



# Final Project Report

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## Abstract

This document, the Final Project Report for P16.4.1, provides a summary of P16.4.1 goals and achievements and is the final project deliverable. The aim of the P16.4.1 was to develop and Human Performance (HP) assessment process for SESAR air and ground related projects. The HP assessment process developed serves to ensure that HP aspects are taken into account in the SESAR operational and technical developments in WP4-15 projects that are in the V1 (Scope), V2 (Feasibility) or V3 (Pre-industrial development & integration) phase of maturity.

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# 1 Final Project Report

## 1.1 Introduction

As stated in the European ATM Master Plan [1] it is foreseen that 'humans will be central in the future European ATM system as managers and decision-makers, in a context where an advanced level of automation will be introduced to accommodate the expected traffic increase. In the ATM Target Concept it is recognised that humans will constitute the core of the future European ATM System's operations. Therefore the human element remains pivotal to the success of SESAR, and in ensuring that SESAR delivers the benefits expected in safety, environment, cost efficiency and capacity' [1]. If the expected performance benefits of SESAR are to be achieved, it is essential that the concepts being developed within SESAR take account of human strengths and weaknesses in the design and development process.

Furthermore, SESAR has adopted a top down performance based approach. Target performance criteria relating to safety, as well as capacity and efficiency, have been defined. It is therefore essential that all operational and technical projects adopt a consistent approach for assessing Human Performance (HP) in the concept design and development process, in order to ensure that the relevant HP findings can be aggregated and linked back to the relevant target performance criteria. Hence the need for a standardised approach to human performance assessment for SESAR was identified.

## 1.2 Project Aim

The aim of P16.04.01 was to develop a HP assessment process for SESAR that serves to ensure HP aspects are systematically identified and considered in the SESAR operational and technical concept developments for both ground based and air-borne projects, i.e. WP 4-15.

The HP assessment process developed for SESAR had to be compatible with the validation approach adopted within SESAR as outlined in E-OCVM [2] and applicable to the three validation phases of Research and Development covered by SESAR (i.e. V1 to V3). Furthermore, as mentioned earlier, the SESAR HP assessment process had to ensure that HP findings from different projects can be compared, aggregated and linked back to the relevant target performance criteria.

## 1.3 Project audience

The customer of the HP assessment process developed in P16.04.01 SESAR is P16.06.05. SESAR P16.06.05 will include the HP assessment process in the HP reference material, which is provided to HF personnel conducting HP assessments for SESAR WP4-15 projects. The future users and hence, intended audience of the HP assessment process, once it is included in the HP reference material, will be HF specialists in the SESAR WP4-15 projects as well as HF specialists in SESAR P16.06.05 who are coaching and supporting the projects.

## 1.4 Project Achievements

P16.04.01 has developed a HP assessment process to ensure that HP aspects are identified and considered in SESAR operational and technical developments. The HP assessment process developed in P16.04.01 provides guidance for conducting HP assessments in the SESAR WP4-15 projects that are in phase V1 (Scope), V2 (Feasibility) or V3 (Pre-industrial development & integration) [3].

The SESAR HP assessment process developed by P16.04.01 builds on existing ATM HF integration processes but in contrast, adopts an argument<sup>1</sup> and evidence based approach. The HP arguments cover four different HP related areas that need to be considered in the design and development of ATM concepts, namely; 1) Human Roles; 2) Human and the System; 3) Teams and Communication and; 4) Transition Factors (which includes arguments relating to general acceptability, training, skills and competencies, and staffing) and are applicable to both air and ground systems.

The argument and evidence based approach helps to standardise and systemise the HP assessment process and ensure consistency between projects, in terms of: the 'arguments' to be satisfied (or objectives of the HP assessment); the evidence required to 'satisfy' an argument and; the activities employed to elicit the required evidence. Where appropriate the arguments and evidence are linked to other HP related guidance material developed within SESAR P16.04.x and P16.05.x projects as well as relevant key performance / transversal areas. Thus the argument and evidence approach enables HP findings from different projects to be compared, aggregated and linked back to the relevant target performance criteria as necessary.

Furthermore, the HP arguments, evidence, and recommended activities are tailored to each of the three V-phases covered by SESAR, i.e., V1, V2, V3, as the arguments, evidence required to 'satisfy' an argument and the activities employed to elicit the required evidence become more detailed and elaborate as the maturity of a concept increases, from V1 to V2 to V3.

The HP assessment process itself is structured according to four steps: (1) Understand the ATM concept; (2) Understand the HP implications; (3) Improve and validate the concept; and (4) Collate findings and conclude on transition to next V-phase. For each step, the activities, required inputs, and expected outputs are described. In addition, the link with other SESAR documentation (e.g. OSED, SPR, Validation Plan and Validation Report) is outlined for each of the four steps.

As well as developing the HP assessment process and guidance material for SESAR operational and technical projects, P16.04.01 has also developed training material [4] which has been used to coach P16.06.05 participants on the HP assessment process developed for V1, V2 and V3 [5].

Test applications of the HP assessment process developed by P16.04.01 for each of the three V-phases, V1, V2 and V3 have been conducted by P16.06.05 participants (the customers / end users of the SESAR HP assessment process) on relevant SESAR projects. The HP assessment process and guidance material for each of the three V-phases have subsequently been approved by P16.06.05 and is now being actively used on SESAR operational and technical projects.

In addition, initial guidance material to build a HP case by aggregating HP findings from one SESAR operational project, with HP findings from another SESAR operational project has been produced within P16.04.01 [12]. This initial guidance material for HP case building will be applied and tested, and further developed, as necessary, by P16.06.05.

## 1.5 Project Key Deliverables

The following are the key project deliverables produced in the development of the SESAR HP assessment process:

### 1.5.1 D02 – HP assessment process requirements register

To ensure that the HP assessment process supports the systematic management of HP issues within the SESAR projects, the first activity, conducted at start of the execution phase of the project, was to identify the requirements of a HP assessment process for SESAR. A total of 66 requirements were registered in the HP assessment process requirements register. The requirements fall broadly into three classes (1) general requirements (i.e. requirements that relate to the overall process), (2) requirements that relate to the level of HP assessments carried out by the primary projects, and (3) requirements that relate to the level of HP case-building carried out by P16.06.05.

<sup>1</sup> A HP argument can be understood in this context as 'a human performance claim that has to be proven'.

At the general level, the main requirements for the SESAR HP assessment process related to the fact that the process should be: 1) feasible to conduct within reasonable time and effort; 2) in-line and compatible with the European Operational Concept Validation Methodology (E-OCVM) [2], addressing the first three concept development lifecycle stages V1 to V3; 3) linked, as far as is possible, to the relevant key system performance areas, namely, capacity, efficiency, security and most notably safety; 4) standardised and systematic to enable data obtained from a HP assessment conducted on one project to be aggregated with data obtained from HP assessments conducted on other projects, as well as with data obtained from the other transversal areas, such as safety and security.

During the development of the HP assessment process for V1, V2 and V3, the requirements register was used as a check list to ensure that all modules of the HP assessment process developed were consistent with the identified requirements of a HP assessment process for SESAR.

The second and final version of the HP assessment process requirements register [11] was delivered at the end of the execution phase of the project after the requirements register had been applied to each of the relevant project deliverables.

### 1.5.2 D07 – Input to the test application of the HP assessment process

Each initial module of the HP assessment process developed for each of the three V-phases, V1, V2 and V3, was subject to a test application by P16.06.05. Following each test application the initial HP assessment process guidance material was updated, as necessary, based on the feedback obtained from P16.06.05.

D07 – ‘Input to the test application of the HP assessment process’ [6] provides guidance to SESAR P16.06.05 with regards to the test application of the initial modules of the HP assessment process developed within P16.04.01. This guidance relates to, among others, (a) the type of project(s) to be chosen for the test application, (b) the aspects of the process that may require particular attention, and (c) the criteria against which the HP assessment process should be tested.

### 1.5.3 D08 – Support to 16.06.05: Coaching of 16.06.05 Staff on the 3 modules

The SESAR HP assessment process developed for V1, V2 and V3 within P16.04.01 is to be used by P16.06.05 as the reference material for the assessment of HP aspects in the SESAR operational and technical project (WP4-15). Therefore, as P16.06.05 is the customer / future user of the SESAR HP assessment process developed in P16.04.01, a series of coaching sessions were held by P16.04.01 to train P16.06.05 staff on the HP assessment process developed for SESAR.

D08 – ‘Support to 16.06.05: Coaching of 16.06.05 Staff on the three modules’ [5] provides a summary of the coaching provided to P16.06.05 staff on the HP assessment process developed for V1, V2 and V3.

### 1.5.4 D09 – FPR\_Final Project Report

D09 – ‘Support to 16.06.05: Input to training material’ [4], provides the P16.04.01 contribution to the SESAR HP assessment process training material being developed within P16.06.05.

The training material developed by P16.04.01 to coach P16.06.05 staff on the SESAR HP assessment process has formed the basis of the training material that P16.06.05 uses to coach operational and technical projects (WP1-15) on the SESAR HP assessment process, and thus constitutes P16.04.01’s contribution to the training material being developed within P16.06.05.

The training material developed by P16.04.01 and provided to P16.06.05 consists of a five minute video that provides an overview of the argument and evidence based HP assessment process developed in SESAR by P16.04.01, plus a 114 slide, MS power point presentation that provides a detailed description of the argument and evidence based HP assessment process for each of the V-phases: V1, V2 and V3.



## 1.5.5 D10 – HP assessment process for V1, V2 and V3

D10 – ‘HP assessment process for V1, V2 and V3’ [3] is the final version of HP assessment process guidance material developed by P16.04.01 in which the HP assessment processes developed for V1, V2 and V3 for air-borne and ground based projects are integrated.

The HP assessment processes for V1 (Scope), V2 (Feasibility) and V3 (Pre-industrial development & integration) were initially developed in P16.04.01 as separate modules /deliverables within separate project tasks, i.e. D06 – HP assessment process for V1 [7], D04-HP assessment process for V2 [10] and D05 – HP assessment process for V3 respectively [8][9].

The only difference between the HP assessment modules for each of the V-phases V1, V2 and V3 is the argument structure, i.e. the arguments, evidence required to ‘satisfy’ an argument and; the activities employed to elicit the required evidence become more detailed and elaborate as the maturity of a concept increases, from V1 to V2 and likewise from V2 to V3. The actual four steps of the HP process, (1) Understand the ATM concept; (2) Understand the HP implications; (3) Improve and validate the concept; and (4) Collate findings and conclude on transition to next V-phase, are the same for each of the three V-phases. Therefore, the HP assessment processes for V1, V2 and V3 for air-borne and ground based projects were integrated one document, i.e. D10 – ‘HP assessment process for V1, V2 and V3’.

In addition, within D10 [3], HP guidance material developed in the P16.04.x and P16.05.x projects has been integrated into the argument structure as appropriate.

## 1.5.6 D11 – Guidance for HP case building – initial version

D11 – ‘Guidance for HP case building – initial version’ [12] provides guidance for aggregating HP assessments conducted at the project and OFA level to form a HP Case. The guidance is sufficiently generic and can be for any V-phase aggregation. Therefore, this guidance for the HP Case building can be used for the aggregation of HP assessments conducted for V1, V2 or V3 respectively.

As there have been no ‘clusters’ of HP assessments performed at the project or OFA level available that can be feasibility combined to form a HP case during the execution phase of P16.04.01. The test application and update of the initial version of D11 – ‘Guidance for HP case building’ will be conducted by P16.06.05 when such clusters of HP assessments are available.

## 1.6 Recommendations

### 1.6.1 Recommendations on process use

**Recommendations on use within SESAR:** The HP assessment process developed in P16.4.1 is currently being successfully applied to number of SESAR air-borne and ground based projects. Preliminary feedback from initial applications of the HP assessment process is overall positive, as the SESAR argument and evidence based HP assessment process has been found to support concept development and validation activities within SESAR projects. It is therefore recommended that HP assessment process should be used on all SESAR V1-V3 OFAs addressing OIs which have a potential impact on human performance aspects. (Ideally all projects should conduct the first step of the HP assessment to assess whether a SESAR concept does have a potential impact on human performance aspects and determine whether a HP assessment is required). Furthermore, the SESAR HP assessment process can be applied to the Very Large Demonstrations that will take place in SESAR 2020.

**Recommendations on use outside SESAR:** Although the HP assessment has been developed for SESAR projects, there is no reason why the SESAR argument and evidence based HP assessment process cannot be applied to non SESAR ATM projects, projects that are at a higher level of maturity than V3 or even other domains. Conference paper and articles to disseminate information and inform HF practitioners working in ATM and / or other domains of the HP argument and evidence based approach should be encouraged.

## 1.6.2 Recommendations to support process uptake and maintenance

To support the future uptake and maintenance of the HP assessment process, we make the following recommendations concerning the need for (a) guidance material for project managers and non-HF specialists, (b) training of HF specialists and (c) further process development and maintenance.

**Need for guidance material:** Many projects managers are not aware of SESAR HP assessment process in terms of what it involves and how it supports the concept development and validation process. Therefore, it is recommended that guidance material is developed specifically for project managers, and non-HF specialists in general, to help them understand what the SESAR HP assessment process is, when it should be applied and how it can contribute to the success of their project. This guidance material should help project managers determine whether it is necessary to perform HP assessment on their project or not, and furthermore what the HP assessment will involve. As well as guidance material, a SESAR HP assessment awareness training program specifically for project managers and other non-HF specialists should be developed to compliment such guidance material.

**Need for training of HF-specialists:** One concern regarding the application of the SESAR HP assessment process is that the number of HF specialists familiar with the SESAR argument and evidence based process is relatively limited; hence there is a shortage of experienced HF specialists that are familiar with the SESAR HP assessment process. It recommended that a strategy for training HF specialists on the SESAR process is developed to ensure there are an adequate number of HF specialists familiar with and that have the necessary skills and knowledge to successfully execute the HP assessment process within SESAR projects.

**Need for further process development and maintenance:** Although test applications to assess and validate the HP assessment process and guidance material have been performed by P16.6.5 as part of the development process it is recommended that the development of the HP guidance material continues as it is applied more extensively within SESAR. Therefore, the HP assessment guidance material should be reviewed and updated as necessary at regular intervals following more extensive applications of the HP assessment process and guidance material to SESAR air and ground projects. For example, initial feedback from HF practitioners working on SESAR projects that have had the opportunity to use and apply the HP assessment guidance material suggests that more needs to be done to improve the usability of the material and in particular to aid users navigate their way through the document.



## 2 References

- [1] [European ATM Master Plan, Edition 2](#)
- [2] EUROCONTROL (2010). E-OCVM Version 3.0: European Operational Concept Validation Methodology. Brussels, Belgium: Eurocontrol.
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