

## D5.1 Project Management Plan

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### Abstract

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The present deliverable conforms the Project Management Plan (PMP) for Project E-CONTRAIL. It is aimed at providing the guidelines for the timely and efficient management of the project. The document provides the context in which the project is framed, including reference material and the maintenance of the document. It also elaborates on the objectives of the project and the work plan to achieve them, including Work Packages (WPs), Tasks, and their corresponding leaders. A section is devoted to the management structure, including the composition of the different boards, and the different roles and rules that apply. A quality management plan is presented, including all the processes involved and the ensurement of E-CONTRAIL to Horizon Europe rules SESAR 3 JU project handbook. The risks and the associated risk management plan is also presented. We devote the final two sections to analyse how the potential solution of E-CONTRAIL should follow the SESAR 3 JU performance management and how to integrate it into the ATM master plan.

## Authoring & Approval

### Author(s) of the document

Organisation name	Date
Universidad Carlos III de Madrid	27/07/2023

### Reviewed by

Organisation name	Date
UC3M	26/07/2023
RMI	07/09/2023
KTH	07/09/2023
BIRA	06/09/2023

### Approved for submission to the SESAR 3 JU by<sup>1</sup>

Organisation name	Date
UC3M	26/07/2023
RMI	07/09/2023
KTH	07/09/2023
BIRA	06/09/2023

### Rejected by<sup>2</sup>

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<sup>1</sup> Representatives of all the beneficiaries involved in the project

<sup>2</sup> Representatives of the beneficiaries involved in the project

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# E-CONTRAIL

ARTIFICIAL NEURAL NETWORKS FOR THE PREDICTION OF CONTRAILS AND AVIATION INDUCED CLOUDINESS

# E-CONTRAIL

This document is part of a project that has received funding from the SESAR 3 Joint Undertaking under grant agreement No 101114795 under European Union's Horizon Europe research and innovation programme.



We provide now a high-level summary of the project E-CONTRAIL:

Contrails and aviation-induced cloudiness effects on climate change show large uncertainties since they are subject to meteorological, regional, and seasonal variations. Indeed, under some specific circumstances, aircraft can generate anthropogenic cirrus with cooling. Thus, the need for research into contrails and aviation-induced cloudiness and its associated uncertainties to be considered in aviation climate mitigation actions becomes unquestionable.

We will blend cutting-edge AI techniques (deep learning) and climate science with application to the aviation domain, aiming at closing (at least partially) the existing gap in terms of understanding aviation-induced climate impact.

The overall purpose of E-CONTRAIL project is to develop artificial neural networks (leveraging remote sensing detection methods) for the prediction of the climate impact derived from contrails and aviation-induced cloudiness, contributing, thus, to a better understanding of the non-CO2 impact of aviation on global warming and reducing their associated uncertainties as essential steps towards green aviation.

Specifically, the objectives of E-CONTRAIL are:

- O-1 to develop remote sensing algorithms for the detection of contrails and aviation-induced cloudiness.
- O-2 to quantify the radiative forcing of ice clouds based on remote sensing and radiative transfer methods.
- O-3 to use of deep learning architectures to generate AI models capable of predicting the radiative forcing of contrails based on data- archive numerical weather forecasts and historical traffic.
- O-4 to assess the climate impact and develop a visualization tool in a dashboard.

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## List of Acronyms

Acronym	Description
a-CCFs	Algorithmic Climate Change Functions
AI	Artificial Intelligence
AIC	Aviation Induced Cloudiness
ATR	Average Temperature Response
BTD	Brightness Temperature Difference
CNN	Convolutional Neural Networks
ERF	Effective Radiative Forcing
GPU	Graphical Processor Unit
GWP	Global Warming Potential
LSTM	Long-Short Term Memory networks
LUTs	Look Up Tables
MSG	Meteosat Second Generation
MTG	Meteosat Third Generation
RF	Radiative Forcing
RNNs	Recurrent Neural Networks
RTM	Radiative Transfer Models
TOA	Top of Atmosphere

# 1 Introduction

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Annex 1 of the Grant Agreement (GA - 10111479) [1] provides the contractual baseline of the project by means of the Description of the Action. It contains a high level description of what the project is aiming to achieve and how and which additional outputs will be produced in terms of deliverables. The descriptions of these deliverables in the Grant Agreement provide a common reference for the project and the SESAR 3JU to support the assessment of the project achievements.

While the GA provides a common reference about the project it does not cover all the details necessary for managing the project on a daily basis. This project management plan (PMP) therefore complements what is already defined in the GA by detailing how the project will be executed. It does this by explaining how the programme management and content integration guidance published by the SESAR 3JU is put into practice for this specific project, without repeating that guidance material. It does not contradict the Grant Agreement in any way, nor the project handbook.

While this document aims to avoid duplication of material from the references it builds on, some elements may nevertheless be repeated to make the PMP document as readable as possible without continuously having to consult all the reference material.

## 1.1 Applicable reference material

**Unless otherwise stated in this PMP**, the execution of the project **will be fully compliant** with the latest version of the Digital European Sky (DES) project handbook [2] and is based on Digital European Sky Horizon Europe Project Management Plan template (DES HE PMP template), available in the programme library [3].

## 1.2 PMP maintenance

This project management plan has been produced at the beginning of the project as a contractual deliverable. Its main purpose is however to be part of the daily management tools of the project team and at the same time to support the coordination between projects by providing insight in how the project is organised and managed.

The PMP is intended to be a living document in which information will be made available on a finer level of granularity through updates as the implementation of E-CONTRAIL project progresses and when significant changes occur.

We envision three phases for the PMP:

1. Initial PMP (Current version of the document), which includes the main guidelines.
2. Intermediate Version PMP, month 13 (before the Intermediate Review Meeting).
3. Final PMP, month 22 (before the Final Review Meeting).

## 2 Overview of the project

### 2.1 Project objectives

The overall purpose of E-CONTRAIL is to develop artificial neural networks (leveraging remote sensing detection methods to estimate radiative forcing and effective radiative forcing) for the prediction of the climate impact derived from contrails and aviation-induced cloudiness, contributing, thus, to a better understanding of the non-CO2 impact of aviation on global warming and reducing their associated uncertainties as essential steps towards green aviation. The specific objectives are:

O-1 is to develop remote sensing algorithms for the detection of contrails and aviation-induced cloudiness.

O-2 is to quantify the radiative forcing of ice clouds based on remote sensing and radiative transfer methods.

O-3 is to use deep learning architectures to generate AI models capable of predicting the radiative forcing of contrails based on data-archive numerical weather forecasts and historical traffic. We will make use of Convolutional Neural Networks (CNNs), together with transfer learning from already-existing models, as well as recurrent networks such as Long-Short Terms Memory (LSTM), and generative models such as Generative Adversarial Networks (GANs) and variational autoencoders (VAEs).

O-4 is to assess the climate impact and develop a visualization tool in a dashboard.

Lead	Objective	SESAR solution	Work package	Deliverable
UC3M	O1. To develop remote sensing algorithms for the detection of contrails and aviation-induced cloudiness.		WP1	D.1.1 Data acquisition, parsing, and processing
				D.1.2 Contrail tracking algorithm
RMI	O2. To quantify the radiative forcing of ice clouds based on remote sensing and radiative transfer methods.		WP2	D.2.1 Report on the cirrus cloud properties retrieval with MSG.
				D.2.2 Scientific Look Up Tables of the cirrus cloud radiative forcing
				D.2.3 Cirrus cloud radiative forcing data record



				D.2.4 Report on all WP2 activities including transition to MTG and EarthCARE evaluation
KTH	O3. To use of deep learning architectures to generate AI models capable of predicting the radiative forcing of contrails based on data-archive numerical weather forecasts and historical traffic.		WP3	D.3.1 Relevant data for deep-learning models.
				D.3.2 Deep-learning-based temporal predictions.
				D.3.3 Deep-learning-based spatial predictions.
BIRA	O4. To assess the climate impact and develop a visualization tool in a dashboard.	Demonstration of E-CONTRAIL dashboard tool.	WP4	D.4.1 Solution side
				D.4.2 Definition of E-CONTRAIL Aviation Contrails Detection Products and Archive.
				D.4.3 Presentation of E-CONTRAIL Dashboard Visualization Tool
				D.4.4 Solution Slides (Intermediate version)
				D.4.5 Solution Slides (Final)

Table 1: List of deliverables

## 2.2 Project milestones

Scope	Objective	SESAR solution	Work package	Milestone
UC3M	O1. To develop remote sensing algorithms for the detection of contrails and aviation-induced cloudiness.		WP1	MS-4. Contrail tracking algorithm (D.1.2)
RMI	O2. To quantify the radiative forcing of ice clouds based on remote sensing and radiative transfer methods.		WP2	MS-5. Maps of contrails & aviation-induced cloudiness RF-ERF (D.2.3)

KTH	O3. To use of deep learning architectures to generate AI models capable of predicting the radiative forcing of contrails based on data-archive numerical weather forecasts and historical traffic.		WP3	MS-6. AI-Model trained (D.3.2)
BIRA	O4. To assess the climate impact and develop a visualization tool in a dashboard.	Demonstration of E-CONTRAIL dashboard tool.	WP4	
UC3M	The goal of this WP is to effectively fulfil all the administrative, contractual, financial and technical aspects of the coordination of the project.		WP5	MS-1. Consortium Agreement Signed
				MS-2. TEAM's Software in place
				MS-3. Kick-off Meeting
				MS-8. Latest date for technical deliverables for maturity gate
				MS-9. Exit maturity gate
UC3M	Coordinate all E-CONTRAIL dissemination, exploitation, and communication, and data management activities while ensuring that the different targets have been reached.		WP6	MS-7. Demonstration of E-CONTRAIL dashboard tool.

Table 2: List of milestones

### 3 Project management and organisation

#### 3.1 Management structure



Figure 1: Management Structure Chart

#### 3.2 Organisation and roles

The tables below elaborate on section 3.2 of Annex 1 Part B of the Grant Agreement (101114795) [1] and provide the names of the people allocated to the various teams / roles in the project.

In this project, a lean and efficient management structure will be applied. This structure allows for fast decision making. All of the project management activities are included in WP5. This approach will allow an effective and efficient assignment of partner contributions, while facilitating separation of research and technology tasks from the administrative works necessary to carry out the project.

The combined legislative-executive level is composed of the Project Coordinator (PC) and the General Assembly (GAss). It is supported by the Project Manager (PM) and the person in charge of the Dissemination and Communication Board.

Additionally, E-CONTRAIL project has an external reference person to act as Advisory Board (AB), understanding needs and barriers to overcome. In addition, the AB will advise the projects in all its phases to achieve goals relevant to the different stakeholders and key actors. It will also support the project consortium by linking it to other interest groups.

The PM, as a central point of reference, participates in activities of all these boards, coordinating the operational day-to-day management tasks. The PM reports to SESAR JU on behalf of the consortium.

### 3.2.1 Project management team

A descripción of the team and its responsibility is presented in the table 3.

Role <sup>3</sup>	Description	Name	Beneficiary
Project manager	The PM, as a central point of reference, participates in activities of all boards, coordinating the administrative day-to-day management tasks, resolves conflicts and monitors the work progress with respect to the project plan. The PM shall be the intermediary between the Parties and SESAR JU, as Funding Authority.	MGracia Pérez	UC3M
Project coordinator <sup>4</sup>	The PC performs the day-to-day management of the project on the executive and technical level, and shall perform all tasks assigned to it as described in the Grant Agreement (Annex 1, part B).	Manuel Soler	UC3M
Risk manager	Responsible for identifying and reporting RIOs; defining appropriate mitigation actions; monitoring and tracking the status of their implementation; communicating about RIO status and actions undertaken.	MGracia Pérez	UC3M
CDE lead	Plan, document and produce CDE activities	Virginia Villaplana	UC3M
Quality lead	Responsible for submitting the deliverables baselined in the GA in line with the baseline schedule and the applicable quality requirements. Care must be taken to ensure that all contributors have reviewed and agreed with the deliverable submission (internal to the project quality insurance). Any quality/review issue must be reported by the project manager to the SESAR 3 JU.  Is also responsible to follow up on the quality assessment outcome in case corrections are required.	Manuel Soler; MGracia Pérez	UC3M
External Advisor	External reference person to act as Advisory Board (AB), understanding needs and barriers to overcome. It will also support the project consortium by linking it to other interest groups.	Klaus Sievers	

**Table 3: Project management team roles**

<sup>3</sup> Definitions of typical roles are provided in the Project Handbook

<sup>4</sup> As defined in the Grant Agreement.

### 3.2.2 Project management board

Role	Description	Name	Beneficiary
Chair	Owner of the Project Management Plan. Manages and supervises the correct execution of the project within costs, schedule, and risks as agreed in the proposal. Manages the internal communication in the project.	MGracia Pérez	UC3M
PC	As PC, advises and supervises the project management board	Manuel Soler	UC3M
Member	WP2 Leader. Responsible for coordinating the work of his work package. The scientific and technical progress of the activities. Planning, monitoring and reporting (periodic reports and deliverables) of its task. Submitting the required scientific, technical, financial and administrative data.	Pierre de Buyl	RMI
Member	WP3 Leader. Responsible for coordinating the work of her work package. The scientific and technical progress of the activities. Planning, monitoring and reporting (periodic reports and deliverables) of its task. Submitting the required scientific, technical, financial and administrative data.	Evelyn Otero	KTH
Member	WP3 Leader. Responsible for coordinating the work of his work package. The scientific and technical progress of the activities. Planning, monitoring and reporting (periodic reports and deliverables) of its task. Submitting the required scientific, technical, financial and administrative data.	Hugues Brenot	BIRA
Member	WP6 Leader. Plan, document and produce CDE activities	Virginia Villaplana	UC3M

**Table 4: Project management board roles**

### 3.2.3 Stakeholders

Stakeholder	Description	Interest(s)	Engagement <sup>5</sup>
UC3M	Project partners	Leader of WP1, academic institution; interest in air traffic management, artificial intelligence, meteorology, climate change	Responsible

<sup>5</sup> RACI matrix: Responsible, accountable, consulted, informed roles.

RMI	Project partners	Leader of WP2, meteorological office. Interest in remote sensing, climate change	Responsible
KTH	Project partners	Leader of WP3, academic institution. Interest in artificial intelligence	Responsible
BIRA	Project partners	Leader of WP4, research centre; Interest in air traffic management, meteorology, remote sensing	Responsible
Klaus Sievers	Advisor	Aviation expert; viewpoint of the end user (pilots, airlines)	Consulted
IntelMet Solutions	Potential commercializer of results	Spinoff company; meteorology and air traffic management	Consulted
	End users		Consulted
Eurocontrol (environmental office)		Development of climatic indicators	
SESAR 3 JU		Incorporate new solutions. Pass maturity gates and scale in the TRL pipeline to include future topics in ATM applied research and/or Industrial Research tracks.	Accountable
European Commission	Funding entity		Accountable

Table 5: Stakeholder matrix

### 3.3 Internal project communication

#### 3.3.1 Internal Communication

In the E-CONTRAIL project, internal communication is essential for a correct functioning and a more efficient work, that is why we have set up a specific tool for this purpose, Microsoft Teams (MS-Teams). Different channels have been created to centralize the work of each specific WP and a main channel to be used for general issues. MS-Teams is used for the daily communication and a file repository. Where important documents, templates and necessary information, among other things will be stored.

#### 3.3.2 Meeting management

The meetings and their objectives are the following:

- The Kick-off meeting took place at M0 and it is an SJU official meeting. It aims at informing the project partners about the operational and applicable financial provisions in more detail, and reviewing the project objectives, organisation, deliverables, resources, planning, communication and dissemination activities and other relevant information as outlined in Annex I of the GA.

- The face-to-face GAss meetings are planned every 6 months on site. They aim to manage the overall strategic and financial development of the project, deciding upon risk or opportunity situations, and addressing any administrative problems.
- Progress meetings. Planned monthly online, the purpose of these meetings is to supervise the development of the technical activities, and coordinate all pending and upcoming actions. These meetings are one of the fundamental tools for short-time-scale project management. They will be held on the first Wednesday of each month. The PM may arrange additional topical meeting at the request of a member, if any technical or administrative issue requires attention.
- The Project Intermediate Review meeting is planned between month 12 and 14 and it is an SJU official meeting. It is supported by the Periodic Technical and Financial Report (M12). It consists of a presentation summarizing the progress and technical results achieved during the first 12 months. It is aimed at assessing the progress and steering the project if necessary to achieve the expected quality and maturity at the Project Gate (Final Review). A review of top-level Risks and Issues will be done to ensure appropriate actions. A Review Report will be issued by the SJU through the EC Portal and the SESAR 3 JU's collaboration platform (STELLAR).
- The Final Review Meeting is planned at M24 and it is an SJU official meeting. It will be organized following the submission of: All technical deliverables including the Final Project Results Report; Maturity Gate presentation and Maturity Self-Assessment; and the submission at M24 of the 2nd Annual Progress Report. It is Supported by continuous reporting on EC Portal and SESAR 3 JU's collaboration platform. It is aimed at:
  - Assessing the achieved Maturity
  - Having a discussion on the project scientific results as documented in the Final Project Results Report and on the achievement of project objectives
  - Discussing the Recommendations for the next R&D Phase
  - A Maturity Gate Report will be issued by the SJU
- The Project Close-out meeting is planned at M30. It is aimed at discussing the outcome of the performed communication and dissemination activities and the feedback received from the R&D Community. It will also serve to review pending actions and formally close the project.

Meetings will be scheduled at least six months (ideally one year) ahead of time to allow all the parties involved to perform their own arrangements.

The PM will provide to the participants, before each meeting, an agenda including the points to be addressed. For all the meetings, the PM will prepare a presentation describing the overall status of the project and will deliver it at the meeting.

The project meetings (including GAss meetings and SJU meetings), along with the due dates and locations, are listed in Table 6.

Meetings	Date	Location
Kick off Meeting. SJU + GAss meeting	M1 (June 23)	Madrid
2º GAss Meeting	M8 (January 24)	Stokhom
3º GAss Meeting + Intermediate Review Meeting	M13/14 (June/July 24)	Brussels
4º GAss Meeting	M19/20 (Dic 24/January 25)	Madrid
5º GAss Meeting + Final Review Meeting + Maturity Gate	M25/26 (June/July 25)	Brussels
Closeout Meeting	M30 (Nov 25)	

Table 6: List of meetings

### 3.3.3 Minutes of meeting management

The PM is responsible of taking minutes of every meeting. The minutes of the meetings will be managed according to the following process:

- Within 10 days of the meeting, the PM will send a draft version of the minutes for revision to the members who participated in the meeting for their review and comments.
- The minutes shall be considered as accepted if, within 15 calendar days from receipt, no Party has sent any objection to the PM with respect to the accuracy of the draft minutes.
- The PM will upload the accepted minutes to the consortium file repository (“general” directory in MS-Teams) shared by the consortium.

In case that the SJU participates in the meeting, the PM will send the internally-revised version of the minutes to the SJU for further revision before accepting the minutes.



## 4 Quality management plan

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### 4.1 Management processes for ensuring adherence to Horizon Europe rules and SESAR 3 JU project handbook

In E-CONTRAIL we will work together as a consortium to archive all the objectives that are set out in the GA [1], following the Horizon Europe rules and the recommendations and step described in SESAR 3 JU Project Handbook [2] and all the recommended guidelines, in order to ensure the consistency of project data.

The ultimate responsible for ensuring the adherence to the HE rules and SESAR 3 JU project handbook is the coordinator of the project (UC3M). The work package leaders are co-responsible for their work packages.

The process to ensure adherence is described in point 4.2 and its subsections.

### 4.2 Quality process

The E-CONTRAIL consortium brings together a catalogue of reputed scientists in different fields contributing to the needed interdisciplinarity, covering the whole spectrum from basic research in geosciences (including Earth observation, weather observation, space weather, climatic impact) to Air Traffic Management experts. Note that these scientists are not only reputed in their fields of expertise, yet they have been involved during the last years in ATM applied research. Thus, they have proven experience in bringing in knowledge and expertise from other fields to ATM/Aviation research.

E-CONTRAIL has a strong commitment with excellent science and will pursue it through:

- Review work package documentation deliverables.
- Do internal peer-review of conference and journal papers before submission.
- Assess the technical and scientific achievements of the work package outputs.
- Comment upon WP progress with respect to the proposed schedule when appropriate.
- Provide general feedback, and when necessary, recommendations that will assist the management team and project coordinator in fulfilling their roles.

#### 4.2.1 Quality for validation activities

E-CONTRAIL is an exploratory research / fundamental science solution project, aiming at formulating and preliminarily testing a concept, achieving TRL 1. Since it is not aiming at the advanced development of a solution, the validation activities are limited. Notwithstanding this, the project coordinator will supervise the validation activities and report on them in the following deliverables:

Del. Nº	Del. Name	Date	Definition
D5.2	Exploratory research plan (ERP)	M6 (Nov 23)	The exploratory research plan describes the way in which one or more validation exercises or activities are to be prepared and executed in order to achieve the validation objectives of an Exploratory Research project.
D5.4	Exploratory research report (ERR)	M13 (June 24)	The exploratory research report consolidates the results obtained by an exploratory research project once the validation activities, experiments, etc, have been completed.
D5.8	Exploratory research report (final)	M22 (March 25)	

**Table 7: Digital European Sky programme deliverables**

#### 4.2.2 Deliverable quality process

Each WP is led by a WP Leader (WPL), who manages and monitors the progress of the tasks and the deliverables of their WPs through a continuous dialogue with the GAss. Each WPL is responsible for:

- Coordinating the work of his WP.
- The scientific/technical progress of the activities in the WP.
- The planning, monitoring and reporting (periodical reports & deliverables) of each task in his/her WP.
- Using the Official Templates published in the STELLAR portal.

Before the submission of a project deliverable, it will be reviewed and approved according to the following process:

- At least 20 days before the due date of the deliverable, the WP Leader responsible of producing the deliverable will send a draft version to the members of the project for revision.
- Within 7 days after receiving the draft, the reviewers will provide, if any, their comments.
- At least 5 days before the due date, the WP Leader will send a revised version of the draft addressing the comments given in the revision to the members of the project
- The process will be iterated until the approval of the PC. Before the due date, the PM will submit the approved deliverable to the SJU portal and EC Portal.

WP	Deliverable	Lead	Estimated date	
WP1	D1.1 Data acquisition	UC3M	M08	2024-01
	D1.2 Control tracking and aviation-induced cloudiness algorithm	UC3M	M10	2024-03
WP2	D2.1 Report on the cirrus cloud properties retrieval with MSG.	RMI	M08	202401
	D2.2 Scientific Look Up Tables of the cirrus cloud radiative forcing, +README.	RMI	M12	2024-05

	D2.3 Cirrus cloud radiative forcing data record, +README.	RMI	M18	2024-11
	D2.4 Report on all WP2 activities, including transition to MTG and EarthCARE evaluation	RMI	M22	2025-03
WP3	D3.1 Relevant data for deep-learning models	KTH	M03	2023-08
	D3.2 Deep-learning-based temporal predictions.	KTH	M15	2024-08
	D3.3 Deep-learning-based spatial predictions.	KTH	M22	2025-03
WP4	D4.1 Solution Slides	UC3M	M13	2024-06
	D4.2 Definition of E-CONTRAIL Aviation Contrails Detection Products and Archive.	BIRA	M14	2024-07
	D4.3 Presentation of E-CONTRAIL Dashboard Visualization Tool.	BIRA	M22	2025-03
	D4.4 Solution Slides (Intermediate version)	UC3M	M22	2025-03
	D4.5 Solution Slides (Final)	UC3M	M24	2025-05
WP5	D5.1 Project management plan	UC3M	M03	2023-08
	D5.2 Exploratory research plan (ERP)	UC3M	M06	2023-11
	D5.3 Concept outline	UC3M	M13	2024-06
	D5.4 Exploratory research report	UC3M	M13	2024-06
	D5.5 Project Management Plan (Intermediate Version)	UC3M	M13	2024-06
	D5.6 Project Management Plan (final )	UC3M	M22	2025-03
	D5.7 Concept outline (Final)	UC3M	M22	2025-03
	D5.8 Exploratory research report (final)	UC3M	M22	2025-03
	D5.9 Final project report	UC3M	M24	2025-05
WP6	D6.1 Dissemination Exploitation and Communications Plan	UC3M	M03	2023-08
	D6.2 Data Management Plan	BIRA	M06	2023-11
	D6.3 Dissemination Exploitation and Communications Plan (Intermediate)	UC3M	M13	2024-06
	D6.4 Data Management Plan (Intermediate)	BIRA	M13	2024-06
	D6.5 Data Management Plan (final)	BIRA	M29	2025-10
	D6.6 Dissemination Exploitation and Communications Plan (Final)	UC3M	M29	2025-10

**Table 8: List of work packages and deliverables leaders**

#### 4.2.2.1 Intellectual property rights (IPR)

IPR will be governed by the GA and the Consortium Agreement (CA) [4], which has been signed by the members of the consortium. The principal mechanisms that this agreement will incorporate are:

#### 4.2.2.1.1 Ownership of Results

- Results are owned by the Party/Parties (or employees in case an imperative law is applicable) that generates them.
- Joint ownership: Where Results are generated from work carried out jointly by two or more Parties and where their respective contribution to the joint Results cannot be ascertained or it is not possible to separate such joint Results for the purpose of applying for, obtaining or maintaining the relevant intellectual property rights protection, they shall have joint ownership of those Results. Each joint owner shall have a share in and to a joint Result, as well as in and to resulting Intellectual Property Rights in accordance with its contribution to the joint Result. Such share will be determined by taking into account in particular, but not limited to, the contribution of a joint owner to an inventive step, the person months or costs spent on the respective work.

Unless otherwise agreed in a separated ownership written agreement:

- Each of the joint owners shall be entitled to use their jointly owned Results for non-commercial research activities, including public funded projects and educational purposes, on a royalty-free basis, and without requiring the prior consent of the other joint owner(s), and
- Each of the joint owners shall be entitled to otherwise Exploit the jointly owned Results and to grant non-exclusive licenses to third parties (without any right to sub-license), if the other joint owners are given:
  - o at least 45 calendar days advance notice; and
  - o Fair and Reasonable compensation.

The joint owners shall agree on all protection measures and the division of related cost in advance.

#### 4.2.2.1.2 Transfer of Results

- Each Party/Parties (or employees in case an imperative law is applicable) may transfer ownership of its own Results, including its share in jointly owned Results, following the procedures of the Grant Agreement Article 16.4 and its Annex 5, Section Transfer and licensing of results, sub-section “Transfer of ownership”.
- Each Party may identify specific third parties it intends to transfer the ownership of its Results to in Attachment (3) of the Consortium Agreement. The other Parties hereby waive their right to prior notice and their right to object to such a transfer to listed third parties according to the Grant Agreement Article 16.4 and its Annex 5, Section Transfer of licensing of results, sub-section “Transfer of ownership”, 3rd paragraph.
- The transferring Party shall, however, at the time of the transfer, inform the other Parties of such transfer and shall ensure that the rights of the other Parties under the Consortium Agreement and the Grant Agreement will not be affected by such transfer. Any addition to Attachment (3) after signature of the Consortium Agreement requires a decision of the General Assembly.
- The Parties recognise that in the framework of a merger or an acquisition of an important part of its assets, it may be impossible under applicable EU and national laws on mergers and acquisitions for a Party to give at least 45 calendar days prior notice for the transfer as foreseen in the Grant Agreement.
- The obligations above apply only for as long as other Parties still have - or still may request - Access Rights to the Results.

### 4.2.3 Maturity assessment

The maturity assessment consists of checking whether or not the set of SESAR maturity criteria for a given TRL maturity phase are successfully achieved for the SESAR solution under analysis. It is supported by a maturity assessment tool (MAT) provided by the SESAR 3 JU.

Thus, after defining the solution and its target TRL level, we provide will a maturity self-assessment. See the criteria to be satisfied for a solution targeting TRL1 (see Table 9) and for a solution targeting TRL2 (see Table 10). We will thus provide a rationale to all the criteria.

ID	Criteria	Satisfaction	Rationale - Link to deliverables - Comments
TRL 1.1	<p>Has the ATM problem/challenge/need(s) that innovation would contribute to solve been identified?</p> <ul style="list-style-type: none"> <li>- Where does the problem lie?</li> <li>- Has the ATM problem/challenge/need(s) been quantified that justify the research done? Note: an initial estimation is sufficient</li> </ul>	<p>Achieved</p> <p>Not Achieved</p> <p>Partially Achieved</p>	
TRL 1.2	<p>Have the solutions (concepts/capabilities/methodologies) under research been defined and described?</p>	<p>Achieved</p> <p>Not Achieved</p> <p>Partially Achieved</p>	
TRL 1.3	<p>Have assumptions applicable for the innovative concept/technology been documented?</p>	<p>Achieved</p> <p>Not Achieved</p> <p>Partially Achieved</p>	
TRL 1.4	<p>Have the research hypothesis been formulated and documented?</p>	<p>Achieved</p> <p>Not Achieved</p> <p>Partially Achieved</p>	
TRL 1.5	<p>Do the obtained results from the fundamental research activities suggest innovative solutions (e.g. concepts/methodologies/capabilities)?</p> <ul style="list-style-type: none"> <li>- What are these new concepts/methodologies/capabilities?</li> <li>- Can they be technically implemented?</li> </ul>	<p>Achieved</p> <p>Not Achieved</p> <p>Partially Achieved</p>	

TRL 1.6	<p>Have the potential strengths and benefits of the solution identified and assessed?</p> <p>- Qualitative assessment on potential benefits. This will help orientate future validation activities. Optional: It may be that quantitative information already exists; in which case it should be used.</p>	<p>Achieved</p> <p>Not Achieved</p> <p>Partially Achieved</p>	
TRL 1.7	<p>Have the potential limitations, weaknesses and constraints of the solution under research been identified and assessed?</p> <p>- The solution under research may be bound by certain constraints, such as time, geographical location, environment, cost of solutions or others.</p> <p>- Qualitative assessment on potential limitations. This will help orientate future validation activities. Optional: It may be that quantitative information already exists; in which case it may be used.</p>	<p>Achieved</p> <p>Not Achieved</p> <p>Partially Achieved</p>	
TRL 1.8	<p>Do fundamental research results show contribution to the Programme strategic objectives ,e.g., performance ambitions identified at the ATM MP Level?</p>	<p>Achieved</p> <p>Not Achieved</p> <p>Partially Achieved</p>	
TRL 1.9	<p>Have stakeholders been identified, consulted and involved in the assessment of the results? Has their feedback been documented in project deliverables? Have stakeholders shown their interest on the proposed solution?</p>	<p>Achieved</p> <p>Not Achieved</p> <p>Partially Achieved</p>	
TRL 1.10	<p>Have initial scientific observations been communicated and disseminated (e.g., technical reports/journals/conference papers)?</p>	<p>Achieved</p> <p>Not Achieved</p> <p>Partially Achieved</p>	
TRL 1.11	<p>Are recommendations for further scientific research documented?</p>	<p>Achieved</p> <p>Not Achieved</p> <p>Partially Achieved</p>	

Table 9: ER Fund / AO Research Maturity Assessment – Pre-TRL1 to TRL1

ID	Criteria	Satisfaction	Rationale - Link to deliverables - Comments
OPS.ER.1	Has a potential new idea or concept been identified that employs a new scientific fact/principle?	Achieved Not Achieved Partially Achieved	
OPS.ER.2	Have the basic scientific principles underpinning the idea/concept been identified	Achieved Not Achieved Partially Achieved	
OPS.ER.3	Does the analysis of the "state of the art" show that the new concept / idea / technology fills a need?	Achieved Not Achieved Partially Achieved	
OPS.ER.4	Has the new concept or technology been described with sufficient detail? Does it describe a potentially useful new capability for the ATM system?	Achieved Not Achieved Partially Achieved	
OPS.ER.5	Are the relevant stakeholders and their expectations identified?	Achieved Not Achieved Partially Achieved	
OPS.ER.6	Are there potential (sub)operating environments identified where, if deployed, the concept would bring performance benefits?	Achieved Not Achieved Partially Achieved	
SYS.ER.1	Has the potential impact of the concept/idea on the target architecture been identified and described?	Achieved Not Achieved Partially Achieved	

SYS.ER.2	Have automation needs, e.g., tools required to support the concept/idea been identified and described?	Achieved Not Achieved Partially Achieved	
SYS.ER.3	Have initial functional requirements been documented?	Achieved Not Achieved Partially Achieved	
PER.ER.1	Has a feasibility study been performed to confirm the potential feasibility and usefulness of the new concept / idea / Technology being identified?	Achieved Not Achieved Partially Achieved	
PER.ER.2	Is there a documented analysis and description of the benefit and costs mechanisms and associated Influence Factors?	Achieved Not Achieved Partially Achieved	
PER.ER.3	Has an initial cost / benefit assessment been produced?	Achieved Not Achieved Partially Achieved	
PER.ER.4	Have the conceptual safety benefits and risks been identified?	Achieved Not Achieved Partially Achieved	
PER.ER.5	Have the conceptual security risks and benefits been identified?	Achieved Not Achieved Partially Achieved	
PER.ER.6	Have the conceptual environmental impacts been identified?	Achieved Not Achieved Partially Achieved	



PER.ER.7	Have the conceptual Human Performance aspects been identified?	Achieved Not Achieved Partially Achieved	
VAL.ER.1	Are the relevant R&D needs identified and documented?  <i>Note: R&amp;D needs state major questions and open issues to be addressed during the development, verification and validation of a SESAR Solution. They justify the need to continue research on a given SESAR Solution once Exploratory Research activities have been completed, and the definition of validation exercises and validation objectives in following maturity phases.</i>	Achieved Not Achieved Partially Achieved	
TRA.ER.1	Are there recommendations proposed for completing V1 (TRL-2)?	Achieved Not Achieved Partially Achieved	

Table 10: ER Fund / AO Research Maturity Assessment TRL1 – TRL2

#### 4.2.4 Maturity gate

The purpose of this phase is to assess and agree on the actual maturity (TRL) of a SESAR solution; and subsequently, to agree on recommendations and perform an RIO assessment for the next phase of maturity development. In E-CONTRAIL, the target TRL for the single solution of the project is TRL2. The management of the Maturity Gate is summarized in table x and is described in detail below.



Figure 2. Maturity Gate Overview

The **planning the exit maturity gate session (0)** has already been performed. E-CONTRAIL project has established in the Annex 1. Description of Action (part b) Grant Agreement to execute the exit maturity gate session on M24.

The **submission of the Technical deliverables in STELLAR (A)**, relevant for the maturity gate process of the solution, is scheduled for M22. At this point, the PM, under the direction of the PC, will:

1. Propose and agree with the SESAR 3 JU on an available time slot for the exit maturity gate session
2. Perform the maturity self-assessment in STELLAR
3. Begin the preparation of the exit maturity gate session presentation

The **preparation and execution of the exit maturity gate session (B)** includes the reception of any feedback from the SESAR 3 JU regarding the maturity of the SESAR solution, including inputs from the review panel: transversal projects / SESAR 3 JU experts / external experts supporting the SESAR 3 JU. This is planned to occur 15 days prior to the meeting.

At the exit maturity gate, the PC will

1. Provide a presentation on the SESAR solution: scope, validation results and benefits, ...
2. Provide feedback on the maturity concerns raised by the review panel
3. Present the project maturity self-assessment for the SESAR solution
4. Present the project plans for the next maturity phase (if applicable)

With this information, the review panel is expected to:

1. Conclude on the maturity achieved by the SESAR solution
2. Identify risks, issues and opportunities
3. Allocate required actions, e.g., to update SESAR solution technical deliverables

As a result of this process, a **decision on the Maturity Gate (C)** will take place. Possible outcomes, as defined in DES ER 1 Projects KoM Slides [5], are listed in table 11.

Exit Maturity gate decision	Exit Maturity gate status
<b>COMPLETED</b>	<ul style="list-style-type: none"> <li>TRLx successfully achieved</li> <li>No risks or issues identified</li> </ul>
<b>COMPLETED – WITH ACCEPTABLE RISKS</b>	<ul style="list-style-type: none"> <li>TRLx successfully achieved: technical deliverables and results are sufficient to pass this gate</li> <li>Non-blocking concerns can be addressed in next TRL phase</li> <li>Risks and issues (and mitigation actions) recorded in STELLAR</li> </ul>
<b>ACHIEVED-P</b>	<ul style="list-style-type: none"> <li>TRLx successfully achieved</li> <li>No formal maturity gate: TRLx justified by solution maturity self-assessment</li> </ul>
<b>CONDITIONAL</b>	<ul style="list-style-type: none"> <li>The maturity gate cannot conclude e.g. missing evidence, which can be addressed in a relatively short timeframe as part of the project activities</li> <li>Requires a follow-up maturity gate</li> </ul>
<b>CLOSED</b>	<ul style="list-style-type: none"> <li>The solution did not provide expected benefits, proved unfeasible, etc. and it is proposed to be closed since it does not justify additional R&amp;I work</li> <li>Opportunities for future R&amp;I activities may be recorded in STELLAR</li> <li>This may trigger need for Grant Amendment</li> </ul>
<b>NOT COMPLETED</b>	<ul style="list-style-type: none"> <li>TRLx not achieved</li> <li>Blocking concerns mean that further R&amp;I activities are required before completing TRLx</li> <li>This may trigger need for Grant Amendment</li> </ul>

Table 11. Maturity Gate Decision

Finally, SESAR will **publish the solution technical deliverables (D)** on the SESAR 3 JU website.

#### 4.2.5 Change management

In case that one of the partners is interested in making a change, he will send a duly justified request to the PC, and then the PC will pass the request to the GAss. Within 15 days after receiving the request, the GAss will approve or reject the request. If the request is accepted by the GAss, a request for change will be sent to the SJU via the Programme Manager.

#### 4.2.6 Project review

The PC will coordinate the preparation of the project reports to the SJU and has final responsibility for editing according to a standard layout and for the distribution. The periodic reports will be submitted via the HE Funding & Tenders Opportunities portal and SESAR 3 JU's collaboration platform within 60 working days following the end of the two Reporting Periods established in the GA, namely:

- RP1: from month 1 to month 12
- RP2: from month 13 to month 30

The Final Project Report will be delivered within 60 days from the completion of the project.

##### 4.2.6.1 Periodic Reports

For the elaboration of the Periodic Reports, each WP Leader is responsible for producing, by the end of the reporting period, of cost statements and management control reports that contain the current status of the active work packages he/she is performing as a reference, these periodic reports include:

1. The Periodic Technical Report containing:
  - An explanation of the work carried out by the beneficiaries.
  - An overview of the progress towards the objectives of the action, including milestones and deliverables, and the monitoring of risks. If any, this report must include explanations justifying the differences between work expected to be carried out in accordance with GA and that actually carried out.
  - The report must detail the exploitation and dissemination of the results.
  - The report must indicate the communication activities.
  - A summary for publication by the JU.
2. The Periodic Financial Report containing:
  - An 'individual financial statement' (Annex 4 in the GA) from each beneficiary, for the reporting period concerned. The individual financial statement must detail the eligible costs for each budget category (Annex 2 in the GA).
  - An explanation of the use of resources and the information on subcontracting (if any) and in-kind contributions provided by third parties (in any) from each beneficiary, for the reporting period concerned.

- A 'periodic summary financial statement', created automatically by the electronic exchange system, consolidating the individual financial statements for the reporting period concerned and including — except for the last reporting period — the request for interim payment.

#### 4.2.6.2 Final Technical and Financial Reports

The Final Report covers the whole project and is composed of a Technical and Financial part. It is delivered within 60 days from the completion of the project.

Among others, the Technical Report provides:

- An overview of the results and their exploitation and dissemination;
- The conclusions.
- The socio-economic impact.
- The validation report.

The Final Financial Report, includes:

- A 'final summary financial statement', created automatically by the electronic exchange system, consolidating the individual financial statements for all reporting periods and including the request for payment of the balance.
- A 'certificate on the financial statements', drawn up in accordance with Annex 5 in GA [1] for each beneficiary.

#### 4.1.1.5 Final Project Results Report

The Final Project Results (deliverable D5.9) covers all the research activities performed by the project, based on a template to be provided by the SJU. This report will be used at the Final Review Meeting and Maturity Gate to discuss the transition to subsequent development stages including a self-assessment of the TRL achieved at the end of the project. The SJU will verify the maturity achieved in order to establish the appropriate transition of the results to subsequent phases. This report will be delivered to the SJU for approval on Month 24.

## 5 Risk management plan

### 5.1 Risk, issue and opportunity (RIO) management process

The PM together with the PC and GAss are responsible for identifying, monitoring, reporting and managing the risks, issues and opportunities that may affect the progress or results of the project throughout its life. They will be managed as follows:

3. Identifying and classifying RIOs. Several potential risks have already been identified at proposal time; the PM, PC and GAss will remain alert to identify new ones.
4. Defining appropriate mitigation/avoidance actions.
5. Monitoring and tracking the status of the mitigation/avoidance action implementation.
6. Updating, at least, every 6 months at the GAss meetings, the list of risks in the SESAR 3 JU'S collaboration platform and EC Portal.
7. Escalating RIOs to SJU and EC as necessary.
8. Communicate about RIOs status and actions undertaken as necessary.

The PM will keep record of all identified RIOs in a RIO Register in MS Excel, which will be shared with the GAss via the internal consortium repository (MS Teams). The initial version of the RIO Register, consisting of the risks identified in the E-CONTRAIL proposal, are presented in the next Table 12.

Risk number	Description	WP	Mitigation
1	Inadequate coordination	WP5	Severity: High. Likelihood: Low (The project Coordinator has experience in coordinating 2 SESAR projects: START and ALARM). Mitigation: Discussion with SESAR JU leading possibly to changes in the grant agreement.
2	Conflicts between partners	WP5	Severity: Medium. Likelihood: Low (All partners have experience in working in EU projects. Moreover, they have had successful collaborative experiences in the past, as Section 3.6 indicates). Mitigation: Any unsolved conflict will be addressed at Steering Board level voting if disagreement persists.
3	Withdrawal of partner	All	Severity: High. Likelihood: Low (All partners have shown strong commitment and interest during the preparation of the proposal). Mitigation: Discussion with SESAR JU leading to an amendment to the Grant Agreement.

4	Major delays in milestones	All	Severity: High. Likelihood: Low (All partners have vast experience in their disciplines, respectively. They have been solving similar problems in the past and all agree the time allocated is enough to carry out the tasks). Mitigation: Discussion between the coordinator and the WP leaders to find alternatives.
5	Delay in the availability of MTG data	WP2	Severity: Medium. Likelihood: Low (MTG is a high priority mission for EUMETSAT and there is no information about further delays in its launch). Mitigation: Use of data from the current satellite (lower resolution) as an interim and validation using the upcoming EarthCARE satellite (high spatial resolution and broadband radiometer).
6	IPR issues	All	Severity: High. Likelihood: Low (a clear and detailed definition of the IPR strategy among all involved actors will be stated in the Consortium Agreement. IPR monitoring will be a recurrent agenda item in all SB meetings.). Mitigation: Discussion with the partners
7	AI models not working	WP3	Severity: High. Likelihood: Low (KTH, leader of WP3 has extensive experience in building deep learning models. Moreover, UC3M and KTH have successfully implemented models for weather forecasting). Mitigation: use of traditional neural networks (multi-layer perceptron).
8	Implementation of Aviation Contrails Detection Products	WP4	Severity: High. Likelihood: High (All partners have vast experience in their disciplines, respectively. They have been solving similar problems in the past and all agree the time allocated is enough to carry out the tasks). Mitigation: Discussion between partner to obtain the best successful rate.
9	Creation and Demonstration of E-CONTRAIL Dashboard	WP4	Severity: High. Likelihood: Low (BIRA has experience in making visualization tool. In addition, BIRA has experience in making demonstration of system combining different types of information. The demonstration will rely on the quality and success of the detection and prediction products. Mitigation: Discussion in between partners to fix the issue in detection/prediction of contrail and RF

**Table 12: List of RIO**

## 6 Performance management

We will follow the SESAR 3 JU performance management process as described in the figure below:

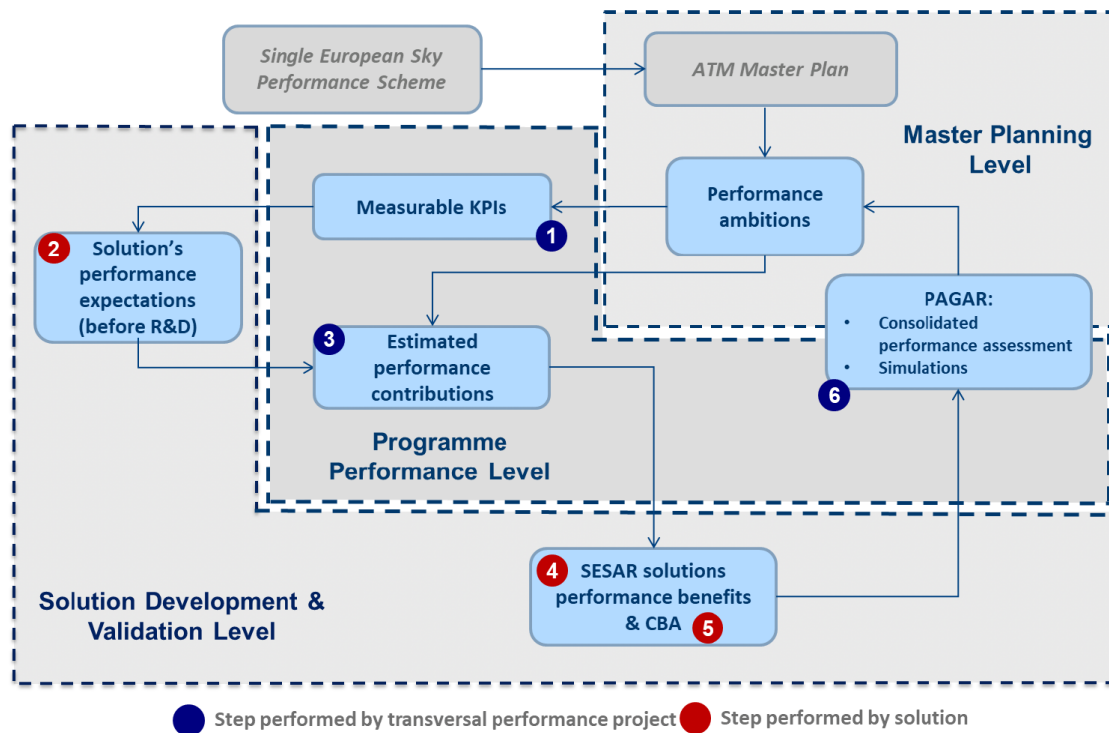


Figure 3: experimental Research plan (From the SJU3 Project Handbook)

E-CONTRAIL will thus follow the following scheme:

1. We will identify those Key Performance Areas (KPA) in which E-CONTRAIL solution is expected to bring benefits. Tentatively, the main KPA will be "Environment".
2. We will also identify existing Key Performance Indicator (KPI) to measure the performance impact. Since E-CONTRAIL deals with non-CO<sub>2</sub> impacts, we believe these KPI do not exist. We will then try to provide new KPIs to measure the impact. This will be defined in the experimental Research plan.
3. The estimated contributions in the area of "Environment" via KPIs will be defined in the experimental Research plan. This will come together with the Research Questions to be answered and the Hypotheses to be verified.
4. The experimental exercises will be executed. The obtained contributions measured using the KPIs in the area of environment will be then reported in the Exploratory Research Report.
5. The results of the experimental exercise, including the quantification of expected gains (measured with KPIs in the KPA of Environment) will be integrated in the Solution description.
6. The solution will be then integrated in the ATM Master Plan (see Section 7).

The E-CONTRAIL management board will conduct this process.

## 7 Content integration management

We herein sketch the approach we will follow to ensure that the E-CONTRAIL solution is integrated into the ATM Master plan.

### 7.1 Contribution to the ATM Master Plan

We will first of all we will describe the solution, then proceed analysing the existing solutions in the ATM Master Plan and then we will describe the solution within the ATM Master Plan, going down to the level of enablers, stakeholder identification, initial operational capability date, etc. as described in Section 3.5 of the Project handbook [2].

#### 7.1.1 Proposed Solution for E-CONTRAIL project

Code	Name	Project contribution	Maturity at project start	Maturity at project end
	<b>Climate hotspot preciction service</b>	AI-driven model (already trained using historical data) capable of predicting the volumes of airspace with the conditions for large global warming impact due to contrails and aviation-induced cloudiness. A user-friendly visualization tool tailored for stakeholders’ needs will be also implemented.	<i>Pre TRL1</i>	

Table 13: Project Maturity – E-CONTRAIL Solution 1

#### 7.1.2 Existing SESAR solutions.

This 2020 edition of the European ATM Master Plan introduces nine new Essential Operational Changes top-down as nine essential “game changers”. They are triggering structural evolutions of the European ATM, that are required to deliver the SESAR vision, up to the “digital European sky” enabling the delivery of the Single European Sky’s objective to implement “more sustainable and better performing aviation”.

Outputs from the SESAR Programme R&I activities which relate to an Operational Improvement (OI) step or a small group of OI steps and its/their associated enablers, which have been designed, developed and validated in response to validation targets that, when implemented, will deliver business benefits to the European ATM.

Reviewing the existing solutions, there is NO solutions directly targeting topics related to climate change. When it comes to Operational Improvements and Technical Enablers, we neither find topics directly targeting climate change.

Thus, there is clear need to develop this strand into future editions of the ATM master plan.



### 7.1.3 E-CONTRAIL solution within the ATM Master Plan

As E-CONTRAIL is a solution project with TRL <4, the central aspect to address in the content integration plan is the alignment of the project results with the information taxonomy set-up of SESAR.

To this end, integration will be accomplished in coordination with the SESAR transversal projects. The process shall be articulated along two axes:

- Assess the consistency and coherence of information in support of the SESAR architecture
- Validate that the information is aligned with the vision of the ATM MP

The process shall provide inputs to the maturity gate, to confirm that the content is aligned with the master plan and the inputs of other solutions.

## 8 References

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- [1] E-CONTRAIL Grant Agreement Number 101114795 (2023). Sesar 3 Joint Undertaking. *Version 1.1, 02 June 2023.*
- [2] SESAR 3 Joint Undertaking (2022). *Digital European Sky Project Handbook: Programme Execution Framework. 11th April 2022. Edition 1. 2022.*
- [3] Digital European Sky Horizon Europe Project Management Plan Template (2023). *Sesar 3 Joint Undertaking. Version 1.0, 15th June 2023. Edition 1. 2023.*
- [4] E-CONTRAIL Consortium Agreement (2023). Based on DESCA – Model Consortium Agreement for Horizon Europe, version 1.1, November 2022
- [5] SESAR 3 Joint Undertaking (2023) *Digital European Sky Exploratory Research 1 Projects, Kick-off Meeting.* Bussels, 4 July 2023.

## Appendix A Project initiation file

Please see the file E-CONTRAIL\_SESAR3\_Initiation\_file attached to this PMP.

