessment of the proposed solutions for runway lighting. The aim of this simulation was to assess operational acceptability of SRAP from pilots’ point of view. A series of cockpit simulations using a high-level professional Level D/Type 7 flight crew training simulator was conducted. The purpose was to collect pilots’ feedback on the additional threshold operation (acceptability, workload, operational procedures), on how

this threshold is shown on the runway and about the corresponding lighting. Different visibility conditions were simulated and the aircraft following the enhanced procedure were mixed with aircraft following ILS to normal threshold. Both steady and switching solutions were evaluated.

EXE-14.2-V3-VALP-R15 - Runway marking

Assessment of different solutions of runway marking for SRAP threshold.

The aim of the simulation was to assess operational acceptability of SRAP from pilot's point of view. A series of cockpit simulations using a high-level professional Level D/Type 7 flight crew training simulator were conducted. The purpose was to collect pilot feedback on the different proposed marking solutions for the second threshold (acceptability, workload, operational procedures). Different visibility conditions were simulated.

EXE-14.2-V3-VALP-R25 - Runway lighting

The main goal of the simulation was to further assess the steady proposed solution for runway lighting.

In addition, the aim of the simulation was to assess operational acceptability of SRAP from pilot's point of view. A series of cockpit simulations using a high-level professional Level D/Type 7 flight crew training simulator were conducted. The purpose was to collect pilot feedback on the additional threshold operation with static lighting (acceptability, workload, operational procedures).

Different visibility conditions were simulated and the aircraft following the enhanced procedure were mixed with aircraft following ILS to normal threshold.

The pilots participating in this exercise had not participated in R10 nor to any flight simulation on SRAP lighting in PJ.02-W1.

Table 8: Description of Activity 3 – Flight simulation

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

4.4.1 Summary of HP activities results & recommendations / requirements

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

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

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

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

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

Issue ID	HP issue / Benefit	HP Issue/ Benefit Status	HP/ Valid. Obj. ID	Activity conducted	Results / evidence	Recommendations	Requirements
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Arg. 1.2.1: Operating methods (procedures) cover operations in normal operating conditions.

HPI Arg 1.2.1_SRAP02	SRAP procedures are not accepted by pilots	Closed	SRAP -HP- OBJ 02	Flight Sim	More than 95% of the pilots indicated that they executed all tasks in line with the SOPs and that they can imagine using the concept of SRAP in an every-day operation.	EAP_HPREC_OPS02 EAP_HPREC_OPS09 SRAP_HPREC_008	EAP_HPREQ_OPS01 SRAP_HPREQ_006 SRAP_HPREQ_009
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Arg. 1.2.2: Operating methods (procedures) cover operations in abnormal operating conditions.

HPI Arg 1.2.2_SRAP01	The procedures for abnormal situations are not acceptable.	Closed	SRAP -HP- OBJ 03 SRAP -HP- OBJ 04	RTS	The participants stated that the defined procedure was feasible, acceptable and can be resolved safely with a tolerable workload and sufficient situational awareness. However, the participants acknowledged that this procedure is an emergency procedure, which is never easy to manage.	EAP_HPREC_OPS02 SRAP_HPREC_006 SRAP_HPREC_007	EAP_HPREQ_OPS01
HPI Arg 1.2.2_SRAP02	The transition procedures from normal to abnormal conditions are not acceptable.	Closed	SRAP -HP- OBJ 05	RTS	The participants stated that the defined procedure was feasible, acceptable and can be resolved safely with a tolerable workload and sufficient situational awareness. However, the participants acknowledged that this procedure is an	EAP_HPREC_OPS02 EAP_HPREC_OPS03 SRAP_HPREC_006 SRAP_HPREC_007	EAP_HPREQ_OPS01

					emergency procedure, which is never easy to manage.		
HPI Arg 1.2.2_SRAP03	The pilot intends to fly to the second threshold but due to abnormal situation (heavy rain) he does not see the second threshold once passes	Closed	SRAP -HP- OBJ 06	Flight Sim	Overall, at least 80% of the pilots during all scenarios stated that the threshold identification was acceptable using “agree” or “strongly agree”. A slightly tendency can be identified for “strongly disagree” statements with respect of the scenarios using the static solution.	EAP_HPREC_OPS09	EAP_HPREQ_DSG05 SRAP_HPREQ_009

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

HPI Arg 1.2.3_SRAP01	Transition procedures for degraded modes are not acceptable	Closed	SRAP -HP- OBJ 07a	RTS	The participants stated that the defined procedure was feasible, acceptable and can be resolved safely with a tolerable workload and sufficient situational awareness. The rules of the separation delivery tool failure procedure were found to be easy enough to remember and apply during SRAP arrival procedures.	EAP_HPREC_OPS02 EAP_HPREC_OPS03 SRAP_HPREC_003 SRAP_HPREC_004 SRAP_HPREC_005	EAP_HPREQ_OPS01 SRAP_HPREQ_001 SRAP_HPREQ_002 SRAP_HPREQ_007 SRAP_HPREQ_011
HPI Arg 1.2.3_SRAP02	Following a failure of the	Closed	SRAP -HP-	RTS	The separation delivery tool failure appears to slightly	SRAP_HPREC_003	

	sequencing and separation tool, the ATCO fails to accurately and efficiently perform the tasks		OBJ 07b		increase the workload of the controllers as expected during a non-nominal situation. Participants also commented that their workload noticeably increased when returning to current operations with contingency separation minima. However, the workload remains tolerable.	SRAP_HPREC_004	SRAP_HPREQ_001 SRAP_HPREQ_002 SRAP_HPREQ_007 SRAP_HPREQ_008
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Arg. 1.3.1: The potential for human error is reduced to a tolerable level

HPI Arg 1.3.1_SRAP01a	The ATCO does not detect that the aircraft intercepts the wrong glide slope	Closed	SRAP-HP-OBJ 08a	RTS	Results from the simulation show that the alert when an aircraft intercepts the wrong glideslope is acceptable according to the ATCO subjective feedback. This is if the requirement for the alert is met as the conclusion of the simulation that the alert must be reliable and there must not be any false alerts, is met.	SRAP_HPREC_010 SRAP_HPREC_011 SRAP_HPREC_012 SRAP_HPREC_013 SRAP_HPREC_015 SRAP_HPREC_016 SRAP_HPREC_017	SRAP_HPREQ_005 SRAP_HPREQ_009 SRAP_HPREQ_010
HPI Arg 1.3.1_SRAP01b	The ATCO does not detect in due time that one of the a/c in the sequence	Closed	SRAP-HP-OBJ 08b	RTS	As a result of the simulation, a requirement must be developed that the coordinator/assistant must aid the Approach for checking the separations between aircraft	SRAP_HPREC_018	

	is performing a go-around.				and suggesting which aircraft should be sent around. There should also be communication between the sectors about which aircraft have been sent around and a communication to the TWR Runway Control informing them of the final aircraft in the sequence that will be flying on the upper glideslope and performing a SRAP arrival procedure.		
HPI Arg 1.3.1_SRAP02	The pilot confuses the thresholds in the switching scenario	Closed	SRAP-HP-OBJ 09	Flight Sim	Overall, at least 80% of the pilots during all scenarios stated that the threshold identification was acceptable using “agree” or “strongly agree”.	EAP_HPREC_OPS09	EAP_HPREQ_DSG05 SRAP_HPREQ_009
HPI Arg 1.3.1_SRAP03	Flight crew is not supported by appropriate landing visual aid references for their flown approach procedure (e.g. specific PAPIs) , down to CAT I minima resulting in an	Closed	SRAP-HP-OBJ 10a	Flight Sim	Based on the overall result the PAPI was acceptable – at least 80% of the pilots stated for all scenarios 80% “strongly agree” and “agree”. Only a few pilots stated the PAPI indications were not acceptable. However, no clear tendency was to be identified regarding any wind/visibility	EAP_HPREC_OPS09	EAP_HPREQ_OPS01 EAP_HPREQ_DSG05

	unstable approach				scenario or using the first or second threshold.		
HPI Arg 1.3.1_SRAP04	Flight Crew is disoriented by (virtual or physical?) the several available runway markers and lighting indicators and lands on a RAP different from the one cleared for.	Closed	SRAP -HP- OBJ 11	Flight Sim	Most of the pilots stated that the yellow marking was not very visible. There was potential to confuse the yellow marking with taxiway marking or even construction work marking. Pilot briefing on using a different colour than the standard white would be needed to maintain situation awareness and avoid confusion during flare. As such, it would be preferred to retain the current white ICAO markings.	EAP_HPREC_OPS09 EAP_HPREC_OPS11	EAP_HPREQ_DSG05 SRAP_HPREQ_009

Arg. 1.3.2: Tasks can be achieved in a timely manner.

HPI Arg 1.3.2_SRAP01	When the a/c on the lower glide is going on missed approach / instructed to Go-around, the ATCO (APP or TWR) does not success to	Closed	SRAP -HP- OBJ 12	RTS	In terms of appreciating the distance separation behind the leader, which performs the go-around/missed approach in the simulation, the TWR Runway Control could make use of the distance markers presented on the Tower Runway Control HMI, which made it easy for them	SRAP_HPREC_019	SRAP_HPREQ_002 SRAP_HPREQ_003 SRAP_HPREQ_008
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	compare the actual separation to the standard separation.				to measure the distance behind the leader.		
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Arg. 1.3.3: The level of workload (induced by cognitive and/or physical task demands) is acceptable.

HPI Arg 1.3.3_SRAP01	In case of multiple go-arounds the ATCOs workload increases to unacceptable levels (once detected the 1st go-around, check if follower is on the higher slope or not, check against standard minima & coordinate TWR/APP).	Closed	SRAP -HP- OBJ 13	RTS	Results from the simulation show that controller workload is tolerable for SRAP arrival procedures during non-nominal situations according to subjective feedback and sector performance metrics.	SRAP_HPREC_019	
HPI Arg 1.3.3_SRAP03	The ATCOs fail to instruct the second a/c flying a SRAP to execute a missed	Closed	SRAP -HP- OBJ 14	RTS	Two double go-arounds (ILS-SRAP pairs) were observed in all the SRAP runs where 19 ILS approach go-arounds occurred (30 go-arounds in total). Out of those two, only one led to a		

	approach (instruction “turn left/right immediately”) or to ensure that the follower is maintained above the lead traffic (taking into account sufficient climb performance), when a lead a/c is executing a missed approach.				loss of wake separation (separation below conservative minima) with a maximum of 0.25 NM under-separation. Overall, it seems that these reaction times were enough not to create large under-separations with SRAP procedures. In terms of the controller being able to spot the missed approach of the leading aircraft, the participants expressed that it is easy as per the current procedures, the pilots always tell the controller when a missed approach is taking place.		
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Arg. 1.3.5: Human actors can maintain a sufficient level of situation awareness.

HPI Arg 1.3.5_SRAP01	The ATCO perception of the aircraft position in relation to the SRAP is ambiguous	Closed	SRAP -HP- OBJ 15	RTS	No need has been identified for the ATCO to determine the aircraft position in relation to the SRAP, as this will be provided by the tool support as mitigation.	SRAP_HPREC_008 SRAP_HPREC_009 SRAP_HPREC_014	SRAP_HPREQ_011
HPI Arg 1.3.5_SRAP02	The ATCO cannot easily identify the SRAP through	Closed	SRAP -HP-	RTS	No need has been identified for the ATCO to identify the SRAP via the window, as this		

	the out of the window view.		OBJ 16		will be provided by the tool support as mitigation.		
HPI Arg 1.3.5_SRAP03	Due to the more complex procedures and a higher traffic sample, the ATCOs might have a reduced level of SA and in case of degraded mode of operation they would not be aware of all the details of the traffic	Closed	SRAP -HP- OBJ 17	RTS	Results from the simulation show that controller situational awareness is acceptable for SRAP arrival procedures during non-nominal situations according to subjective feedback.	SRAP_HPREC_014	
HPI Arg 1.3.5_SRAP04	In case of multiple go-arounds the ATCOs situational awareness is decreased and has a potential safety impact.	Closed	SRAP -HP- OBJ 18	RTS	The participants found the go-around/missed approach procedure to be feasible, acceptable and able to be resolved safely whilst maintaining a tolerable workload and sufficient situational awareness.		

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

HPI Arg 2.1.2_SRAP01	The ATCO becomes over-	Open	SRAP -HP-	RTS	The participants stated during debriefs that when the	SRAP_HPREC_003	SRAP_HPREQ_001
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	reliant on the ORD tool and fails to revert easily to working without the tool (degraded mode).		OBJ 19		separation delivery tool fails there is a sudden increase in workload. It is necessary that the Approach control is aided by an assistant in the event of the separation delivery tool failure, otherwise the workload is too high and situational awareness is very low when the ATCO works alone. The Approach participant relied on the assistant completely and the procedure would not have been manageable alone.	SRAP_HPREC_004 SRAP_HPREC_005	SRAP_HPREQ_007 SRAP_HPREQ_008 SRAP_HPREQ_011
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Arg. 2.3.4: Alarms and alerts have been developed according to HF principles.

HPI Arg 2.3.4_SRAP01	The glide alert improves the monitoring and the implementation of SRAP	Closed	SRAP -HP- OBJ 20	RTS	Results from the simulation show that the alert when an aircraft intercepts the wrong glideslope is useful/acceptable according to the ATCO subjective feedback. Results from the simulation show that the alert when an aircraft intercepts the wrong glideslope supports SRAP arrival procedures during non-nominal situations according	SRAP_HPREC_012 SRAP_HPREC_013 SRAP_HPREC_015 SRAP_HPREC_016 SRAP_HPREC_017	SRAP_HPREQ_006
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					to the participants' subjective feedback.		
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Arg. 2.3.6: The usability of the user interface (input devices, visual displays/output devices, alarm& alerts) is acceptable.

HPI Arg 2.3.6_SRAP01	The usability of the glide alert is poor, not intuitive nor easy to use/interpret and reduces situation awareness	Closed	SRAP-HP-OBJ 21	RTS	During the simulation, many "false" alerts appeared on the HMI, which increased the task load, workload and communication load of the participants. Hence, a participant disagreed with the statements that the alert was reliable and worked accurately. This will not be acceptable during real operations as it increases the workload and communication load of the ATCO. A requirement has been introduced, stating that the wrong glideslope alert must be reliable and there must not be any false alerts.	SRAP_HPREC_012 SRAP_HPREC_013 SRAP_HPREC_015 SRAP_HPREC_016 SRAP_HPREC_017	SRAP_HPREQ_004
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Arg. 3.3.1: Intra-team and inter-team communication supports the information requirements of team members.

HPI Arg 3.3.1_SRAP01	Phraseology needs to be revised for both normal and abnormal	Closed	SRAP-HP-OBJ 22	RTS Flight Sim	In case of glide alert, regarding phraseology, it has been confirmed that ATCO shall always ask the pilot to confirm the type of approach and the landing runway as it is		SRAP_HPREQ_009 SRAP_HPREQ_010
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	operating conditions.				important that the ATCOs are aware of the situation and the pilots are aware of the reason for possible go-arounds.		
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Arg. 3.3.4: The communication load of team members is acceptable in normal and abnormal conditions and degraded mode of operations.

HPI Arg 3.3.4_SRAP01	Multiple go-arounds management requires additional coordination between APP and TWR (especially in the case in which the lead a/c is in contact with the TWR and the follower in contact with APP (ITM)).	Closed	SRAP-HP-OBJ 23	RTS	During the separation delivery tool failure, the workload for the Approach sector is too high. The Approach ATCO will require an assistant to help them with the procedures such as checking the separation between pairs and identifying which aircraft must be sent to go-around.	SRAP_HPREC_001	SRAP_HPREQ_002 SRAP_HPREQ_003 SRAP_HPREQ_007 SRAP_HPREQ_008
HPI Arg 3.3.4_SRAP02	The potential case of multiple go-arounds require additional coordination between the ATCOs and FC, which might	Closed	SRAP-HP-OBJ 24	RTS	In terms of the controller being able to spot the missed approach of the leading aircraft, the participants expressed that it is easy as per the current procedures, the pilots always tell the controller	EAP_HPREC_OPS09 SRAP_HPREC_002	SRAP_HPREQ_009

	have a negative impact on workload.				when a missed approach is taking place. Nevertheless, a requirement is needed to emphasise and reinforce that the pilot shall communicate to the controller about a missed approach as soon as practicable when applying SRAP.		
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Arg. 4.1.1: Changes in roles and responsibilities are acceptable to the affected human actors.

HPI Arg 4.1.1_SRAP01	The new abnormal procedures could have an impact on acceptability for both ATCOs and pilots.	Closed	SRAP -HP- OBJ 25	RTS	The participants stated that the defined procedure was feasible, acceptable and can be resolved safely with a tolerable workload and sufficient situational awareness.	EAP_HPREC_OPS09	EAP_HPREQ_OPS01
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Arg. 4.5.1: The content of training for each actor group is specified.

HPI Arg 4.5.1_SRAP01	ATCOs and pilots are not sufficiently familiar with the novel SRAP operations and associated changes (e.g. runway marking and	Open	SRAP -HP- OBJ 26	RTS	The participants also stated that they occasionally mistook between the speed indicator and the wake category on the aircraft's electronic label; this was due to lack of training and unfamiliarity when working with electronic labels as the participants are working with paper strips.	EAP_HPREC_OPS09 EAP_HPREC_OPS11 SRAP_HPREC_005 SRAP_HPREC_006 SRAP_HPREC_007	
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	lighting, glide alerts, abnormal conditions).						
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Table 9: Summary of the HP results and recommendations/ requirements for each identified issue & related argument

4.4.2 Maturity of the Solution

Maturity checklist for finalising the V3 assessment			
ID	Question	Answer	Comments
1	Has a Human Performance Assessment Report been completed? Have all relevant arguments been addressed and appropriately supported?	Yes	The consolidated list of identified arguments, issues, requirements and recommendations can be found in Table 9.
2	Are the benefits and issues in terms of human performance and operability related to the proposed solution sufficiently assessed (i.e. on the level required for V3)?	Yes	The consolidated list of identified arguments, issues, requirements and recommendations can be found in Table 9.
3	Have all the parts of the solution/concept been considered?	Yes	All OI steps described in the final OSD have been addressed in several validation exercises and considered in the HP assessment.
4	Have potential interactions with related projects/concepts been considered and addressed?	Yes	The interaction other PJ.02-W2-14 solutions have been considered.
5	Is the level of human performance needed to achieve the desired system performance for the proposed solution consistent with human capabilities?	Yes	The results can be found in Table 9 of the HP assessment report.
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	Yes the HP issues are addressed and recommendations and requirements are formulated to reach anticipated targets. (Appendix B and Appendix C).
7	Has the proposed solution been tested with end-users and under sufficiently realistic conditions, including abnormal and degraded conditions?	Yes	Different simulation exercises were conducted under both abnormal and degraded conditions for ATC. Normal conditions were validated in Wave 1. Flight Deck simulations have been conducted for the airborne side.
8	Do validation results confirm that the interactions between human and technology are operationally feasible, and consistent with agreed human performance requirements?	Yes	The results can be found in Table 9 of the HP assessment report.
9	Have all relevant SESAR documentation been updated according to the HP activities outcomes (OSD, SPR)?	Yes	The HP requirements are crosschecked with safety and OSD.
10	Do the outcomes satisfy the HP issues/benefits in order to reach the expected KPA?	Yes	The outcome of the HP activities can be found in Appendix B and Appendix C (Recommendations and Requirements).

11	Have HP recommendations and HP requirements correctly been considered in HMI design, procedures/documentation and training?	Yes	The requirements and recommendations are listed in Appendix B and Appendix C of the HP assessment report.
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	Training Requirements have been formulated and are listed in Appendix C (Requirements).
13	Have any impacts been identified that may require changes to regulation in the area of HP/ATM? This includes changes in roles & responsibilities, competence requirements, or the task allocation between human & machine.	N/A	No regulatory impact is expected to be introduced through the SRAP solution.
14	Has the next V-phase sufficiently been prepared (additional testing conditions, open HP issues to be addressed)?	N/A	The HP assessment has proven that the solution has, from the HP point of view, reached the end of V3 ready to go into the next V phase. Most relevant issues are closed.

Table 10: V3 HP Maturity checklist

5 References

Human Performance

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

Reference Documents

- [2] PJ.02-W2-14.2 OSED V3 – Part I_D4.2.002, 00.01.01
- [3] PJ.02-W2-14.2 VALR V3 – D4.2.006, 00.01.00
- [4] 16.06 Strawman Paper on Case Building in SESAR SWP 16.6
- [5] 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
- [6] 06.09.03 D05.1 Single Remote Tower Validation Plan – Appendix Human Performance Assessment Plan
- [7] 16.06.05 D 27 HP Reference Material D27
- [8] 16.04.02 D04 e-HP Repository - Release note
- [9] SESAR Solution PJ.02-01: Validation Plan (VALP) for V3 – Part IV – Human Performance Assessment Plan
- [10] SESAR Solution PJ.02-01: SPR-INTEROP/OSED for V3 – Part IV – Human Performance Assessment Report

Appendix A – Additional HP activities conducted

No additional HP activities were required to support the V3 HP assessment. All identified HP issues/benefits were assessed via the ATCO and Pilot RTS exercises, as described in the VALR [3].

Appendix B – HP Recommendations Register

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

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

HP Recommendations Register						
Reference	Type of recommendation	Recommendation	Rationale	Assessment source + Reference report	Recommendation status	Rationale in case of rejection
EAP_HPREC_OPS01	OPS (operating methods / procedures)	In case of high traffic a “sequencer role” is recommended (It is already implemented in certain environments)	No potential impact on the existing roles and responsibilities and task sharing within the team involving ATCOs and pilots has been identified. A sequencer role might be required for traffic optimisation purposes.	Validation Report of EXE-02.02-V3-VALP-R02 Workshop	Accepted	
EAP_HPREC_OPS02	OPS (operating methods / procedures)	A set of working methods / guidelines to cover the SRAP procedure/concept and associated tools should be locally defined.	The validation activities did not include scenarios in which the SRAP procedure was instructed without a support tool under high traffic densities. However, the results of the validation activities conducted showed that under high traffic densities, the ATCOs considered it as impossible to work without a support tool (i.e. ORD tool).	Validation report of EXE-02.02-V3-VALP-R02 Workshop	Accepted	
EAP_HPREC_VAL01	Validation activities	Future validation exercises should include more non-nominal and	Due to the more complex procedure and a higher traffic sample, the ATCOs agreed they did	Validation report of	Accepted	

		degraded modes of operations, in addition to nominal cases.	not have the same level of SA as in normal operations and that in case of a degraded mode of operations they would not be aware of all the details of the traffic	EXE-02.02-V3-VALP-R02		
EAP_HPREC_OPS03	OPS (operating methods / procedures)	Transitions should not be instructed on the base leg.	The results of the flight deck simulation revealed that transition instructions given on the base leg, could negatively increase workload on the flight crew side.		Rejected	Not accepted in Wave 1
EAP_HPREC_OPS04	OPS (operating methods / procedures)	A test case with new perimeter taxiway should be tested, without departures in the simulation	Normal ILS operating conditions have been considered acceptable under certain conditions. Concerns were mentioned that SRAP might only be acceptable under single runway operations.	Validation report of EXE-02.02-V3-VALP-R02	Rejected	Not accepted in Wave 1
EAP_HPREC_OPS05	OPS (operating methods / procedures)	The Approach should be supported by a Separation Delivery and Monitoring function providing indications about applicable separation minima between arrival aircraft pairs onto final approach segment, taking into account the expected and cleared approach procedures (48 OSD)	The results of the validation activities conducted showed that under high traffic densities, the ATCOs considered it as impossible to work without a support tool (i.e. ORD tool).	Validation report of EXE-02.02-V3-VALP-R02	Accepted	
EAP_HPREC_DSG01	DSG (System design)	A support tool or a sequencer role should support the ATCO in finding the optimal sequence.	The ATCOs requested an additional support tool or a refinement of the ORD tool, that would help them to optimise the sequence. In high density traffic, the workload of the INI position would not allow the evaluation of the most "optimal" pairs, at all times.	Validation report of EXE-02.02-V3-VALP-R02	Accepted	

EAP_HPREC_OPS06	OPS (operating methods / procedures)	For SRAP operations, the Approach Controllers should be supported by a Separation Delivery function providing indications about optimum spacing to applied for achieving the minima separation at the separation delivery point (49 OSD)	The results of the validation activities conducted showed that under high traffic densities, the ATCOs considered it as impossible to work without a support tool (i.e. ORD tool).	Validation report of EXE-02.02-V3-VALP-R02	Accepted	
EAP_HPREC_OPS07	OPS (operating methods / procedures)	For SRAP operations, the Tower Controllers should be supported by a Separation Delivery and Monitoring function providing indications about applicable separation minima between arrival aircraft pairs onto final approach segment, taking into account the expected and cleared approach procedures (50 OSD)	The results of the validation activities conducted showed that under high traffic densities, the ATCOs considered it as impossible to work without a support tool (i.e. ORD tool).	Validation report of EXE-02.02-V3-VALP-R02	Accepted	
EAP_HPREC_OPS09	OPS (operating methods / procedures)	Pilots should be involved in information campaigns before local deployments, in order to gain the trust and the acceptability of the SRAP associated procedure.	Self-explanatory		Accepted	
EAP_HPREC_DSG02	Design	If colour coding is used for the flight list to differentiate the different approaches the same colour should be reflected in the aircraft label	In order to ensure that ATCOs were able to quickly connect the information displayed.	Validation report of EXE-02.02-V3-VALP-R02 EXE-02.02-V3-VALP-R03	Accepted	
EAP_HPREC_DSG03	DSG (System design)	The ATCOs should be able to tailor HMI features according to personal preference.	The HMI display can enhance usability and even SA, depending on the ATCOs' preferences.	Validation report of EXE-02.02-V3-VALP-R01 EXE-02.02-V3-VALP-R02	Accepted	

EAP_HPREC_DSG04	Design	With regards to alerts on the tower position it was suggested that in case there is an infringement of the FTD in the last miles there should be a warning on the tower HMI	To ensure an appropriate reaction/situation awareness for Approach Executive Control.	Validation report of EXE-02.02-V3-VALP-R02	Accepted	
EAP_HPREC_TRN01	TRN (training)	Local training plans should be feasible in order for all ATCOS to be trained to the required standard before SRAP is used in operations	Training requirements have to be extensively covered in local implementation programs.	Validation report of EXE-02.02-V3-VALP-R02 Workshop Flight deck simulation	Accepted	
EAP_HPREC_OPS11	Operational	In the switching scenario, at the time of the landing clearance the “correct” runway has to be illuminated and switching should be finished latest at around 1000ft. This is the “gate” at which also in the flight deck everything must be stable (aircraft fully configured, at the correct approach speed and approach path and with stable thrust settings)	The pilots did not unanimously conclude on one preferred lighting configuration. However it was concluded in order to avoid confusion and a negative impact on safety that the “correct runway “ has to be indicated latest at around 1000ft.	Validation report of EXE-02.02-V3-VALP-R05	Rejected	Not accepted in Wave 1
EAP_HPREC_OPS12	Operational	On the flight deck, special focus has to be put on the briefing: Briefing has to include the expected lighting configuration Special briefing is needed in case of 3.5 °approach.	The pilot has to be aware and fully assured which runway he is aiming at. The switching configuring might otherwise mislead him/ her.	Validation report of EXE-02.02-V3-VALP-R05	C Accepted	
SRAP_HPREC_001	OPS (operating methods / procedures)	In the case of separation tool failure, there should be communication between the sectors about which aircraft have been sent around and a communication to the Tower Runway	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	

		Control informing them of the final aircraft in the sequence that will be flying on the upper glideslope and performing a SRAP arrival procedure.				
SRAP_HP C_002	Validation activities	There should also be further investigation into the amount of time that it takes a pilot to communicate a missed approach to the ATCO.	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HP C_003	OPS (operating methods / procedures)	The separation delivery tool failure procedure should remain simple, as it is an emergency procedure with no time for optimisation.	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HP C_004	OPS (operating methods / procedures)	The separation delivery tool failure procedure should be treated as a rare, emergency procedure.	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HP C_005	TRN (training)	The procedure to manage the failure of the separation delivery tool should be included in the regular non-nominal/emergency training.	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HP C_006	TRN (training)	The procedure to manage an alert caused by an aircraft intercepting the wrong glideslope should be regularly briefed and included in the refresher training.	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HP C_007	TRN (training)	The procedure to manage a go-around or missed approach should be regularly briefed and included in the refresher training.	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HP C_008	Validation activities	The procedure should be further investigated locally to see whether it could be acceptable to have Heavy aircraft flying the SRAP procedure.	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	

SRAP_HP C_009	Validation activities	The need for additional information for ATCOs to visualise the vertical position of the aircraft on the glide, such as Vertical Speed information or Approach Path Monitoring, should be further investigated locally.	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HP C_010	Validation activities	The interception points for the two glideslopes on the HMI should be locally considered to ensure that they are clear and distinguishable.	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HP C_011	OPS (operating methods / procedures)	The ATCO should know if an aircraft has changed its landing runway (27L or 28L).	The approach controller shall evaluate the need for such a coordination on a case by case basis.	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HP C_012	OPS (operating methods / procedures)	The approach sectors should notify the tower of any flight that triggered a glide alert.	In order to have full awareness of the situation, to plan and monitor the situation more carefully.	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HP C_013	OPS (operating methods / procedures)	The approach sectors should inform the tower if an aircraft is flying a different procedure from the expected glide slope, especially during SRAP arrival procedures.	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HP C_014	Validation activities	It should be further investigated locally if a vertical profile-plotting tool is necessary for the Tower and Approach controllers.	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HP C_015	Validation activities	For the wrong glideslope alert, the rule where heavy aircraft should be assessed and improved in terms of whether they should be able to intercept the upper glideslope for SRAP	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	

		operations such that the rule is less penalising.				
SRAP_HP C_016	OPS (operating methods / procedures)	During the wrong glideslope alert, the Approach Executive Control should communicate to the Tower Runway Control whether an aircraft triggered a glide alert before it is transferred to Tower Runway Control.	Self-explanatory	Validation report of EXE-14.2-V3- VALP-R01	Accept ed	
SRAP_HP C_017	Validation activities	ANSPs should locally consider the necessary tools and information required in order to best detect deviations from the glideslopes during deployment phases.	These should help during the non-nominal situations: go-around/missed approach and wrong glideslope alert.	Validation report of EXE-14.2-V3- VALP-R01	Accept ed	
SRAP_HP C_018	DSG (System design)	An alert should be provided when aircraft perform a pilot initiated missed approach for all circumstances.	This is an existing problem.	Validation report of EXE-14.2-V3- VALP-R01	Accept ed	
SRAP_HP C_019	DSG (System design)	Heavy aircraft should be assigned to the lower glide.	Self-explanatory	Validation report of EXE-14.2-V3- VALP-R01	Accept ed	

Table 11: HP recommendations

Appendix C – HP Requirements Register

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

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

HP Requirements Register						
Reference	Type of requirement	Requirement	Rationale	Assessment source + Reference report if available	Requirement status	Rationale in case of rejection
EAP_HPREQ_OPS01	Operational	A set of clearly defined parameters shall be defined in local implementation, with regard to when (e.g. peak hours, duration of peak hours) the ATCOs shall be supported by a Separation Delivery and Monitoring function.	In order to ensure harmonisation upon implementation.	Validation report of EXE-02.02-V3-VALP-R02 Workshop	Accepted	
EAP_HPREQ_OPS04	Operational	Clear procedures for non-nominal modes of operations shall be defined (e.g. until which phase of flight can the transition mode take place?)	In order to ensure clarity and acceptability amongst all actors involved, prior to implementation.	Validation report of EXE-02.02-V3-VALP-R01 EXE-02.02-V3-VALP-R02	Accepted	
EAP_HPREQ_OPS05	Operational	Clear procedures for degraded modes of operations shall be defined (e.g. until which phase of flight can the transition mode take place?)	In order to ensure clarity and acceptability amongst all actors involved, prior to implementation.	Validation report of EXE-02.02-V3-VALP-R02	Accepted	

			Abnormal and degraded modes of operations require further investigation.			
EAP_HPREQ_VAL01	Validation	The SRAP procedure shall be tested in parallel runway conditions	Normal ILS operating conditions have been considered acceptable under certain conditions. Concerns were mentioned that SRAP might only be acceptable under single runway operations.	Validation report of EXE-02.02-V3-VALP-R03	Accepted	
EAP_HPREQ_VAL02	Validation	The IGS-SRAP procedure shall be tested in parallel runway conditions.	Normal ILS operating conditions have been considered acceptable under certain conditions. Concerns were mentioned that SRAP might only be acceptable under single runway operations.	Validation report of EXE-02.02-V3-VALP-R03	Rejected	Not specific to SRAP
EAP_HPREQ_VAL03	Validation	The SRAP procedure shall be further validated with pilots	Further validations required on the flight crew side	Validation report of EXE-02.02-V3-VALP-R03	Rejected	Addressed in Wave 2 validation
EAP_HPREQ_VAL04	Validation	SRAP has to be validated in a more realistic tower environment to be able to assess the perception of the ATCOs and the impact of an aircraft landing mid runway on his performance.	Further validations required	Validation report of EXE-02.02-V3-VALP-R03	Rejected	Mitigated by tool support and validated in Wave 2

EAP_HPREQ_DSG04	Design	The applicable approach separation minima shall be available on display to the Controllers at the Control Working Position (CWP) (51 OSD)	The results of the validation activities conducted show that under high traffic densities, the ATCOs considered it was impossible to work without a support tool (i.e. ORD tool).	Validation report of EXE-02.02-V3-VALP-R02	Accepted	
EAP_HPREQ_DSG05	Design	Flight Crew shall be supported by appropriate landing visual aid references for their flown approach procedure (e.g. specific PAPIs), down to CAT I minima.	Self-explanatory	Validation report of EXE-02.02-V3-VALP-R05 Validation report of EXE-14.2-V3-VALP-R10 Validation report of EXE-14.2-V3-VALP-R15 Validation report of EXE-14.2-V3-VALP-R25	Accepted	
EAP_HPREQ_DSG06	Design	Alarms and alerts shall indicate erroneous information (e.g. weather information) displayed on the HMI.	To ensure an appropriate support for the ATCOs in terms of situation awareness.		Accepted	
EAP_HPREQ_TRG01	Training	The training shall extensively cover the new working methods associated with the	The results of the questionnaires and debrief discussions	Validation report of	Rejected	Not specific to SRAP

		ORD tool (if applicable) in order to ensure high trust in the tool and acceptability of the related SRAP procedure.	showed that the ATCOs had a good level of trust in the ORD/separation tool, when working all positions.	EXE-02.02-V3-VALP-R02		
EAP_HPREQ_DSG07	Design	The display of information (a/c labels, TDIs etc) shall not clutter the ATCOs' screens.	In order to ensure the ATCOs can easily find relevant information, without having to search for items or without having the potential of mixing up the information displayed.	Validation report of EXE-02.02-V3-VALP-R02	Accepted	
EAP_HPREQ_OPS06	Operational	The Approach controller shall be the master of the arrival sequence and be able to update the sequencing tool in a simple and timely way in accordance with her/his strategy for the interception with no adverse impact on workload.	The target distance indicators were also reported not to only reduce workload but also make it easier to identify potential separation infringements and this helps to reduce the effort required contributes to lower stress levels when working these positions.	Validation report of EXE-02.02-V3-VALP-R02	Accepted	
EAP_HPREQ_OPS07	Operational	The ATIS report shall be checked by the flight crew, in order to help decide whether SRAP will be accepted or not.	In order to ensure an appropriate decision making process.	Validation report of EXE-02.02-V3-VALP-R02	Accepted	
EAP_HPREQ_DSG08	Design	The HMI shall comply with automation and adhere to human factors principles.	Local implementation shall ensure human factors principles are taken into account upon implementation.	Validation report of EXE-02.02-V3-VALP-R02	Accepted	

				EXE-02.02-V3-VALP-R03		
EAP_HPREQ_DSG09	Design	The flight list for the different approaches shall be easily distinguishable	To ensure an appropriate level of SA.	Validation report of EXE-02.02-V3-VALP-R02 EXE-02.02-V3-VALP-R03	Accepted	
EAP_HPREQ_DSG10	Design	The dynamic threshold highlight has to be improved; the timing has to be more accurate of when to switch from one threshold to the other.	Self-explanatory	Validation report of EXE-02.02-V3-VALP-R02 EXE-02.02-V3-VALP-R03	Accepted	
EAP_HPREQ_VAL07	Validation	The perception of the ATCO in terms of the position of the aircraft in relation to the SRAP has to be further investigated	Further evaluations are required.	Validation report of EXE-02.02-V3-VALP-R02 EXE-02.02-V3-VALP-R03	Rejected	Mitigated by tool support and validated in Wave 2
EAP_HPREQ_DSG11	Design	In case of an A-IGS the aircraft label shall be highlight-able	Due to the fact that the request for an A-IGS approach comes from the pilot exclusively, there shall be an option on the HMI of the ATCO to indicate the A-IGS approach once acknowledged.	Validation report of EXE-02.02-V3-VALP-R02 EXE-02.02-V3-VALP-R03	Accepted	
EAP_HPREQ_DSG12	Design	The aircraft labels shall allow for a clear distinction between the instructed approach procedures.	For an appropriate level of SA.	Validation report of EXE-02.02-V3-VALP-R02	Accepted	

EAP_HPREQ_DSG14	Design	Alarms and alerts shall be refined according to the local available approach procedures, in order to avoid nuisance alerts as much as possible.	Overall there was a positive feedback with regard to the usability of different ORD tool. Room for improvement for alerts functions	Validation report of EXE-02.02-V3-VALP-R02	Accepted	
EAP_HPREQ_DSG15	Design	An alert shall be made available highlighting an aircraft that is not complying / deviating from the intended final approach profile (using the Approach Path Monitoring – APM function) (55 OSD)	Overall there was a positive feedback with regard to the usability of different ORD tool. Room for improvement for alerts functions.	Validation report of EXE-02.02-V3-VALP-R02	Accepted	
EAP_HPREQ_DSG16	Design	Approach and Tower require access to the same information (on their CWP HMI) to be able to communicate effectively with each other.	A set of relevant questions from the STQ questionnaire were used to assess various aspects of team work. The four aspects assessed using the STQ were team prioritization of tasks, synchronicity, sharing of information between the two positions and identification of possible mistakes made by the other position. All aspects were rated positively, supporting the idea that the ORD tool enhances the performance of the ATCOs when instructing SRAP procedure.	Validation report of EXE-02.02-V3-VALP-R02	Accepted	

EAP_HPREQ_OPS08	Operational	The phraseology shall clearly indicate the expected arrival procedure and the cleared arrival procedure, without any potential for confusion between “expect” and “cleared”.	The proposed phraseology was clear and without a potential to lead to errors by both ATCOs.	Validation report of EXE-02.02-V3-VALP-R02 Workshop Flight deck simulation EXE-02.02-V3-VALP-R03	Accepted	
EAP_HPREQ_OPS09 (REQ-14.2-SPRINTEROP-CTL.1005)	Operational	The Approach Controller shall provide an information to the arrival aircraft about the expected approach procedure	The proposed phraseology was clear and without a potential to lead to errors by both ATCOs	EXE-02.02-V3-VALP-R02 Workshop Flight deck simulation	Accepted	
EAP_HPREQ_OPS10	Operational	Upon information from ATC about the expected approach procedure, the Flight Crew shall acknowledge and read-back to ATC in case they accept such approach type, or shall refuse and inform ATC in case they reject such approach type	The proposed phraseology was clear and without a potential to lead to errors by both ATCOs	Validation report of EXE-02.02-V3-VALP-R02 Workshop, mock up flight deck simulation	Accepted	
EAP_HPREQ_OPS11 (REQ-14.2-SPRINTEROP-GOAR.0002)	Operational	When the lead aircraft flying on final conventional approach is executing a missed approach and a following traffic is flying on final EAP spaced at or close to the separation minimum, the Approach or Tower Controller shall also instruct the following aircraft flying SRAP to execute	The proposed phraseology was clear and without a potential to lead to errors by both ATCOs	Validation report of EXE-14.2-V3-VALP-R01	Accepted	

		a missed approach, either with a "Turn left/right immediately" instruction or ensure that the follower is maintained above the lead traffic (taking into account sufficient climb performance) (60 OSED)				
EAP_HPREQ_TRG02 (REQ-14.2-TS-GND-0012)	Training	New recruits shall be trained to work with conventional modes of operations without tool support as well as SRAP procedure with the support of the ORD tool.	Training requirements have to be extensively covered in local implementation programs.	Validation report of EXE-02.02-V3-VALP-R02 Workshop Mock up flight deck simulation	Accepted	
EAP_HPREQ_TRG03 (REQ-14.2-TS-GND-0013)	Training	ATCOs and Supervisors shall receive training on contingency procedures in case of abnormal and degraded modes of operations	Training requirements have to be extensively covered in local implementation programs.	Validation report of EXE-02.02-V3-VALP-R02 Workshop Mock up flight deck simulation Validation report of EXE-14.2-V3-VALP-R01	Accepted	
EAP_HPREQ_TRG04 (REQ-14.2-TS-GND-0012)	Training	The training shall extensively cover the new SRAP working methods associated with the ORD tool (if applicable) in order to ensure high trust in	Training requirements have to be extensively covered in local implementation programs.	Validation report of EXE-02.02-V3-VALP-R02 Workshop	Accepted	

		the tool and acceptability of the related procedures.		Mock up flight deck simulation		
SRAP_HPREQ_001 (REQ-14.2-SPRINTEROP-ORDF.0008)	Operational	When the separation delivery tool returns to operations, the Approach Executive Control shall communicate to the Tower Runway Control the first aircraft in the sequence that is performing SRAP arrival procedure.	This is important for the Tower Runway Control to know that the SRAP is back in operation.	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HPREQ_002 (REQ-14.2-SPRINTEROP-ORDF.0004)	Operational	In peak traffic, in case of loss of separation tool, the coordinator/assistant shall aid the Approach Executive Control for checking the separations between aircraft and suggesting which aircraft should be sent around.	Self-explanatory	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HPREQ_003 (REQ-14.2-SPRINTEROP-ORDF.0005)	Operational	In case of loss of separation tool, Approach Executive Control should inform Tower Runway Control about the last aircraft flying the SRAP procedure until the tool is running again and the situation back to nominal.	That would improve Tower Runway Control situational awareness and avoid Tower Runway Control to be surprised if an aircraft flying on SRAP arrives after a number of aircraft on standard approach.	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HPREQ_004 (REQ-14.2-SPRINTEROP-CTL.1114)	Design	The wrong glide alert shall be sufficiently reliable, the level of reliability being defined locally at each airport.	This increases the workload and communication load of the Controller.	Validation report of EXE-14.2-V3-VALP-R01	Accepted	

SRAP_HPREQ_005 (REQ-14.2-SPRINTEROP-CTL.1109)	Design	The need for displaying to Approach Executive Control / Tower Runway Control the interception points respective for each procedure shall be evaluated as part of the local deployment, such that the visual references are operationally relevant and unambiguously presented without e.g. cluttering on the controller air surveillance display.	This should be further investigated locally.	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HPREQ_006 (REQ-14.2-SPRINTEROP-ACFT.2107)	Operational	Flight Deck shall pay particular attention to the transition of frequencies from APP to TWR and shall not delay it.	To avoid an aircraft being in between two frequencies where they are unable to communicate a missed approach or, conversely, the ATCO to not be able to communicate a go-around.	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HPREQ_007 (REQ-14.2-SPRINTEROP-ORDF.0009)	Operational	Additional staffing shall be available so that in peak (non-nominal) conditions, an Assistant can support the Approach Executive Control position.	The Supervisor will decide when an Assistant is needed, in coordination with Approach Runway Control.	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HPREQ_008 (REQ-14.2-SPRINTEROP-CTL.1010)	Design	Applicable Contingency approach separation minima shall be available to Approach Executive Control and Tower Runway Control, when	In case of loss of the separation tool, the applicable standard baseline separation table (for same slope pairs) and	Validation report of EXE-14.2-V3-VALP-R01	Accepted	

		controllers are supported by a separation tool.	a simplified mixed slope pairs table (e.g. leader on the higher and follower on the lower slope) shall be available to the ATCOs. These tables are to be used only when the tool is off. As an example, if RECAT-EU is the standard baseline separation to be applied for same slope pairs, the RECAT-EU table shall be available to the controllers. An additional table to cover mixed slope pairs when the separation tool is off, this could be RECAT-EU + 3NM.			
SRAP_HPREQ_009 (REQ-14.2-SPRINTEROP-GALT.0001)	Operational	When a wrong glide alert is activated, Approach Executive Control shall ask Flight Crew to confirm the flown approach procedure.	It is important that the ATCOs are aware of the situation and the pilots are aware of the reason for possible go-arounds.	Validation report of EXE-14.2-V3-VALP-R01	Accepted	
SRAP_HPREQ_010 (REQ-14.2-SPRINTEROP-GALT.0003)	Operational	After following the glide alert procedure, Approach Executive Control shall coordinate with Tower Runway Control about the aircraft that triggered the glide alert when SRAP is active.	To maintain the situational awareness of Tower Runway Control. This is particularly important when an aircraft is finally not flying the procedure it would	Validation report of EXE-14.2-V3-VALP-R01	Accepted	

			normally fly (for example if a Heavy aircraft is flying the SRAP Approach).			
SRAP_HPREQ_011 (REQ-14.2-SPRINTEROP-ORDF.0006)	Operational	In case of loss of separation tool, Approach Executive Control or Tower Runway Control should let all aircraft from pairs which are stabilised at 160kts and on (or behind) the ITD, continue on final.	The Approach Executive Control or Tower Runway Control needs to be confident that aircraft are stabilised before allowing them to continue on final.	Validation report of EXE-14.2-V3-VALP-R01	Accepted	

Table 12: HP Requirements

