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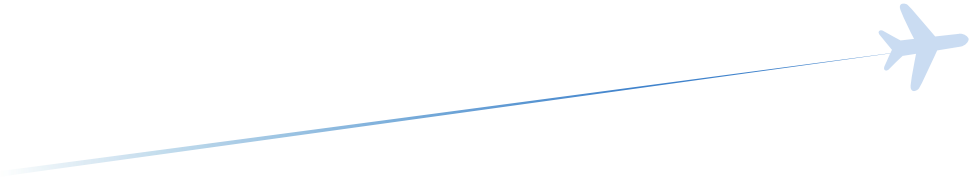

Data Management Plan

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AISA

AI SITUATIONAL AWARENESS FOUNDATION FOR ADVANCING AUTOMATION

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Abstract

This document describes the Data Management Plan (DMP) of the AISA project according to the guidelines described in the Guidelines on Data Management in Horizon 2020 document [1]. As such, this DMP describes the data management life cycle for all datasets to be collected, processed, or generated by AISA project during its research activities. It details all data the project will collect and generate, how it will be exploited or made accessible for verification and re-use, and how it will be curated and preserved.

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Executive Summary

The AISA Data Management Plan (DMP) details all the data that the project will collect and/or generate, how it will be exploited and made accessible to all project members, how and what data sets will be made available for verification and re-use, and how it will be curated and preserved.

The document shows the applicable rules and regulations and then introduces the generic methodology for data management applied in AISA. As the type of data used and generated is quite different at different work package (WP) level, the detailed planning in terms of managing data is accomplished at WP level.

The final part of the document is focusing on the AISA Open access policy and the planned measures and what kind of data will be accessible for third parties and how.

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1 Introduction

As the Horizon 2020 Data management template states: "Horizon 2020 beneficiaries make their research data **findable, accessible, interoperable and reusable** (**FAIR**), to ensure it is soundly managed" [2]. As a basic research focused, low Target Readiness Level (TRL1-2) project, AISA's main target is to generate further research. Further research can be conducted by the consortium members, but more importantly by other researchers, other organisations. There are two main reasons for that:

- SESAR Exploratory research projects (in line with the general Horizon 2020 rules and regulations) should be as transparent as possible in order to enable further building on them, either via other research projects or by industrial projects (within SESAR or by the European industrial projects).
- The research area targeted by AISA (artificial intelligence integration to air traffic management) is such a complex and a long-term process, that it is inevitable that the grounds are well shared.

Besides the external needs and benefits, proper sharing of information is also for the interest of the AISA consortium: by that other researchers, stakeholders can give their validating feedbacks in time, so fine tunings can be made during the project or later by other similar actions executed by the AISA consortium members.

1.1 Intended readership

This document is intended to be used by AISA consortium members, the SJU staff and researchers who are interested what kind of data are generated within AISA as besides the obvious ones (deliverables, papers) they might identify potential data sets generated within the project that might be useful for them for further use.

1.2 Acronyms and Terminology

Abbreviation	Description
AI	Artificial Intelligence
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATM	Air Traffic Management
ConOps	Concept of Operations
DOA	Description of Action
DMP	Data Management Plan
FAIR	Findable, accessible, interoperable and reusable

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H2020	Horizon 2020
IPR	Intellectual Property Rights
ML	Machine Learning
TRL	Target readiness level
WP	Work Package

Table 1 Acronyms and Terminology

1.3 Project Introduction

This project aims to research the effects of human-machine distributed situational awareness for the purpose of automating monitoring tasks in en-route operations. The main research question to be answered is whether an AI system can be made aware of the situation, in a narrow ATC-specific scope, by using current state-of-the-art technology, and can that awareness provide transparency and generalization required of such systems. We hypothesize that machines can be aware of the situation, including its own state, in a domain-specific way, and it can take part in the team situational awareness and that such a system can be used to automate monitoring tasks in a transparent manner. The goal is to develop a Concept of Operations for en-route ATC with AI taking part in team situational awareness [3]. We aim to define which monitoring tasks could be assigned to AI and what kind of system must run in the background to accomplish those tasks. During this project, it will be analysed which monitoring tasks exist, which of them can be automated in different scenarios (medium/high automation), and most importantly what are requirements for their automation in terms of needed data, changes in operations, changes in user interface, and the possible effect on human operators.

1.4 Relation to other Work Packages and Deliverables

This deliverable is related mainly to all work packages, namely WP1, WP2, WP3, WP4, WP5 and to WP6. In terms of deliverables it is applicable to all the AISA deliverables, especially the public ones.

1.5 Approach Taken and Structure of the Deliverable

The approach is detailed in the methodologies section and the structure is already presented in the Executive Summary of this document. Here is a summary of these items:

- AISA has its own data processing value chain. When possible, individual Data Management Plans (DMPs) are produced for each important data set.
- In terms of structure, the document starts with the introductory chapter, continues with methodology, chapter 3 is the listing of all the DMPs, and it concludes with the Data sharing and Open Access principles of the project.

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2 AISA Data Management Methodology

2.1 H2020 Requirements for DMP

The Horizon 2020 programme has concrete requirements for Data Management Plans. When writing this document, the following sources are used as requirements:

- Template Horizon 2020 Data Management Plan (DMP) [2]
- H2020 Programme Guidelines on FAIR Data Management in Horizon 2020 [4]
- Guidelines to the Rules on Open Access to Scientific Publications and Open Access to Research Data in Horizon 2020 [5]

Besides, the DMP online tool was partially used when establishing the AISA DMP Framework.

The above-mentioned documents are considered as a checklist where only the most relevant questions are answered as some items are not relevant in certain cases due to the nature of the data stored and generated.

2.2 The AISA data value chain

The AISA data value chain is as follows:

Initial data gathering and/or preparation:

In this step the input data is collected and/or related raw data is generated.

In case of building on external source primarily: then first the external source will be identified, the accessibility and usability conditions will be clarified by person collecting it on behalf of the AISA consortium. This person must ensure that the data will be available for the project even if for some reason the initial data source is no longer available.

If the initial data is generated internally: then the rules and mechanism of the data generation should be agreed in advance including the WP leader of the related deliverable (where the deliverable will be primary used).

Data Processing Analytics and Assessment:

In this step the required assessment steps are accomplished with the raw/input data. This activity is derived from the technical plans of the certain work package/tasks.

Data Refinement:

If during the analysis it turns out that the data is not suitable to maintain the needed analysis, fine tuning might be necessary either by collecting new data or by revisiting the raw data with new methods.

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Data Usage and Sharing:

This step has to different sub-steps according to the users:

Internal consortium usage: this is the step where the certain data is further used within the project in frame of building it directly to a deliverable or more frequently to build the analysis on the bases of it to a deliverable. Also, this newly generated data can be used as inputs to other activities within the project.

External usage: In some cases, the data generated by AISA is also directly usable by other researchers. In this case AISA will communicate this possibility and will share the data with appropriate guidance with those who are interested. Obviously, this kind of sharing should be treated with special care, only such data can be shared which is not restricted by authors, participants of the initial data and/or no ethical, IPR issues apply.

Internal data storage:

As a general rule the internal long-term data storage of the master file of the data will be maintained by those consortium members who was the main partner of the assessment with that data (usually the owner/main responsible author of the corresponding deliverable). In some cases, a diversion from this rule is possible: certain parts of the data are stored by another partner or a third partner (for example the primary user of the data) is responsible for the storing of this data. In each case the updates of the DMP should make it clear what kind of data can be found where.

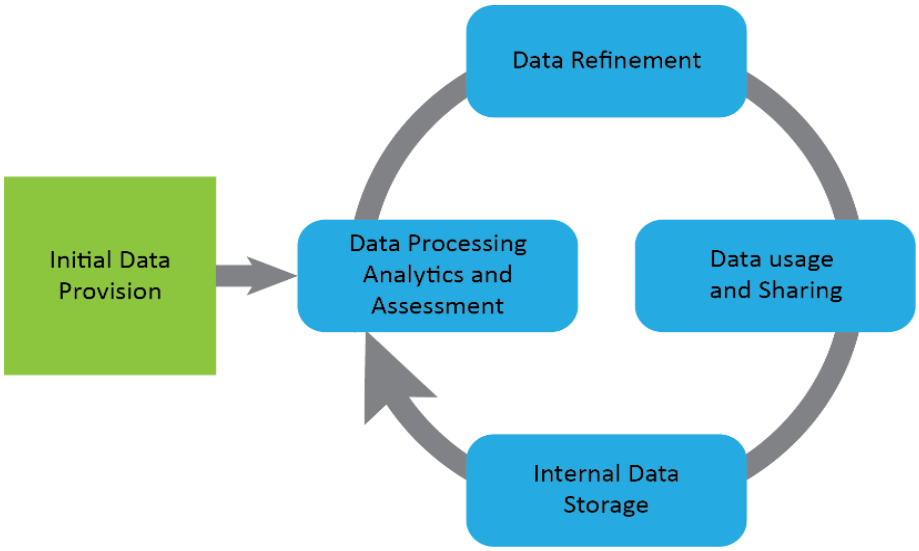

Figure 1 AISA data value chain

2.3 Stakeholders and Constraints

Key stakeholders that have been identified and that influence the data management plan decisions as they have specific interest in data in sources, research results, domain specific results (i.e. results connected to aviation operational concerns) are as follows:

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Data providers. These represent the organizations which provide the data sources to be used in the AISA project. These may be AISA beneficiaries, or third parties connected to beneficiaries, or organizations providing open data. These AISA partners play significant roles, specifying the data sources to be used and assist with the definition of requirements. These data providers can be:

Internal entities: for example, Skyguide is a primary data and information source for many activities as defined in the Description of the Action (DOA).

External entities: External entities are usually general organisations in the field of ATM, for example EUROCONTROL or the SJU itself can be a potential data source for AISA activities.

End users. End-users can be a wide range of groups as described in the Exploitation and Dissemination Plan. Here only two categories are established:

Researchers: Researchers who would like to build on AISA sub-results or AISA generated data in their work.

Other potential users: Other stakeholders who are interested in AISA generated data for other reasons.

2.4 Data Management Recording

The consortium in the frame of WP6 developed a template for the recording of the data management activities and attributes related to a certain data set. This data set is made in line with the documents mentioned in chapter 2.1 but especially with the appendix of H2020 Programme Guidelines on FAIR Data Management in Horizon 2020: "FAIR Data Management at a glance: issues to cover in your Horizon 2020 DMP" [4]. This template can be found in the appendix of this document and it is used in chapter 3 to show separately the data management planning for all the key data sets in all project work packages[1].

2.5 Data Management

The following bodies and persons are responsible for data management:

- Each Steering Board member is responsible for:
    - Ensuring that all the research results and associated data generated by his/her organisation during the project are made publicly available.
    - Raising to other Steering Board members if a certain data set (used or generated by that organisation) is sensitive for personal information or IPR reasons.

[1] WP1 – Project Management and WP 7 – Ethics requirements are excluded as the data there is generally confidential and governed by special measures and therefore it is out of scope for the DMP.

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- The project coordinator, Tomislav Radišić is responsible for ensuring that the project is working according to this plan.
- The WP6 managers (Roland Guraly - WP 6 leader and Andrej Kocsis - dissemination manager) are responsible for maintaining the DMP, to publish the public documents on the website and to communicate the results (as described in D6.1).

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3 AISA Data Management in practice

3.1 Data Management in Work package 2

Work package 2 (Concept of Operations) has two deliverables:

- D2.1 Concept of Operations (ConOps) for AI Situational Awareness System
- D2.2 Requirements for automation of monitoring tasks via AI SA.

For the ConOps a main data source was the 1st AISA workshop but as it is only linked to WP 6, the detailed data management issues related to that is mentioned there.

In terms of D2.2 the main relevant data source was the selection of the monitoring tasks by Skyguide air traffic controllers (ATCOs). The relevant data management planning is shown below:

AISA Data Set Record	List of selected monitoring tasks
Related Work package	WP2
Related Deliverable(s)	D2.2
Author(s) of the DMP of the data set	Roland Guraly (SLOT)
Date of filling in the template	6/11/2020
1. Data Summary	
Purpose of data collection/generation	The selected monitoring tasks will be used as input to WP4 and more specifically to the Tasks 4.3 and 4.4.
Relation to the objectives of the project	The list is to be used by subsequent work packages in the project.
Type and formats	Word document (doc)
Usage of existing data	The list was prepared on the basis of the general ATCO task list in the AISA ConOps (D2.1) document.
Data Origin	Skyguide
Expected size of data	Normal document (some hundred KBs)
Data Utility	It will be useful for the project, but also via D2.2 to other researchers focusing on the use of AI in ATM.
2. FAIR Data	

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Data Findability	
Discoverability (Metadata)	The data can be found at the deliverable owner (SLOT) and also at the data generator (Skyguide). Also, the metadata is description of the selected list in D2.2.
Identifiability	Identification is via the document name.
Naming convention	AISA_listofmonitoringtasks_VS1.0
Keyword approach (search)	Monitoring, list
Versioning approach	1.0 is the final number
Metadata creation standards	n.a. as the document is simple and easily identifiable
Data Accessibility	
Open availability	The list will be openly available via the public D2.2 once approved by the SJU.
Way of availability	The deliverable will be available online at the AISA website.
Software to be used (guidelines, if any)	Microsoft Word
Data, metadata, etc. storage location	Computers at the hosting organization (Skyguide and SLOT).
Access in case of restrictions	n.a.
Data Interoperability	
Data and metadata vocabularies, standards or methodologies followed for interoperability	n.a. as it is a standard Microsoft Word doc.
Increasing of data re-use	
Data licensing	n.a. as it is a public list
Availability for re-use	Yes
Third party usability	Yes
Data quality assurance	n.a. as it is a simple Word doc.
Re-usability duration	Until the document will be online accessible, for at least two years after the project closure.
Allocation of resources	

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Cost of making data FAIR	Related effort was part of the generation of the deliverable D2.2.
Data Management responsibility	SLOT is responsible for the update of the list with the support of Skyguide if it turns to be necessary.
Cost/value for long term preservation	n.a.
Data Security	
Data recovery options	The document is disseminated to all AISA consortium members, so recovery is easy.
Secure storage	SLOT has a back-up system for computers, also a professional virus scanner is applied.
Transfer of sensitive data	Sensitive raw material (e.g. who said what) is not available for third parties, it is stored according to Skyguide internal guidelines.
Ethical aspects	
Ethical deliverables, DOA	The ethical deliverables and the DOA governs how to treat sensitive data, e.g. personalized information.
Other	
Specific local regulation, measures to follow	Skyguide measures to treat personalized data are applied. Skyguide is located in a third country (Switzerland) so special national regulations might apply which are generally consistent with the similar EU legislation.
AOB	n.a.

Table 2 D2.2 relevant data management planning

3.2 Data Management in Work package 3

Work package 3 is named Development of ML modules and has the following deliverables:

- D3.1 4D trajectory prediction module
- D3.2 Conflict detection module
- D3.3 Air traffic complexity estimation module.

As the WP deals with several machine learning (ML) modules in different tasks, there are DMPs made both on WP and task level.

Naming of the data set	**ADS-B data (The OpenSky Network)**
Related Work package	WP3

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Related Deliverable(s)	D3.1, D3.2, D3.3
Author(s) of the certain DMP	Lars Schmidt
Date of creation	12/11/2020
3. Data Summary	
Purpose of data collection/generation	ADS-B data is required to be used as actual aircraft states during ML training and simulation.
Relation to the objectives of the project	ADS-B data/ actual aircraft states are crucial for to gather further information about the traffic situation.
Type and formats	Historic traffic of format-table state_vectors_data4 (https://opensky-network.org/data/impala) will be initially used.
Usage of existing data	Data is gathered from The OpenSky Network.
Data Origin	The OpenSky Network (https://opensky-network.org/)
Expected size of data	Order of magnitude: Gigabytes
Data Utility	Required as main ML input-data
4. FAIR Data	
Data Findability	
Discoverability (Metadata)	The data is gathered from The OpenSky Network via the Impala shell.
Identifiability	The overall gathered data can be identified by the considered airspace and timeframe of the project. Trajectories crossing the airspace in the corresponding timeframe are part of the data. Trajectories may be identified by callsign or ICAO24-code, but data-licenses and privacy need to be respected in this context.
Naming convention	The data will be called 'ADS-B data' within the project. Further subdivision may be done by specifying a certain geographical region or sub-timeframe (e.g. hour or day).
Keyword approach (search)	n.a.
Versioning approach	n.a.
Metadata creation standards	n.a.
Data Accessibility	
Open availability	The data is bound to licenses and use-restrictions. The data will not be openly available.
Way of availability	n.a.

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Software to be used (guidelines, if any)	n.a.
Data, metadata, etc. storage location	Gathered data will be stored by project partners individually.
Access in case of restrictions	The data is available at The OpenSky Network for registered users.
Data Interoperability	
Data and metadata vocabularies, standards or methodologies followed for interoperability	Terms and vocabulary of The OpenSky Network (see e.g. https://opensky-network.org/data/impala) and general vocabulary of aviation will be used.
Increasing of data re-use	
Data licensing	Data is bound to license and use restrictions. No sub-licensing.
Availability for re-use	n.a.
Third party usability	Data used in the project is not public. Third parties may register at The OpenSky Network to obtain access to the data.
Data quality assurance	n.a.
Re-usability duration	n.a.
Allocation of resources	
Cost of making data FAIR	n.a.
Data Management responsibility	Individual by project partners.
Cost/value for long term preservation	n.a.
Data Security	
Data recovery options	The initial data may be re-gathered from The OpenSky Network.
Secure storage	Individual by project partners.
Transfer of sensitive data	n.a.
Ethical aspects	
Ethical deliverables, DOA	n.a.
Other	

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Specific local regulation, measures to follow	Licenses and terms of use of The OpenSky Network and privacy issues apply.
AOB	n.a.

Table 3 DMPs made on WP 3 and also on task level

Naming of the data set	**DDR2 data (EUROCONTROL)**
Related Work package	WP3
Related Deliverable(s)	D3.1, D3.3
Author(s) of the certain DMP	Lars Schmidt
Date of creation	12/11/2020
1. Data Summary	
Purpose of data collection/generation	DDR2 data is used as filed flight plans during ML training and simulation. Furthermore, does the data specify the considered airspace of scenarios within the project.
Relation to the objectives of the project	Flight plans and waypoints are crucial for communicating trajectory information with ATCOs. The data is also used to determine the current state of knowledge previous to a flight.
Type and formats	.nest and .so6 files
Usage of existing data	Data is obtained from EUROCONTROL.
Data Origin	DDR2 database, EUROCONTROL
Expected size of data	Order of magnitude: Gigabytes
Data Utility	Required as main ML input-data
2. FAIR Data	
Data Findability	
Discoverability (Metadata)	The data is obtained from DDR2 database, EUROCONTROL.
Identifiability	The data is identified by the AIRAC cycle (AIRAC 1907).
Naming convention	The data will be called DDR2 data or flight plan data within the project.
Keyword approach (search)	n.a.

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Versioning approach	n.a.
Metadata creation standards	n.a.
Data Accessibility	
Open availability	The data is bound to licenses and use-restrictions. The data will not be openly available.
Way of availability	n.a.
Software to be used (guidelines, if any)	NEST tool from EUROCONTROL may be used to process .nest data. Other tools may be used on behalf of the project partners.
Data, metadata, etc. storage location	Obtained data will be stored at project partners individually.
Access in case of restrictions	Access to the DDR2 database is managed by EUROCONTROL.
Data Interoperability	
Data and metadata vocabularies, standards or methodologies followed for interoperability	Terms and vocabulary of DDR2 database and general vocabulary of aviation will be used.
Increasing of data re-use	
Data licensing	Data is bound to license and use restrictions. No sub-licensing.
Availability for re-use	n.a.
Third party usability	Data used in the project is not public. Third parties may request access to the DDR2 database from EUROCONTROL to obtain access to the data.
Data quality assurance	n.a.
Re-usability duration	n.a.
Allocation of resources	
Cost of making data FAIR	n.a.
Data Management responsibility	Individual by project partners.
Cost/value for long term preservation	n.a.
Data Security	
Data recovery options	The initial data may be re-obtained from DDR2 database.

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Secure storage	Individual by project partners.
Transfer of sensitive data	n.a.
Ethical aspects	
Ethical deliverables, DOA	n.a.
Other	
Specific local regulation, measures to follow	Licenses and terms of use of DDR2 database (EUROCONTROL) and privacy issues apply.
AOB	n.a.

Table 4 DDR2 data (EUROCONTROL)

3.2.1 WP 3 – Task 3-1 output DMP

Naming of the data set	**Trajectory Prediction output**
Related Work package	WP3
Related Deliverable(s)	D3.1
Author(s) of the certain DMP	Lars Schmidt
Date of creation	16/11/2020
1. Data Summary	
Purpose of data collection/generation	The data constitutes the output of trajectory prediction module. It is collected for verification and validation.
Relation to the objectives of the project	The data represents the results of one of the ML modules. It is further processed by the KG.
Type and formats	TBD
Usage of existing data	The trajectory prediction module uses ADS-B data and DDR2 data as input. The output of the module is based on these input data.
Data Origin	Generated
Expected size of data	TBD
Data Utility	Output data of trajectory prediction module.

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2. FAIR Data	
Data Findability	
Discoverability (Metadata)	n.a.
Identifiability	The output data is based on the input data.
Naming convention	Reference to the input data needs to be maintained.
Keyword approach (search)	n.a.
Versioning approach	Bound to the version of the trajectory prediction module.
Metadata creation standards	Metadata may be generated to enable dissemination of results. This metadata needs to be in line licenses and use restrictions of underlaying input data.
Data Accessibility	
Open availability	The original data is bound to the input data and therefore bound to licenses and use restrictions. Metadata may be generated to be openly available. This metadata may comprise validation results.
Way of availability	Deliverables, TBD
Software to be used (guidelines, if any)	n.a.
Data, metadata, etc. storage location	Individual by project partners.
Access in case of restrictions	Only metadata.
Data Interoperability	
Data and metadata vocabularies, standards or methodologies followed for interoperability	Terms and vocabulary of The OpenSky Network (see e.g. https://opensky-network.org/data/impala), DDR2 database (underlaying input data) and general vocabulary of aviation will be used.
Increasing of data re-use	
Data licensing	n.a.
Availability for re-use	n.a.
Third party usability	Only public metadata.
Data quality assurance	Not applicable. Data is result of a trajectory prediction.
Re-usability duration	n.a.

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Allocation of resources	
Cost of making data FAIR	n.a.
Data Management responsibility	Individual by project partners.
Cost/value for long term preservation	n.a.
Data Security	
Data recovery options	The data may be regenerated with the corresponding input data and the trajectory prediction module.
Secure storage	Individual by project partners.
Transfer of sensitive data	n.a.
Ethical aspects	
Ethical deliverables, DOA	n.a.
Other	
Specific local regulation, measures to follow	The output data is based on the input data of the module. Licenses and terms of use of The OpenSky Network and of the DDR2 database (EUROCONTROL) and privacy issues may apply.
AOB	n.a.

Table 5 Trajectory Prediction output

3.2.2 WP 3 – Task 3-2 output DMP

Naming of the data set	**Conflict Detection output**
Related Work package	WP3
Related Deliverable(s)	D3.2
Author(s) of the certain DMP	Javier Alberto Pérez Castán
Date of creation	16/11/2020
1. Data Summary	
Purpose of data collection/generation	The data constitutes the output of the conflict detection module. It is collected for verification and validation.

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Relation to the objectives of the project	The data represents the results of one of the ML modules. It is further processed by the KG.
Type and formats	TBD
Usage of existing data	The conflict detection module uses ADS-B data as input. The output of the module is based on these input data.
Data Origin	Generated
Expected size of data	TBD
Data Utility	Output data of conflict detection module.
2. FAIR Data	
Data Findability	
Discoverability (Metadata)	n.a.
Identifiability	The output data is based on the input data.
Naming convention	Reference to the input data needs to be maintained.
Keyword approach (search)	n.a.
Versioning approach	Bound to the version of the conflict detection module.
Metadata creation standards	Metadata may be generated to enable dissemination of results. This metadata needs to be in line with licenses and use restrictions of underlaying input data.
Data Accessibility	
Open availability	The original data is bound to the input data and therefore bound to licenses and use restrictions. Metadata may be generated to be openly available. This metadata may comprise validation results.
Way of availability	Deliverables, TBD
Software to be used (guidelines, if any)	n.a.
Data, metadata, etc. storage location	Individual by project partners.
Access in case of restrictions	Only metadata.
Data Interoperability	
Data and metadata vocabularies, standards or	Terms and vocabulary of The OpenSky Network (see e.g. https://opensky-network.org/data/impala), and general vocabulary of aviation will be used.

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methodologies followed for interoperability	
Increasing of data re-use	
Data licensing	n.a.
Availability for re-use	n.a.
Third party usability	Only public metadata.
Data quality assurance	n.a.
Re-usability duration	n.a.
Allocation of resources	
Cost of making data FAIR	n.a.
Data Management responsibility	Individual by project partners.
Cost/value for long term preservation	n.a.
Data Security	
Data recovery options	The data may be regenerated with the corresponding input data and the conflict prediction module.
Secure storage	Individual by project partners.
Transfer of sensitive data	n.a.
Ethical aspects	
Ethical deliverables, DOA	n.a.
Other	
Specific local regulation, measures to follow	The output data is based on the input data of the module. Licenses and terms of use of The OpenSky Network and privacy issues may apply.
AOB	n.a.

Table 6 Conflict Detection output

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3.2.3 WP 3 – Task 3-3 output DMP

Naming of the data set	Complexity Assessment Output
Related Work package	WP3
Related Deliverable(s)	D3.3
Author(s) of the certain DMP	Tomislav Radišić
Date of creation	24/11/2020
1. Data Summary	
Purpose of data collection/generation	The data constitutes the output of complexity assessment machine learning module. It is collected for verification and validation.
Relation to the objectives of the project	The data represents the results of one of the ML modules. It is further processed by the KG.
Type and formats	TBD
Usage of existing data	The complexity assessment module uses ADS-B data and DDR2 data as input. The output of the module is based on these input data.
Data Origin	Generated
Expected size of data	TBD
Data Utility	Output data of complexity assessment module.
2. FAIR Data	
Data Findability	
Discoverability (Metadata)	n.a.
Identifiability	The output data is based on the input data.
Naming convention	Reference to the input data needs to be maintained.
Keyword approach (search)	n.a.
Versioning approach	Bound to the version of the complexity assessment module.
Metadata creation standards	Metadata may be generated to enable dissemination of results. This metadata needs to be in line with licenses and use restrictions of underlaying input data.
Data Accessibility	

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Open availability	The original data is bound to the input data and therefore bound to licenses and use restrictions. Metadata may be generated to be openly available. This metadata may comprise validation results.
Way of availability	Deliverables, TBD
Software to be used (guidelines, if any)	n.a.
Data, metadata, etc. storage location	Individual by project partners.
Access in case of restrictions	Only metadata.
Data Interoperability	
Data and metadata vocabularies, standards or methodologies followed for interoperability	Terms and vocabulary of The OpenSky Network (see e.g. https://opensky-network.org/data/impala), DDR2 database (underlaying input data) and general vocabulary of aviation will be used.
Increasing of data re-use	
Data licensing	n.a.
Availability for re-use	n.a.
Third party usability	Only public metadata.
Data quality assurance	n.a.
Re-usability duration	n.a.
Allocation of resources	
Cost of making data FAIR	n.a.
Data Management responsibility	Individual by project partners.
Cost/value for long term preservation	n.a.
Data Security	
Data recovery options	The data may be regenerated with the corresponding input data and the complexity estimation module. Encrypted cloud storage will be used.
Secure storage	Individual by project partners.
Transfer of sensitive data	n.a.
Ethical aspects	

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Ethical deliverables, DOA	n.a.
Other	
Specific local regulation, measures to follow	The output data is based on the input data of the module. Licenses and terms of use of The OpenSky Network and of the DDR2 database (EUROCONTROL) and privacy issues may apply.
AOB	n.a.

Table 7 Complexity Assessment Output

3.3 Data Management in Work package 4

Within WP4 (AI Situational Awareness System) the following deliverables are to be submitted:

- D4.1 Proof-of-concept KG system
- D4.2 KG-Prolog mapper
- D4.3 Populated knowledge graph
- D4.4 Facts, rules and queries capturing en-route ATC operations.

The related DMPs are the followings:

Naming of the data set	**Source Code for AISA KG2Prolog Mapper**
Related Work package	WP4
Related Deliverable(s)	D4.2
Author(s) of the DMP of the data set	Christoph Schütz, Bernd Neumayr, Michael Schrefl, Sebastian Gruber
Date of creation	23/11/2020
1. Data Summary	
Purpose of data collection/generation	The mapper transforms RDF knowledge graphs into a Prolog representation, which can be queried using Prolog.
Relation to the objectives of the project	Prolog is a general-purpose logic programming language that can be used to express rich query semantics, which are important for AI SA.
Type and formats	Prolog code, Java code
Usage of existing data	Use of knowledge graph produced by the AISA XMI Mapper.
Data Origin	The mapper is developed as part of the project.
Expected size of data	Expected to be smaller than 10 MB

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Data Utility	The mapper is used as part of the knowledge graph management system.
2. FAIR Data	
Data Findability	The source code of the implemented mapper will be posted on the project website as well as on a GitHub repository.
Discoverability (Metadata)	The program serves as a study for future research and should be used together with the accompanying deliverable, which references the software. The software artifact is a proof-of-concept prototype and thus not ready for production use.
Identifiability	The mapper will be named AISA KG2Prolog Mapper, clearly establishing the fact that the software artifact was produced as part of the AISA project and with the aim of mapping a knowledge graph to Prolog.
Naming convention	Using the conventions for Prolog code and for Java code.
Keyword approach (search)	
Versioning approach	Revision numbers as usual in software engineering.
Metadata creation standards	Documentation of the software.
Data Accessibility	The source code and binaries will be posted on the project website and on GitHub.
Open availability	Open Source, MIT License
Way of availability	Download
Software to be used (guidelines, if any)	Typical developer tools for Prolog and Java, text editor
Data, metadata, etc. storage location	Project website, GitHub
Access in case of restrictions	No restriction, open source
Data Interoperability	Use of standard Prolog and Java code
Data and metadata vocabularies, standards or methodologies followed for interoperability	
Increasing of data re-use	
Data licensing	MIT License
Availability for re-use	MIT License allows others to reuse the code.

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Third party usability	MIT License allows others to use the code.
Data quality assurance	Review within project.
Re-usability duration	Usage rights are granted in perpetuity.
Allocation of resources	
Cost of making data FAIR	n.a.
Data Management responsibility	Institute of Business Informatics – Data & Knowledge Engineering (Johannes Kepler University Linz)
Cost/value for long term preservation	n.a.
Data Security	
Data recovery options	n.a. ; will be hosted on public server
Secure storage	Not necessary since no sensitive data
Transfer of sensitive data	No sensitive data included
Ethical aspects	
Ethical deliverables, DOA	No ethical concerns, no personal data are included
Other	
Specific local regulation, measures to follow	None
AOB	n.a.

Table 8 Source Code for AISA KG2Prolog Mapper

Naming of the data set	**Source Code for AISA XMI Mapper**
Related Work package	WP4
Related Deliverable(s)	D4.1
Author(s) of the DMP of the data set	Christoph Schütz, Bernd Neumayr, Michael Schrefl, Sebastian Gruber
Date of creation	23/11/2020
1. Data Summary	

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Purpose of data collection/generation	The mapper transforms UML class diagrams available as XMI file which conform certain semantic and syntactic requirements into RDFS and SHACL.
Relation to the objectives of the project	The transformed RDFS and SHACL are part of the Knowledge Graph of the system.
Type and formats	XQuery modules
Usage of existing data	No external libraries used. Existing AIXM or FIXM XMI files, which are freely available online, are used as input for the mapper.
Data Origin	The mapper is developed as part of the project.
Expected size of data	Less than 10 megabytes (not including AIXM or FIXM XMI files).
Data Utility	The mapper is used as part of the knowledge graph management system.
2. FAIR Data	
Data Findability	The source code of the implemented mapper will be posted on the project website as well as on a GitHub repository.
Discoverability (Metadata)	The program serves as a study for future research and should be used together with the accompanying deliverable, which references the software. The software artifact is a proof-of-concept prototype and thus not ready for production use.
Identifiability	The mapper will be named AISA XMI Mapper, clearly establishing the fact that the software artifact was produced as part of the AISA project and with the aim of mapping XMI data into other formats.
Naming convention	The source code follows typical naming conventions for XQuery programming.
Keyword approach (search)	
Versioning approach	Revision numbers as usual in software engineering.
Metadata creation standards	Documentation of modules in comments using special tags.
Data Accessibility	The source code and binaries will be posted on the project website and on GitHub.
Open availability	Open Source, MIT License
Way of availability	Download
Software to be used (guidelines, if any)	Typical developer tools for XQuery (BaseX), text editor.
Data, metadata, etc. storage location	Project website, GitHub
Access in case of restrictions	No restriction, open source
Data Interoperability	The XQuery modules can be used with XQuery processors complying to the W3C standard.
Data and metadata vocabularies, standards or methodologies followed for interoperability	

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Increasing of data re-use	
Data licensing	MIT License
Availability for re-use	MIT License allows others to reuse the code.
Third party usability	MIT License allows others to use the code.
Data quality assurance	Review within project.
Re-usability duration	Usage rights are granted in perpetuity.
Allocation of resources	
Cost of making data FAIR	n.a.
Data Management responsibility	Institute of Business Informatics – Data & Knowledge Engineering (Johannes Kepler University Linz)
Cost/value for long term preservation	n.a.
Data Security	
Data recovery options	n.a.; will be hosted on public server
Secure storage	Not necessary since no sensitive data
Transfer of sensitive data	No sensitive data included
Ethical aspects	
Ethical deliverables, DOA	No ethical concerns, no personal data are included
Other	
Specific local regulation, measures to follow	None
AOB	n.a.

Table 9 Source Code for AISA XMI Mapper

Naming of the data set	**Populated Knowledge Graph w/ Facts, Rules and Queries**
Related Work package	WP4
Related Deliverable(s)	D4.3 and D4.4
Author(s) of the DMP of the data set	Tomislav Radišić, Tea Rogošić, Dorea Antolović, Mia Bazina
Date of creation	30/09/2021

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1. Data Summary	
Purpose of data collection/generation	The KG related data is used to capture all relevant knowledge, rules, facts, and queries needed for operation of the KG-based system.
Relation to the objectives of the project	This will be used as a basis for assessment of artificial situational awareness.
Type and formats	RDF, Prolog, SPARQL
Usage of existing data	Use of knowledge graph produced by the AISA XMI Mapper
Data Origin	This dataset is developed within the project.
Expected size of data	Approximately 100 MB
Data Utility	Used for WP5
2. FAIR Data	
Data Findability	The code, queries, and rules will be posted on the project website, Zenodo, as well as on a GitHub repository.
Discoverability (Metadata)	Appropriate key words will be used: ATC KG-based system, ATC rules and facts, ATC situational awareness.
Identifiability	Linked to the project website, description. Linked to appropriate deliverables
Naming convention	Standard file naming conventions
Keyword approach (search)	
Versioning approach	Revision numbers as usual in software engineering.
Metadata creation standards	Documentation of the software.
Data Accessibility	The source code and binaries will be posted on the project website, Zenodo and on GitHub.
Open availability	Open Source, MIT License
Way of availability	Download
Software to be used (guidelines, if any)	Typical developer tools for Prolog and Java, text editor
Data, metadata, etc. storage location	Project website, Zenodo, GitHub
Access in case of restrictions	No restriction, open source

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Data Interoperability	Use of standard Prolog and Java code
Data and metadata vocabularies, standards or methodologies followed for interoperability	
Increasing of data re-use	
Data licensing	MIT License
Availability for re-use	MIT License allows others to reuse the code.
Third party usability	MIT License allows others to use the code.
Data quality assurance	Review within project.
Re-usability duration	Usage rights are granted in perpetuity.
Allocation of resources	
Cost of making data FAIR	n.a.
Data Management responsibility	FTTS
Cost/value for long term preservation	n.a.
Data Security	
Data recovery options	n.a. ; will be hosted on public server
Secure storage	Not necessary since no sensitive data
Transfer of sensitive data	No sensitive data included
Ethical aspects	
Ethical deliverables, DOA	No ethical concerns, no personal data are included
Other	
Specific local regulation, measures to follow	None
AOB	n.a.

Table 10 Populated Knowledge Graph w/ Facts, Rules and Queries

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3.4 Data Management in Work package 5

WP5 is named as Concept Assessment. The deliverables produced in the WP are:

- D5.1 Risk assessment report
- D5.2 Report on human machine distributed SA.

The DMP for the WP 5:

Naming of the data set	**Concept Assessment**
Related Work packages	WP 5
Related Deliverable(s)	D 5.1, D5.2
Author(s) of the certain DMP	Dr. Céline Mühlethaler
Date of creation	12/11/2020
3. Data Summary	
Purpose of data collection/generation	Human factor related analysis
Relation to the objectives of the project	The objective is to assess the concept as defined in WP 2 and developed in WPs 3 and 4.
Type and formats	Risk assessment report: Word document, Questionnaires: Word Document, Eye Tracking Data (SMI from ETG Software), Data from Questionnaire: Excel Files
Usage of existing data	n.a.
Data Origin	D 2.1 ConOps Paper (Skyguide), Questionnaires (ZHAW) D 2.2 Requirements report
Expected size of data	Eye Tracking Data (some hundreds MBs), Word Document (some hundreds KBs), Statistical Data (some hundreds KBs)
Data Utility	Concept Assessment of AISA: Findings comparing SA between AI and ATCO & findings related to human performance in distributed SA. Risk Assessment of AISA
4. FAIR Data	
Data Findability	

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Discoverability (Metadata)	The data can be found at the deliverable owner (ZHAW or UPM).
Identifiability	Identification is via the doc names.
Naming convention	n.a.
Keyword approach (search)	n.a.
Versioning approach	1.0 is the final number
Metadata creation standards	n.a.
Data Accessibility	
Open availability	The risk assessment report will be openly available once approved by the SJU, data from the concept assessment will be prepared for publication in journals.
Way of availability	The deliverable will be available online at the AISA website, or made public by journals.
Software to be used (guidelines, if any)	Word document (doc), Eye Tracking Data SMI ETC), Excel Files, statistic software R
Data, metadata, etc. storage location	Computers at the hosting organization (ZHAW or UPM).
Access in case of restrictions	n.a.
Data Interoperability	
Data and metadata vocabularies, standards or methodologies followed for interoperability	n.a. as it is a standard for the used programmes
Increasing of data re-use	
Data licensing	Not necessary
Availability for re-use	yes
Third party usability	yes
Data quality assurance	n.a.
Re-usability duration	Until the document will be online accessible, for at least two years after the project closure.
Allocation of resources	

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Cost of making data FAIR	n.a.
Data Management responsibility	ZHAW or UPM
Cost/value for long term preservation	n.a.
Data Security	
Data recovery options	The report and data are disseminated to all the AISA consortium members, so recovery is easy.
Secure storage	ZHAW has a back-up system for computes, also a professional virus scanner is applied. UPM has a back-up system for computers, also a professional virus scanner is applied.
Transfer of sensitive data	Sensitive raw material (e.g. who said what) is not available for third parties, it is stored according to ZHAW or UPM internal guidelines.
Ethical aspects	
Ethical deliverables, DOA	The ethical deliverables and the DOA governs how to treat sensitive data, e.g. personalized information.
Other	
Specific local regulation, measures to follow	ZHAW and Skyguide measures to treat personalized data is applied. ZHAW and Skyguide are located in a third country (Switzerland) so special national regulations might apply which are generally consistent with the similar EU legislation.
AOB	n.a.

Table 11 Concept Assessment

3.5 Data Management in Work package 6

Within WP 6 (Results dissemination and communication) the following deliverables are to be submitted:

- D6.1 Exploitation and Dissemination Plan
- D6.2 Project's website and factsheet
- D6.3 Exploitation and Dissemination Report
- D6.4 Data Management Plan.

The related DMPs are the following:

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Naming of the data set	AISA communication list
Related Work package	WP6
Related Deliverable(s)	D6.1, D6.3
Author(s) of the certain DMP	Roland Guraly
Date of creation	5/11/2020
1. Data Summary	
Purpose of data collection/generation	The AISA communication list generated by the consortium at the beginning of the project contains a group of stakeholders the project is communicating to: invites them to workshops, sends out newsletters, etc.
Relation to the objectives of the project	To support the achievement of the communication and dissemination objectives.
Type and formats	Excel (xls.)
Usage of existing data	It was compiled from partners individual data sets (similar tables, Microsoft outlook contact details, etc.).
Data Origin	AISA project partners
Expected size of data	Small normal file (some hundred KB)
Data Utility	It is useful for communication purposes.
2. FAIR Data	
Data Findability	
Discoverability (Metadata)	The data is located at the computers of WP 6 leader (SLOT) and occasionally shared with the project coordinator.
Identifiability	By its name
Naming convention	AISA_Contactlist_VS1.0
Keyword approach (search)	n.a.
Versioning approach	The status before sending out the invitations for the first workshop is considered as 1.0
Metadata creation standards	n.a.
Data Accessibility	
Open availability	No – it contains sensitive (personal) data
Way of availability	n.a.

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Software to be used (guidelines, if any)	n.a. – Normal Microsoft Office software is applied
Data, metadata, etc. storage location	Computers of responsible persons, SLOT data repository.
Access in case of restrictions	n.a.
Data Interoperability	
data and metadata vocabularies, standards or methodologies followed for interoperability	Standard Microsoft Office interoperability applies.
Increasing of data re-use	
Data licensing	n.a.
Availability for re-use	n.a.
Third party usability	n.a.
Data quality assurance	The consortium reviews the list from time to time in frame of an internal review process.
Re-usability duration	The list is intended to be used during the project lifetime.
Allocation of resources	
Cost of making data FAIR	The effort associated is counted to the normal WP6 activities.
Data Management responsibility	The WP 6 leader (SLOT) is responsible for the DMP of the data set.
Cost/value for long term preservation	n.a.
Data Security	
Data recovery options	SLOT has back-end solutions applied.
Secure storage	Applied
Transfer of sensitive data	The list is only used internally in the consortium.
Ethical aspects	
Ethical deliverables, DOA	The list is maintained in line with the related chapters of the DOA and the ethical deliverables.
Other	

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Specific local regulation, measures to follow	General EU (GDPR) approach is maintained.
AOB	n.a.

Table 12 AISA communication list

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4 Data sharing & open access

4.1 Open access rules

As mentioned in chapter 2.1, the DMP follows certain documents, in terms of open access the AISA project is mainly relying on the Guidelines to the Rules on Open Access to Scientific Publications and Open Access to Research Data in Horizon 2020 document [5]. The document classifies two main categories for open access related scientific information:

1. peer-reviewed scientific research articles (published in scholarly journals), or
2. research data (data underlying publications, curated data and/or raw data).

In addition to them, the technical project deliverables in AISA will also be publicly available. As the deliverables aim to encompass all the significant developments within the project, the consortium keeps them the highest priority documents in terms of dissemination. As after approval they are placed to the website of the project, they are publicly available so open access to them is granted.

In terms of publications, the consortium members have a plan to publish number of articles in their respected field of research to disseminate the results achieved during the research work. The list of such planned publications is available in the D6.1 Exploitation and Dissemination Plan [6]. The deliverable is a dynamic one, so if a new opportunity presents itself for additional publication the consortium members will take it and the plan will be updated.

Open access to scientific publications means free online access for any user. The AISA consortium will be keen to publish its publication either via *self-archiving / 'green' open access* or via *Open access publishing / 'gold' open access*. In the unlikely event that a certain related paper is published via other methodology the consortium will find a way to publish the paper via other means (e.g. pre-print open publishing, etc.) Besides the website, the consortium will also use Zenodo for disseminating publications, a free and open data repository offered by CERN. Before the data is uploaded it will be curated by the Steering Board. The Steering Board shall ensure that the content is suitable for open dissemination, and that it complies with Zenodo terms and applicable laws, including, but not limited to, privacy, data protection and intellectual property rights.

Naturally, all the publications are subject to IPR considerations. If such an issue arises from one of the consortium's partners, the project committee will discuss the claim and withhold the publication until the protection is in place. The protection should be initiated by the interested party.

Despite that, the project will do its utmost to provide open access to all data collected or generated during the project work.

Regarding research data, the AISA consortium will also follow an open access policy, whenever possible. Although the project is focusing on using data for generating new research results, and new data sets, during the work different kinds of new data will be generated and they will also be made available through the website and through Zenodo. However, this applies only to data sets which are considered to be significant (in terms of usability and also in volume) by the consortium. Ad hoc request might arise from third parties (e.g. after a publication of a scientific paper or a presentation someone

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might raise interest to a particular data set supporting a certain part of the publication) and then these requests will be discussed in time by the Steering Board.

Before making any research data available, the consortium will discuss whether it contains any sensitive data. Sensitive data can fall into the following two main categories:

- data that uses personal information – this data should be made anonym before making them public
- data that is IPR sensitive – it can be either protected by a third party and the publishing of it (even in a re-used form) might hurt the initial data protection conditions, or the data is protected by a consortium member as it is an essential part for IPR generation.

4.2 Data to be shared

According to the classification of chapter 4.1, the AISA project shares the following information/data.

Public deliverables as shown in the DOA:

Deliverable Number	Deliverable Title	Lead beneficiary	Type	Dissemination level	Due Date (in months)
D1.2	Final Project Results Report	1 - FTTS	Report	Public	24
D1.3	TRL-Assessment Report	1 - FTTS	Report	Public	24
D2.1	Concept of Operations for AI Situational Awareness System	1 - FTTS	Report	Public	4
D2.2	Requirements for automation of monitoring tasks via AI SA	3 - SLOT	Report	Public	4
D3.1	4D trajectory prediction module	4 - TUBS	Other	Public	10
D3.2	Conflict detection module	5 - UPM	Other	Public	10
D3.3	Air traffic complexity estimation module	1 - FTTS	Other	Public	10
D4.1	Proof-of-concept KG system	2 - JKU	Demonstrator	Public	9
D4.2	KG-Prolog mapper	2 - JKU	Other	Public	15

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D4.3	Populated knowledge graph	1 - FTTS	Other	Public	13
D4.4	Facts, rules and queries capturing en-route ATC operations	1 - FTTS	Other	Public	16
D5.1	Risk assessment report	5 - UPM	Report	Public	23
D5.2	Report on human machine distributed SA	6 - ZHAW	Report	Public	23
D6.2	Project's website and factsheet	3 - SLOT	Websites, patents filling, etc.	Public	6
D6.3	Exploitation and Dissemination Report	3 - SLOT	Report	Public	30
D6.4	Data Management Plan	3 - SLOT	ORDP: Open Research Data Pilot	Public	6

Table 13 Public deliverables as shown in the DOA

Publications:

The list of publications is set in D6.1 Exploitation and Dissemination Plan and as it is a living document it, is not repeated here to avoid errors from duplications.

Data sets:

Based on the Data management records in chapter 3, those data sets will be available where there are no restrictions on the input data or new IPR is not generated by the project on the output data.

Other results

In addition to the ones listed above the consortium will make public all the presentations, presentations materials (such as video on the first workshop which was an online event) that were conducted or used in course of the project activities.

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5 References

[1] “Data management,” European Commission, [Online]. Available: https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/data-management_en.htm.

[2] European Comission, “TEMPLATE HORIZON 2020 DATA MANAGEMENT PLAN”.

[3] T. Radišić, M. Bazina, D. Antolović, I. Tukarić, R. Gurály, A. Kocsis, K. Moebus, I. Hajdinjak and T. Rogošić, “D2.1 Concept of Operations for AI Situational Awareness,” AISA, 2020.

[4] European Commission, “H2020 Programme Guidelines on FAIR Data Management in Horizon 2020”.

[5] European Commission, “Guidelines to the Rules on Open Access to Scientific Publications and Open Access to Research Data in Horizon 2020”.

[6] R. Gurály, A. Kocsis and T. Radišić, “D6.1 Exploitation and Dissemination Plan,” 2020.

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Appendix A Template for Data Management Records

Naming of the data set	
Related Work package	
Related Deliverable(s)	
Author(s) of the certain DMP	
Date of creation	
1. Data Summary	
Purpose of data collection/generation	
Relation to the objectives of the project	
Type and formats	
Usage of existing data	
Data Origin	
Expected size of data	
Data Utility	
2. FAIR Data	
Data Findability	
Discoverability (Metadata)	
Identifiability	
Naming convention	
Keyword approach (search)	
Versioning approach	
Metadata creation standards	
Data Accessibility	
Open availability	

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Way of availability	
Software to be used (guidelines, if any)	
Data, metadata, etc. storage location	
Access in case of restrictions	
Data Interoperability	
data and metadata vocabularies, standards or methodologies followed for interoperability	
Increasing of data re-use	
Data licensing	
Availability for re-use	
Third party usability	
Data quality assurance	
Re-usability duration	
Allocation of resources	
Cost of making data FAIR	
Data Management responsibility	
Cost/value for long term preservation	
Data Security	
Data recovery options	
Secure storage	
Transfer of sensitive data	
Ethical aspects	
Ethical deliverables, DOA	
Other	

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Specific local regulation, measures to follow	
AOB	

Table 14 Template for Data Management Records

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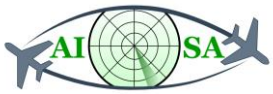

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