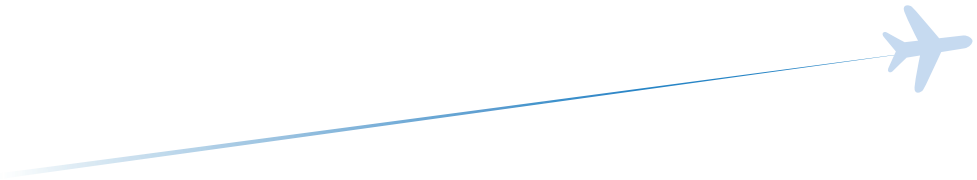

Exploitation plan

D6.2
PACAS

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PACAS

PARTICIPATORY ARCHITECTURAL CHANGE MANAGEMENT IN ATM SYSTEMS

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Abstract

The main objectives of PACAS WP6 are to disseminate knowledge on the scientific and technical achievements, to build awareness of the project and of its potential impacts. This document describes the beneficiaries' strategy and concrete actions related to the protection, dissemination and exploitation of the project results. So, it is a strategic document for the beneficiaries helping them to establish the bases for their intellectual property strategy, future exploitation, multiplication and sustainability activities.

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Executive summary

Exploitation represents one of the core activities of the PACAS project. PACAS develops and promotes the adoption of an innovative participatory change management process, where stakeholders will actively participate to the architectural evolution of the system under consideration, aims at better understanding, modelling and analysing changes at different layers of the Air Traffic Management (ATM) System while capturing how architectural and design choices influence the overall system.

This document presents the PACAS Exploitation Plan developed to promote the project and its results accurately. PACAS takes adequate measures to maximize the impact of the results; specific activities are chosen to ensure fitness with the expected Technological Readiness Level of the call, which is TRL 2. It means that technology concept and/or application have been formulated. In particular, potential application of the basis (technological) principles are identified, including their technological concept. Also the first manufacturing principles are explored, as well as possible markets identified. A small research team is established to facilitate assessment of technological feasibility. In view of that, the impact will be mostly determined by the concepts that originate from PACAS, rather than fully-fledged prototypes.

Indeed, PACAS is a SESAR Research and Innovative Action (RIA) and its main objective is to develop and promote the adoption of an innovative participatory change management process in complex socio-technical systems, such as Air Traffic Management (ATM) systems. Accordingly, the Plans for Communication, Dissemination and Exploitation should be flexible enough, ensuring that the project follows the needs and the expectations of the beneficiaries during its implementation.

Therefore, comprehensive Plans for Communication, Dissemination and Exploitation defines clear objectives and sets out a concrete strategic planning for each measure to maximise the impact of the project (including a description and timing for each activity throughout the project duration). This ensures that developed solutions are both validated and viable for longer-term exploitation.

1 Introduction

1.1 PACAS Overview

ATM systems are complex systems-of-systems that are managed via a layered architectural model, which includes operational, organisational, and technical layers to ease handling complexity. Due to strong interdependencies in an ATM system, any change introduced in any of these layers might trigger changes both within the same layer and in the other layers. Understanding all possible consequences of a design decision in ATM systems is a challenge due to the complexity of these systems and the existence of tight interdependencies within the ATM architecture. A careful consideration of possible changes together with their implications on the entire ATM system is crucial to support decision-making, while making sure that the ATM system does not suffer from any issues with respect to functionality, safety, security, performance, cost efficiency, or other desired characteristics of a well-functioning ATM system.

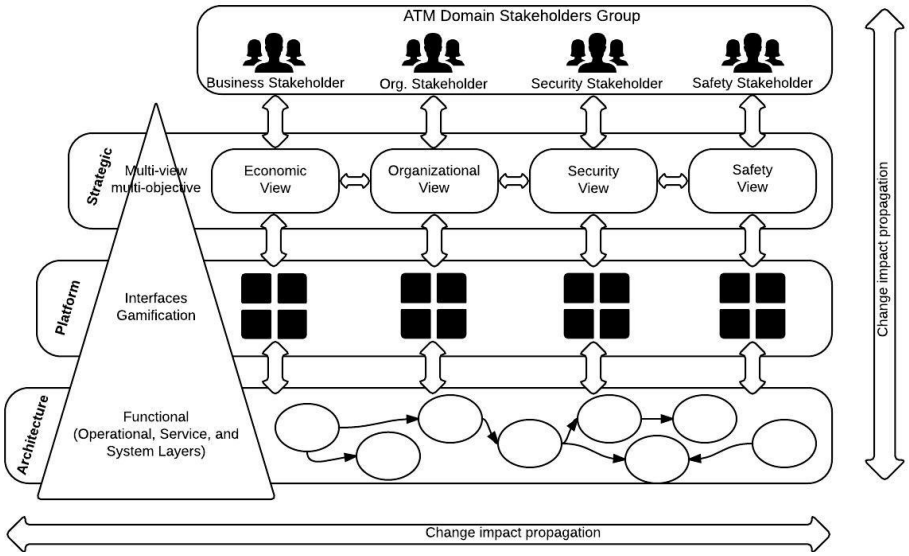

Figure 1: Multi-view multi-objective gamified participatory design process for ATM architectural change management

PACAS is about supporting change management in ATM systems from an architectural point of view, relying on the end-to-end inclusion of ATM domain stakeholders through gamification. The project constructs a platform that facilitates understanding, modelling and analysis of changes in the ATM system at different layers of abstraction. The approach to finding optimal solutions is based on a novel participatory design process to handle change management. The process relies on the provision of multiple views (to accommodate the expertise of the various domain stakeholders), as well as the representation and analysis of multiple objectives, namely those related to economical, organizational, security, and safety concerns (Figure 1).

1.2 Relationship with other deliverables

This deliverable is part of a work package (WP6) concerned with communication, dissemination and exploitation activities, which contribute to the project outcomes during the entire project period (as illustrated in the following picture). Indeed, there will be annually releases of dissemination and communication deliverables for reporting the communication and dissemination activities carried out and re-planning of activities for next period.

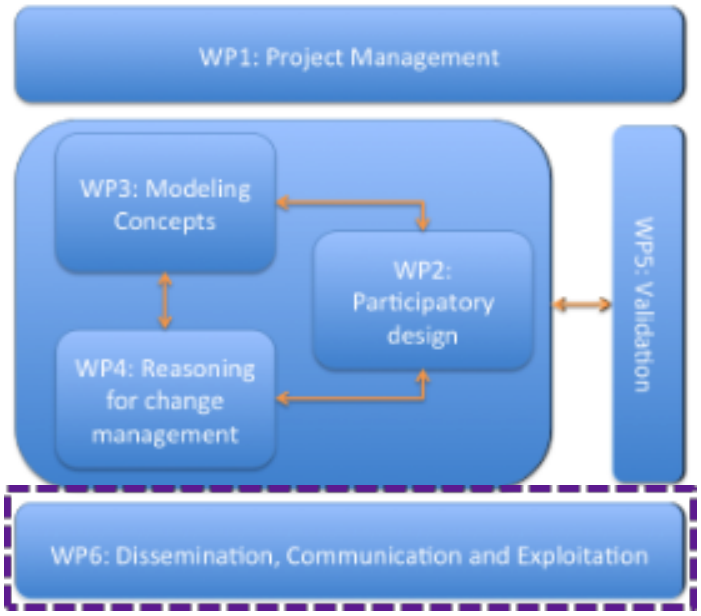

Figure 2: WP6 and other WPs interdependencies

So its contents should be seen in relation with all the technical work packages namely WP2, WP3 and WP4 that must be carried out to deliver the PACAS platform. Moreover, all technical components will be validated by ATM domain stakeholders in WP5 in an integrated process starting since the early phases of the project. Consequently, this document relates closely to these work packages and their deliverables such as “D2.2 and D2.3 First and second release of the platform and guidelines” respectively, “D3.2 First release of the Modelling proof-of-concept”, “D3.3 Modelling language meta model”, “D4.2 First release of the reasoning proof-of-concept” and “D5.1 Concept, Scenarios and Validation Plan”. In particular, all the different validation activities will help in providing an overall view of the project results and constantly updating the exploitable ones (e.g. participatory design process, models, languages, reasoning techniques and supporting tools). Moreover, D6.1 is of relevance for more background as regards how to disseminate knowledge on the scientific and technical achievements, to build awareness of the project and of its potential impacts. Finally, at the end of the project, as D6.4 “Roadmap for the exploitation” will be provided for an estimate of the economic and technical impact of solutions suggested by the PACAS project and a clear business and market exploitation path.

1.3 Structure of this document

This document is structured as follows:

- Section 2 describes PACAS main exploitable results and the main factors to be taken into account for maximising the impact of the project and the successful exploitation the results.
- Section 3 reports the global valorisation of PACAS innovative outcomes. In particular, it details the project innovative approach, the stakeholders interested in the valorisation of PACAS results and how the exploitation is split in two components: mainstreaming and multiplication.
- Finally, Section 4 concludes the deliverable by describing individual partners' exploitation plans. Indeed, the PACAS Consortium includes Small and Medium Enterprise (SME), Universities, and one large independent research organisation. Such different entities also have different exploitation needs and possibilities; therefore, partners' exploitation paths differ from each other.

2 PACAS exploitable results

In accordance with Article 38.1 of the Model Grant Agreement, each beneficiary must — up to four years after the period set out in Article 3— take measures aiming to ensure 'exploitation' of its results (either directly or indirectly, in particular through transfer or licensing) by:

- Using them in further research activities (outside the action);
- Developing, creating or marketing a product or process;
- Creating and providing a service, or
- Using them in standardisation activities.

Task 6.3 - Exploitation and Intellectual Property Right Management [M1-M24] - [Task Leader: DBL Partners: SINTEF, UNITN, UUTR] - is in charge of developing the exploitation plan, examining the Intellectual Property Right (IPR) issues of the project, addressing other market related assessments, including risk analysis, exploitation strategies and new business opportunities. At the end of the project, this task will deliver a report about results of exploitation and opportunity for the multiplication of PACAS results.

In order to maximise the impact of the project and the successful exploitation the results with limited resources, the consortium will consider four main factors:

a) The stakeholders' acceptance of the solutions suggested by the project;
b) The impact of the solutions in applicative usage scenarios;
c) The feasibility of the implementation of measures that shall ensure the sustained utilisation of the outputs by the target users and the appropriate tailoring of the project's methodology/products according to their needs;
d) The feasibility of uptaking activities for promising, but not yet established technical solutions after the project has ended.

Metrics (a) and (b) cover the innovation environment today and relevant future trends that will influence the use of the solutions. The first step entails the selection of users to be engaged in a case-based evaluation assessing the applicability of the outputs of certain work packages to the respective application needs.

Metrics (c) and (d) are jointly investigated in a feasibility study. Firstly, this study will address the ways of identifying and involving stakeholders that are interested in, and capable of following-up and validating the PACAS achievements. The feasibility of obtaining their commitment to do so even beyond the project lifetime will also be assessed. The perceived economic impact of PACAS and the perceived impact of R&D results on the research community will be discussed with relevant stakeholder groups, at conferences and in interviews. The outcome of these discussions will be collected and reported in order to highlight the importance of sustained access to the PACAS results

and achievements. The consortium has already established a solid network over the years among different stakeholders from which to gather feedback.

Secondly, the feasibility study will assess which uptake activities are the most appropriate for technical solutions (e.g. further developments of the participatory platform in order to be implemented in the European ATM Master Plan portal [1] or to be adopted by Risk Managers) envisaged by PACAS that are not yet fully established. This feasibility assessment will take into account the analysis of the economic and technical factors influencing the use of solutions suggested by PACAS. It will also investigate which groups of stakeholders should be involved in fostering future uptake. The technical, organisational and economic feasibility of activities (e.g. assessments, trials, validation exercises) after the project has ended will be assessed. All these assessments will be performed in close contact with experts and users inside and outside the PACAS project. The output of these studies will be cost-benefit analysis of the proposed solutions:

- Recommendations for topics to be stressed in dissemination, to ensure acceptance and to achieve maximum impact in a target community;
- Identification of interlocutors, strategies and measures to ensure the sustained use and update of the PACAS contact database, including priorities for action;
- Priorities for measures and activities to promote uptake after the project has ended, in order to further develop and exploit the PACAS results.

The main exploitable results deriving from the project are the following:

Table 1: Exploitable results

Result title	Brief description	Due Date
PACAS Collaborative Platform	A proof-of-concept platform aims at supporting decision making process in ATM domain by capturing change issues and their impacts, propagating the possible impacts to various aspects semi-automatically, facilitating communication between stakeholders, and applying automated reasoning techniques to identify optimal solutions (for further details [2])	First release – Aug 2016
PACAS participatory design process	A co-management activity made by the end-to-end interaction and consultation between stakeholders, providing background, experience and know-how from her own sub-domain perspective, to ensure better and sustainable change management process.	First release – Aug 2016
PACAS modelling languages	It defines the essential concepts of the modelling language and methods for capturing the strategic objectives (related to economic, organisational, security, and safety aspects) of the ATM domain stakeholders. The models need to visualize organisational concerns, and how security, safety and costs are affected when introducing changes at the architectural level, without having information overload in a single view (for further details [3])	First release – Nov 2016

3 Global valorisation of PACAS innovative outcomes

Exploitation and innovation management are quickly becoming a critical requirement for enabling sustainable Research and Innovation Actions to properly exploit all their relevant innovative outcomes (new ideas, new methods, new concepts, new prototypes/products, new services, etc.).

An overall perspective of the complete set of project activities is the basis for the definition of the exploitation activities to be carried out during the project. According to the maturity of the results, different levels of exploitability could be envisaged.

Controlling and monitoring the exploitation process is an extremely complex task, involving the effective management of many different activities and the collaboration of partners with different expertise.

The PACAS plan for exploitation activities includes the following steps:

1. Identify specific technical results, market and organisational issues for innovation resulting from the specific WPs activities;
2. Identify the range of potential users or stakeholders potentially impacted by innovative results;
3. For each project result:
    a. manage IPR issues;
    b. carry out a periodic SWOT analysis;
    c. monitor the maturity level;
4. Define exploitation measures for project results addressing the range of potential users and possible uses;
5. Identify impact and uses, including: research, commercial, trigger of new investments, social, policymaking, in terms of their pushing potential towards new standardization, regulation and certification standards;
6. Monitor resulting knowledge, identifying potential use, further research paths, and exploitation benefits.

All this process is iterative and will be carried out at least every 6 months (from now on) and/or at major Milestones during the PACAS project by using the template contained in Appendix 1.

3.1 PACAS innovative approach

The aim of the PACAS project is to construct a platform that facilitates understanding, modelling and analysis of changes in the ATM system at different layers of abstraction. The approach to finding optimal solutions is based on a novel participatory design process to handle change management. The process relies on the provision of multiple views (to accommodate the expertise of the various domain stakeholders), as well as the representation and analysis of multiple objectives, namely those related to economical, organizational, security, and safety concerns.

As reported in "Table 1: Exploitable results", the main innovative outcomes of the PACAS will be:

- **PACAS Collaborative Platform** – Developing, based on the results of WPs 2, 3, 4, 5, a collaborative platform that supports change management in settings where multiple perspectives and interests should be taken into account, and the complexity of the domain requires the use of a digital platform to keep track of the changes and to determine the impacts that changes in one perspective have on other perspectives;
- **PACAS participatory design process** - Producing a participatory methodology that supports the effective collaboration among ATM stakeholders. The key novelty of the methodology is to promote participation—as opposed to decisions taken on the basis of "power and politics"—also through the explicit representation of the rationale of the various stakeholders, i.e., their *arguments*;
- **PACAS modelling languages** - Defining the essential concepts of the modelling language and methods for capturing the strategic objectives (related to economic, organisational, security, and safety aspects) of the ATM domain stakeholders.

3.2 Stakeholders interested in the valorisation of PACAS results

Interested decision makers are responsible for the aligning of the end users and researchers.

A preliminary list of decision makers and European Agencies potentially interested in PACAS outcomes includes:

- EASA – European Aviation Safety Agency - www.easa.europa.eu
- EUROCONTROL – European Organisation for the Safety of Air Navigation - https://www.eurocontrol.int
- ENISA – Resilience and Critical Infrastructure Protection Dept. - www.enisa.europa.eu
- EMSA – European Maritime Safety Agency - www.emsa.europa.eu
- IMO – International Maritime Organisation - www.imo.org
- UIC – International Union of Railways - www.uic.org
- UITP – International Association of Public Transport - www.uitp.org
- ERA – European Railway Agency - www.era.europa.eu
- CER – Community of European Railway and Infrastructure Companies - www.cer.be
- ECAC – European Civil Aviation Conference - www.ecac-ceac.org
- IATA – International Air Transportation Association - www.iata.org

3.3 Mainstreaming and multiplication

The exploitation is split in two components: mainstreaming and multiplication.

Mainstreaming addresses the decision-makers in order to convince them to introduce/take into account the results/products of a project, while multiplication is more focused on persuading individual end-users to adopt those products. This usage can be either within partnership or outside, at local, regional, national or European level.

PACAS will foster both mainstreaming and multiplication activities, with a particular focus on mainstreaming being a RIA.

Influencing high-level change in policy and regulations, together with the operational personnel, is a real possibility if project partners will co-operate effectively and at the right levels. This is essentially a process of networking with all relevant stakeholders, so building contacts and attending meetings is vital – which is hard work but the only way. The European Commission, European and National Agencies, National Committees and Programme Committees organise events to facilitate such co-operation.

The PACAS project has a dedicated WP (i.e., WP6) for Coordination and Networking activities that will support the adoption of the PACAS main outcomes and supporting measures (e.g. participatory design process, models, languages, reasoning techniques and supporting tools) by National Agencies and Ministries as well as EC institutions. Policy papers and White papers will also be provided to the EC for informing future R&D on the subject and future policy making activities.

Multiplication will also be targeted to make the PACAS project sustainable.

Other EU R&D projects (please refer to [4] for a preliminary list), as well as end-users in similar domains will be contacted and actively involved in the PACAS Validation, Dissemination and Exploitation activities.

The Advisory Board will be a first set of relevant stakeholders to collaborate with. It will be enriched and complemented during the whole project life-time.

4 Individual partner exploitation plans

The PACAS Consortium includes one SME, two Universities and one large independent research organisation. Such different entities also have different exploitation needs and possibilities; therefore, partners' exploitation paths differ from each other.

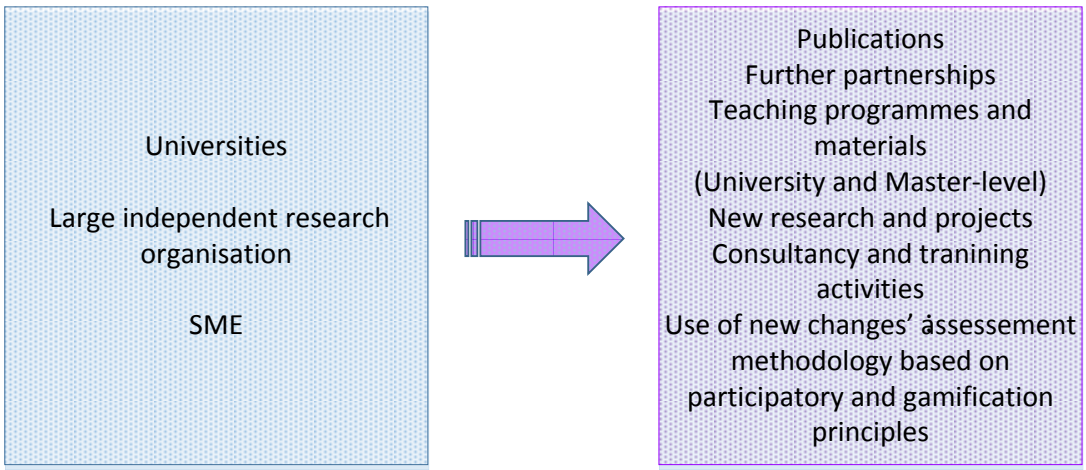

Figure 3: PACAS exploitation paths

4.1 University of Trento

UNITN, as an Italian EIT Node (http://www.eitdigital.eu/about-us/locations/trento-node/) will exploit PACAS research results to drive and promote innovative projects both in the territory and in the ICT sector in Europe. PACAS results will be presented and proposed to both academic and industrial partners within EIT to further develop with them business ideas and explore new application scenarios.

We define exploitation as making use of and deriving benefit from the project's outcomes that can be utilized in two different markets: (1) academic, and (2) commercial, going beyond the ATM sector. For what concerns the academic market, exploitation will consist:

- In making project results directly available to other research groups as well as to instructors of various courses themselves. Some potential courses: requirements engineering, business process management, organizational information systems, security and privacy, etc.
- In disseminating the new scientific knowledge produced within the project. In particular, scientific knowledge will be presented at scientific conferences and

published in international peer-reviewed journals and eventually books. In particular, the focus of scientific activities will be on socio-technical systems, gamification mechanisms, software engineering processes and participatory decision. Following is the list of the papers submitted:

- Cuel, Orabona, Ponte "Changing complex socio-technical infrastructures: the case of Air Traffic Management" accepted at VI STS Italia Conference, Trento November 24-26, 2016.
- Piras, Ponte, Cuel, Giorgini, Mylopoulos "Gamification solutions from software engineering and organizational studies: a comparative study" submitted to Hawaii International Conference on System Science HICSS-50.

For what concerns the commercial market, exploitation will consist in making available the core proof-of-concept of the PACAS project, a delta of the platform, for experimentation and use. We will approach companies both in the Trentino territory and within the EIT Digital network. These activities are aimed at raising awareness of the PACAS approach, which will be measured by the number of downloads of the proof-of-concept (both the core and integrated framework), as well as that of the follow-up projects.

4.2 Deep Blue

Deep Blue will mainly exploit project PACAS results in its consultancy and training activities for public and private organisations in the Airport and Air Traffic Management domains and, more in general, in other similar complex socio-technical domains such as Maritime and Railways Transport, Healthcare and Oil & Gas domains.

The problem of taking into account different views and the mutual interdependencies such as possible impacts and/or drawbacks and cascade effects when a change is needed in complex socio-technical systems (e.g. the ATM) will become explosive in the future, because of increasing automation and tasks migration in these kinds of Systems.

PACAS solutions will represent a very important contribution for the SESAR 2020 and 2050 programmes which target to the re-definition and management of Single European Sky in next decades. Indeed, the collaborative platform and the participatory design process will help ATM stakeholders to actively discuss and envisioning how the operational and technological improvements developed by SESAR members and partners (namely SESAR Solutions [5]) could be effectively implemented and what could be the interdependencies, in terms of pro and cons, focusing on four main aspects: safety, security, organisational and economical. This will support in planning and designing future research programme.

Furthermore, if the results from the project are promising enough and limited steps are required to turn the platform into a product, this could be used in collaboration with the EATMA portal to offer a holistic view of the ATM System and support ATM stakeholders in assessing projects results and integrated them.

Finally, Deep Blue will further re-adapt PACAS solutions and ideas in future R&D proposals and projects on similar topics or on similar domains, also exploiting PACAS partnerships and collaborations.

4.3 Stiftelsen SINTEF

SINTEF will exploit PACAS results to expand our already significant portfolio of research and development projects in the ATM industry. Being able to reason between multiple stakeholder views, as in the PACAS approach including security, safety, economic and organisational, will increase our ability to create unique collaborations between our own experts in each of the stakeholder groups, as well as other stakeholders in the projects we are involved in, both as researchers and consultants.

For what concerns the work on PACAS modelling language and automated reasoning, it will be exploited in terms of scientific publications, and new project collaborations.

Furthermore, our research groups on information security, safety and ATM resilience will all benefit from the PACAS methodology in terms of developing knowledge and first-hand experience with serious games, which can potentially be applied to several challenges within each of these fields.

4.4 Utrecht University

Utrecht University will exploit the results from PACAS (the platform and the participatory process) by applying for further funding from the SESAR 2020 programme in order to further test the validity of the approach in the larger scale and at a higher maturity level (the TRL of PACAS is 2).

The PACAS platform, along with its automated reasoning mechanisms, will be extended and adapted for use in the domain of complex, multi-perspective systems and software engineering. This will be done by seeking for funding from Horizon 2020 projects in other application areas. Although initially proposed for the ATM domain, the same ideas can be reused to face many of the difficult design/engineering challenges that our society is experiencing, including smart cities.

In collaboration with the business incubator UtrechtInc, if the results from the project are promising enough and limited steps are required to turn the platform into a product, Utrecht University will benefit from the experimentation lab and the startup support offered by the incubator to bring the ideas to the market and provide a robust solution that can be employed throughout Europe to support the participatory design of complex socio-technical systems.

References

[1] European Organisation for the Safety of Air Navigation (EUROCONTROL) and SESAR JU, “European ATM Master Plan.” [Online]. Available: https://www.atmmasterplan.eu/.

[2] PACAS Consortium, “D2.2 First release of the platform and guidelines.”

[3] PACAS Consortium, “D3.2 First release of the Modelling proof-of-concept.”

[4] PACAS Consortium, “D5.1 Concept, Scenarios and Validation Plan.”

[5] SESAR JU, “SESAR Solutions,” 2014. [Online]. Available: http://www.sesarju.eu/solutions.