



# D4.3.080 - PJ.10-W2-96 UPMS TRL6

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# PJ10-W2 PROSA

## USER PROFILE MANAGEMENT SYSTEM (UPMS)

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### Abstract

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This Contextual note provides a SESAR Solution description for industrialisation consideration.

When controller's takeover responsibility for air traffic in a volume of airspace it is normal for them to configure the HMI of the CWP to suit the role and the airspace. This may include setting altitude filters, displaying relevant maps, setting up controller tools and generally arranging the HMI to suit their needs so that they can manage air traffic safely and efficiently. However, this manual process may take several minutes and distracts the controllers from their task of controlling the aircraft under their responsibility, potentially at a time of high workload and stress.

The objective is to ensure a complete and instant personalization of workstations according to ATCOs' individual operational needs, requirements and preferences so that, for instance, ATCOs will be prevented from accidentally overlooking potential misalignments of key functionalities or tools. Additionally, the UPMS shall also eliminate the currently existing risk of distraction of ATCOs' attention from operational situation due to the need for customisation.

The concept consists of two main packages: the 'Identification (authentication) system' and 'UPMS configuration system'.

Following a validation exercises in wave 2, controllers gave feedback on whether the system assisted in their task. From the feedback, refinements were made to the point that Swiss ANSP Skyguide industrialised and deployed into operational service a UPMS in en-route and approach environments. As a result, it is considered that the solution has been validated and further research into UPMS is no longer required within SESAR but individual ANSPs may develop the concept further.

## Table of Contents

Abstract.....	4
<b>1 Purpose.....</b>	<b>6</b>
<b>2 Improvements in Air Traffic Management (ATM).....</b>	<b>7</b>
2.1 Challenges and Scope .....	7
<b>3 Operational Improvement Steps (OIs) &amp; Enablers .....</b>	<b>9</b>
<b>4 Background and validation process .....</b>	<b>10</b>
<b>5 Results and performance achievements.....</b>	<b>11</b>
<b>6 Recommendations and Additional activities .....</b>	<b>12</b>
<b>7 Actors impacted by the SESAR Solution .....</b>	<b>14</b>
<b>8 Impact on Aircraft System.....</b>	<b>15</b>
<b>9 Impact on Ground Systems .....</b>	<b>16</b>
<b>10 Regulatory Framework Considerations .....</b>	<b>17</b>
<b>11 Standardization Framework Considerations.....</b>	<b>18</b>
<b>12 Solution Data pack.....</b>	<b>19</b>

## List of Tables

No table of figures entries found.

## List of Figures

No table of figures entries found.

# 1 Purpose

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*This document provides to any interested reader (external and internal to the SESAR programme) an introduction to this Technological SESAR Solution, and this UPMS activity in particular, in terms of scope, the main operational and performance benefits and relevant system impacts, as well as additional activities to be conducted during the industrialization phase. This Contextual Note (CN) complements the technical data pack comprising the SESAR PJ.16-04-04 deliverables required and is now regarded as sufficiently mature for industrialisation and deployment in the ATC (Air Traffic Control) environment and no further research is required under the SESAR Programme.*

*This CN focusses on User Profile Management Systems (UPMS) technology and UPMS automated configuration of the CWP HMI, updated with information provided by skyguide following implementation and deployment.*

*This update has been produced because the solution is consolidating the TRL6 maturity level following deployment by some ANSPs, notably skyguide. It focusses on the User Profile Management Systems (UPMS) for the Human Machine Interface (HMI) of the Controller Working Position (CWP). The UPMS Solution developed guidance and assessment methods regarding the HMI and investigated new HMI concepts and interaction modes in relation to other SESAR solutions (including new user interface technologies such as automatic speech recognition, multi-touch input and gaze detection).*

## 2 Improvements in Air Traffic Management (ATM)

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### 2.1 Challenges and Scope

#### 2.1.1 Introduction

Analysis of operational data shows that a disproportionate number of safety incidents occur during the handover of responsibility for a sector to another sector team, usually at the end of a shift. The incidents occur because the controllers are often busy setting up the HMI on their CWP at the same time that they are assimilating the traffic situation and taking over control. Hence, there is a safety case to develop an intelligent User Profile Management concept for controllers, which supports the controller by configuring the HMI automatically (in seconds) rather than the more protracted and distracting manual process which may take several minutes. This will allow the controllers to focus on the traffic rather than manually setting the HMI in the critical handover phase or when the sector configuration changes.

#### 2.1.2 Scope and Objectives

PJ.10-W2-96 UPMS is focused on the User Profile Management Systems (UPMS) integrated into the Human Machine Interface (HMI) of the Controller Working Position (CWP). UPMS will be especially beneficial at times of higher workload. It supports tower, approach and en-route controllers.

The main pillars of UPMS are:

1. Authentication system – Identification is an important part of UPMS. Air traffic controllers will be able to manually identify themselves, via the HMI, or automatically, via the identification method available. This kind of authentication is needed to decrease the steps the air traffic controller will need to take when choosing their user profile.
2. User profile configuration system (UPCS) – An essential part of the UPMS system is its user profile configuration system. User profile configuration creates a software environment where air traffic controllers can define their profiles according to their needs. Those profiles may be updated later at run-time (directly on the CWP).

The following customization options may be included to the industrialised platforms (on the basis of the results from Questionnaire on Subject of Customisation): range / zoom, OFC (centre of the screen), brightness, altitude filter, maps on display, speed vectors (on/off and magnitude), history of track, label (#lines) and font size. General settings included Flight plan management settings (strips, windows – position, layout, etc.), Air Situation Display settings (Radar Track/Label settings, Screen – range/zoom, position, Altitude filters, other filters, etc.)

See the background section of the document for details of the questionnaire and assessment methods.

These settings/ functions may vary according to the role (ACC/EnRoute, TWR/ APP, Executive / Radar Controller or Planner / Assistant Controller) and task (according to sectorisation, e.g. EAST, WEST, TOP) as well as the preferences of the individual controller.

3. APPC (Automatic Predefined Profile Coupling) on CWP – UPMS intends to increase the level of service being delivered at the CWP today. In the current environment air traffic controllers change their settings manually, depending on the task or role they need to fulfil. Different positions may require various settings. Automatic coupling of the already predefined profile within UPCS with the ATCO's identification automates the user profile selection, therefore the input from the air traffic controller will be minimal.

One of the main objectives of UPMS activity was not only to assess the results obtained in validation exercise, but also to prove the importance of implementation of such technologies. The weaknesses/ limitations were evaluated and addressed as well.

### 2.1.3 Problem Statement

The manual process of configuring the HMI of their workstation by controllers when starting their shift or when there is a change in airspace configuration (e.g. re-sectorisation) is a time-consuming process, usually at a time of high workload and stress. As a result, there are a disproportionate number of safety incidents reported during this configuration process.

This solution sought to develop an automated process where an individual controller's HMI preferences could be stored for a variety of roles and reloaded when the controller identified themselves to the system. The solution investigated and evaluated a number of different methods of controller identification.



### 3 Operational Improvement Steps (OIs) & Enablers

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PJ.10-W2-96 UPMS solution is an enabling solution in the SESAR 2020 framework. It has the OI-step POI-0054-SDM “Improving controller productivity by User Profile Management Systems (UPMS) at the Aerodrome CWP/HMI and ER/APP CWP/HMI.”

The UPMS activity defined the Enabler AERODROME-ATC-101 “Controller productivity enhancements by User Profile Management at the Aerodrome CWP/HMI” in EATMA (DS21 and the Enabler ER APP ATC 183 “Controller productivity enhancements by User Profile Management at the ER/APP CWP/HMI”.

The new functional block “User Profile Management” consists of “User Profile Management” function as described in EATMA and the TRL4 TS/IRS. ATCO’s identification and coupling with the off-line user profiles serve as input for the User Profile Management Systems Logic.

## 4 Background and validation process

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There were no activities in SESAR-1 on User Profile Management Systems. The UPMS solution validation exercise took place in SESAR 2020 Wave 1 through a series of simulation runs with air traffic controllers. During the exercise, post-run questionnaires and general questionnaires, as well as debriefings were used to identify the workload and situational awareness of the controller when using the UPMS and during manual setting of HMI (non-UPMS scenario). The main focus areas of the exercise in PJ.16-04 with regard to UPMS were

- testing the reliability and performance of: Authentication system, User profile configuration system (UPCS) and Automatic Predefined Profile Coupling;
- support the ATCOs work with UPMS by reducing workload and/or increasing situational awareness and performance, and increasing safety;
- measure the time of ATCOs log on, coupling and appearance of their profile on the CWP for their particular role and task.

## 5 Results and performance achievements

During TRL4 phase, the effort invested by all contributors, mainly the one exercise lead, has been focused on:

- the development of UPMS prototype for TRL4 validation process,
- the development of prototype, and execution of TRL4 exercise,
- the analysis of validation results and its documentation, and TRL4 Data Pack.

The prototype used in the exercise validation and its behaviour during the whole development cycle and the simulation runs showed that the integration of the UPMS is technically feasible.

Technical feasibility was proved by the following means:

- In TRL4, LPS SR connected existing ID card technology with CWP/ATM. An interface was created to enable data transfer between the technologies, as recommended in TRL2.
- An interface between UPCS (Offline system) and CWP was created, to ensure that it is feasible to predefine profiles, to define tasks and user accounts in the offline system (UPCS).

Two systems have been implemented to reach the aim of UPMS:

- ATCO's Identification (authentication) after logon into CWP;
- User Profile Configuration system (UPCS), where ATCO's accounts and predefined profile/profiles are managed and then automatically coupled with ATCO's ID (e.g. ID card) and ATCO's task/role, immediately after logon into CWP.

Validation results show a decrease of ATCO's workload by 28% and an increase in situational awareness by 20% whilst using UPMS, in comparison to manual setting of HMI – leading to safety and performance increase.

Furthermore, the Swiss ANSP Skyguide has implemented and deployed an operational UPMS in the En-Route and Approach environment. The implemented UPMS in Skyguide ANSP consists of:

- ATCO manual login: each ATCO has their own corresponding profile;
- Capability for an ATCO to save different settings in their profile, depending on the role and the sector controlled. The new setting is saved on the CWP;
- Changing the setting of the track label, windows, conflict tools and maps displayed;
- Changing the brightness and transparency of the windows;
- Saving a new setting during ATCO's shift;
- The management of the profiles are centralized and synchronized regularly if a change is detected on a CWP;
- In case of failure, a log is created indicating a problem of synchronization. Those logs are monitored in case there is a need to react to an issue.

## 6 Recommendations and Additional activities

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### Recommendations for further development

As the validation results were positive and an ANSP (Skyguide) have industrialised and deployed into operational service a functioning UPMS, it is considered that no further research is needed.

However, as other industrialised solutions are developed and deployed the following are worth consideration in the process:

- Further elaborate on identification system configuration capability based on sectorisation (ACC/EnRoute, APP, TWR) or physical CWP position (Radar Controller, Planner);
- Configure system to automatically couple the identified user with appropriate profile;
- Implement Biometrics: Develop the CWP position identification and authentication system based on biometrics technology (Combination of Voice and Face recognition);
- Implement additional Use Cases:
  - Manual change of profile – after implementing automatic profile coupling allow user to manually select another predefined profile, which is more useful at the moment;
  - OJT training - add confirmation window, to choose whether Instructors or Students profile should be applied;
  - Develop further scenarios - handover & role change. Reflect Coordinator roll-in/out, seat swaps, runway changes/stack swaps.
- Extend the set of available functions: establish the scope of customisation based on the preferences of the end user, but ensure mitigation of negative effects and possible safety issues;
- Develop appropriate ATCO training on the use of UPMS;
- Develop operational and technical procedures to mitigate and manage system failures;
- Investigate safety benefits (Anecdotal evidence of 35% clustering around these transitions). Safety data and modelling (STAR/TEMPEST); focus on causal factors & hazard mitigation and Ops visits, Controller workshop and Questionnaires.

### Recommendation with respect to program view

- Integration of new HMI interaction solutions (Automatic Speech Recognition (ASR), Attention Guidance(AG) and UPMS) into one exercise;
  - In addition, particular combinations are possible, e.g., integration of UPMS and ASR only. ASR impact on UPMS concept - focus on speaker identification via voice for ATCO identification.
- The recommendations and requirements in the HPAR for all sub-solutions should be numbered to ease traceability in the TS.
- The label HP should be added to the TS in the requirement category.

Since the solution has reached TRL-6, further details concerning these recommendations are provided in section 5.2 of the TVALR TRL-4 (Note, the data pack comes from TRL-4 actives in W1) of the UPMS activity.

No further research into UPMS is required within SESAR but individual ANSPs may develop the concept further.

To ensure the solution maturity status is reflected in the ATM Master plan, the following change request has been raised in DS20 EATMA (MEGA):

- CR 05467 will set solution PJ.10-W2-96 UPMS as TRL-6/V3 completed.
- CR 05089 already proposed the creation of a specific POI for PJ.10-W2-96 UPMS. The CR has been updated to ensure the POI appears as validated.
- CR 05068 & CR 05070 have been updated to ensure that the two enablers identified in the CN for the solution will appear as well as TRL-6/V3 completed.

## 7 Actors impacted by the SESAR Solution

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The list of actors which may be impacted by the UPMS Solution are:

- Civil and Military ANSPs (due to CWP system changes):
  - ACC/EnRoute, TWR, APP ATS units with their air traffic (planning and executive) controllers (due to some new HMI elements);
  - Technical units responsible for operation and maintenance of CWP and identification system;
  - Safety units.
- ATM system providers (due to implementing new functionalities).

## 8 Impact on Aircraft System

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UPMS solution focusses on the improvement of the CWP by the implementation of user profile management systems technology, so no Aircraft Systems are impacted.

## 9 Impact on Ground Systems

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The Data Pack for UPMS related to TRL4 describes one new function in the Functional Block User Profile Management “User Profile Management”:

- User Profile Management: The system will automatically couple the identified ATCO with predefined user profiles. It allows that once the ATCO is identified in a safe and secure manner, the individual customized profile related to a particular role or a task on the CWP will be applied. This can happen during a shift handover or whenever an ATCO’s task or role on the CWP changes, for instance in the case of the change of sectorisation.



## 10 Regulatory Framework Considerations

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The use of UPMS supports/influences the Safety Management System of each ANSP. Therefore, the EASA AMC needs to be considered.

As UPMS represents a technological enabler and as a supplement to existing CWP HMI there is no need to adapt procedures as such. Operations in general will remain the same while only the system itself might be affected due to automated customisation of the HMI on CWPs. Thus, the need for additional regulatory oversight in this regard is limited.

Safety considerations were addressed in the TRL-4 TVALR SAR (Appendix B). Functional, Safety, and Performance requirements are addressed in the TRL-4 TS IRS.

# 11 Standardization Framework Considerations

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There are recommendations for the UPMS implementation and development, but no standards were identified using the guidance material of PJ.20.

## 12 Solution Data pack

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The Data pack for this Solution includes the following documents (all of them received the version number 02.00.00 for conformity reasons, being based on the latest final version), refer to section 4 the background and validation process for further details:

- PJ.16-04-04 TRL-4 TS/IRS UPMS, Edition 02.00.00 (30.09.2019)
- PJ.16-04-04 TRL-4 TVALR UPMS, Edition 02.00.00 (30.09.2019)  
with PJ.16-04-04 TRL4 TVALR UPMS, Appendix B Safety Assessment Report, Edition 02.00.00 (30.09.2019)