HECARRUS Project

Hybrid **E**lectri**C** sm**A**ll commute**R** ai**R**craft concept**U**al de**S**ign

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Abbreviations and acronyms

ARK	Archival Resource Key
CS2JU	Clean Sky 2 Joint Undertaking
DMP	Data Management Plan
DOI	Digital Object Identifier
D_x	Deliverable number x
EC	European Commission
EU	European Union
GDPR	General Data Protection Regulation
KPI	Key Performance Indicators
M_x	Month number x
NDA	Non-Disclosure Agreement
IADP	Innovative Aircraft Demonstration Platforms
IP	Intellectual Property
ITD	Integrated Technology Demonstrators
OA	Open Access
PURL	Persistent Uniform Resource Locator
RIA	Research and Innovation Actions
R&D	Research & Development
SAT	Small Air Transport
TA	Transverse Activities
TRL	Technology Readiness Level
WP	Work Package

Partner acronyms

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Executive Summary

This deliverable (D5.2) entitled "Data Management Plan", is a public document of the HECARRUS project, produced in the context of Work Package 5 (WP5). It is in line with Horizon's 2020 'Open Research Data Pilot (ORDP)' and aims to improve and maximize access to and re-use of research data generated by this Clean Sky 2 Joint Undertaking (CS2JU) project.

HECARRUS is a Thematic Topic of the 9th Call for Proposals (CFP09) of Clean Sky 2 Joint Undertaking and belongs in the Research and Innovation Actions (RIA). It is launched outside the complementary framework of IADP/ITD/TA which implies that it is not directly linked to the activities implemented by the members under the IADP/ITD/TA framework. The consortium of HECARRUS develops and integrates the conceptual design of a 19-passenger commuter aircraft, based on hybrid-electric propulsion configurations. The successful completion of this project will enable further development of innovative hybrid-electric propulsion system configurations for the aircraft of the future.

The purpose of this document is to outline the main strategic axes for the management of the data that are generated in the framework of HECARRUS' activities. It also serves as a guide to open-access strategies and a reference point to project planning, for the successful implementation of the workplan bereft of ambiguities, flaws and intellectual property disputes. Hence, the procedures for the management of all research data and/or scientific publication data are addressed herein. The objective is to establish a detailed structure and framework on how the research data will be originated, handled, exchanged, maintained and preserved to guarantee Findable, Accessible, Interoperable and Re-usable (FAIR) data principles. It is noted that these principles precede implementation choices and do not necessarily suggest any specific technology, standard, or implementation-solution.

Moreover, a description of the project executive planning and a project risk assessment is provided, as an update of the corresponding preliminary actions that were performed at the very beginning of this project, during proposal submission. The scope of project planning and risk assessment is limited to the actions linked either directly or indirectly with overall data collection, generation and exchange. Considering the data management policy, this is defined fully in compliance with the open access strategy adopted by CS2JU and enforced through the Grant Agreement. Accordingly, in line with the rules laid down in the latter, the beneficiaries must aim to deposit the research data needed to validate the results presented in the deposited scientific publications.

Even if the document is due at M3 and project activities are at the beginning, a tentative description of the expected dataset generated is carried out, trying to establish the framework that will be used to ensure that data is secured, shared and exploited in the most systematic way during project development. The analysis in this work shows that, so far, there are eleven data sets that will be produced as part of the project activities and are relevant to be included in the Data Management Plan (DMP). The datasets range from the collection of reviews and surveys on existing state-of-the-art technologies of alternative propulsion powertrains and raw data emerging from the simulations, to stakeholder contacts and workshop data. Regarding the risks concerned, it is observed that high-level risks have already been mitigated with effective measures whereas contingency plans are created for the remaining risks that the project may encounter.

Keywords: Data Management Plan (DMP), project planning, risk assessment, open-access

1. Introduction

The present document is a comprehensive outcome of "Task 5.1 – Project planning and progress reporting". Its main goal is to outline the way that internal as well as external data will be treated over the project's life cycle, provide the executive planning of the various tasks and actions and evaluate the underlying project level risks by adding the corresponding mitigation actions. It is noted that an updated version of risk assessment is also provided in M30, in D4.1, which is a public deliverable of the project. Additionally, all topics addressed in this deliverable will be updated in the context of the periodic evaluation/assessment of the project (M18/M36).

This DMP is mandatory considering the treatment of Research Data and the decision of the project's consortium to 'Opt-in' during the proposal setup phase. This decision activates the Article 29.3 of the Grant Agreement model and obliges the partners to publish their results in open access platforms. Considering the treatment of the research data and in line with the Open Access strategy as it is described below, the data identified in the DMP must become accessible, usable and exploitable by third parties through the deposit on a public repository (e.g. project public website/institutional repositories). At the same time, it must be ensured that the public repository provides the possibility to access, mine, exploit, reproduce and disseminate the results, free of charge. Simultaneously, the tools and instruments developed, remain at the disposal of the beneficiaries for validating the results.

The deliverable outline consists of the following sections:

- Section 2 'Open Access' describes the rules, obligations and rights of the consortium partners to share and protect their IP and enhance the potential for effective dissemination, communication and exploitation of the project results.
- Section 3 'Data Management Plan' provides the guidelines of the data collection, generation and treatment so as to guarantee Findable, Accessible, Interoperable and Re-usable data principles.
- Section 4 'Project Executive Planning' introduces the planning of actions that are carried out during the project's life cycle and include the exchange of the various datasets. The section includes a risk assessment analysis, associated with the data exchange, resources to be exchanged and overall project planning, including effective mitigation actions.

2. Open Access

According to Horizon's 2020 online manual [1], open access (OA) refers to the practice of providing online access to scientific information that is free of charge to the end-user and reusable. 'Scientific' refers to all academic disciplines. In the context of research and innovation, 'scientific information' can mean:

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

Peer-reviewed scientific research articles

Open access to scientific publications means free online access for any user. Although there are no legally binding definitions of 'access' or 'open access' in this context, authoritative definitions of open access appear in key political declarations (the 2002 Budapest Declaration, the 2003 Berlin Declaration).

Under these definitions, **'access'** includes not only basic elements – the right to read, download and print – but also the right to copy, distribute, search, link, crawl and mine.

The 2 main routes to open access are:

A. Self-archiving / 'green' OA – the author, or a representative, archives (deposits) the published article of the final peer-reviewed manuscript in an online repository before, at the same time as, or after publication.
B. Open access publishing / 'gold' OA – partners may also decide to publish in journals that sell subscriptions, offering the possibility of making individual articles openly accessible (hybrid journals). In such a case, authors will pay the fee to publish the material for open access, whereby most high-level journals offer this option.

It is noted that, in the context of research funding, open access requirements do not imply an obligation to publish results. The decision to publish is entirely up to the grant beneficiaries. Open access becomes an issue only if publication is chosen as a means of dissemination. This condition applies in this project as scientific publications are described as disseminating material. Moreover, open access does not affect the decision to exploit research results commercially (e.g. patenting). The decision on whether to publish through open access must come after the more general decision on whether to publish directly or to first seek protection.

Research data

Open access to research data refers to the right to access and reuse digital research data under the terms and conditions set out in the Grant Agreement (Article 29.3). Moreover, research **'data'** refers to information, in particular facts or numbers, collected to be examined and considered as a basis for reasoning, discussion, or calculation. In a research context, examples of data include statistics, results of experiments, measurements, observations resulting from fieldwork, survey results, interview recordings and images. The focus is on research data that is available in digital form. Users can normally access, mine, exploit, reproduce and disseminate openly accessible research data free of charge.

Open access is not a requirement to publish, but is seen by the European Commission (EC) and CS2JU as an approach to facilitate and improve the circulation of information in the European research area and beyond. In the framework of the HECARRUS project, it is perceived that giving Open Access to a significant number of public deliverables (11 out of 15 deliverables) and project outcomes (through the scientific publications, public website posts, workshops and educational sessions), can enlarge the possibility of researchers to enhance the development of new knowledge. Moreover, it will foster the opportunity for aerospace, turbomachinery and electrical engineering experts to facilitate their analysis towards innovative management and component integration solutions, increasing hybridization of the modern aircraft and paving the way for the electrification of the aviation sector.

At this point, it should be underlined that there is a clear distinction on the policy between open access to scientific peer-reviewed publications and open access to research data:

- publications – open access is an obligation in Horizon 2020.
- data – The commission is running a flexible pilot as it is thoroughly described in this document.

2.1 Open Access in the Grant Agreement Model

The importance given by the EC to the open access issue is clearly outlined in the HECARRUS Grant Agreement. In particular, Article 29.2 states the responsibilities of beneficiaries and the actions to be undertaken in order to ensure open access to scientific publications and to research data respectively. The text of the aforementioned article is reported below:

Article 29.2: *Open access to scientific publications*

Each beneficiary must ensure open access (free of charge online access for any user) to all peer-reviewed scientific publications relating to its results.

In particular, it must:

(a) as soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications;

Moreover, the beneficiary must aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications.

(b) ensure open access to the deposited publication – via the repository – at the latest:

i. on publication, if an electronic version is available for free via the publisher, or

ii. within six months of publication (twelve months for publications in the social sciences and humanities) in any other case.

(c) ensure open access – via the repository – to the bibliographic metadata that identify the deposited publication.

The bibliographic metadata must be in a standard format and must include all of the following:

- the terms "Clean Sky 2 Joint Undertaking", "European Union (EU)" and "Horizon 2020";
- the name of the action, acronym and grant number;
- the publication date, and length of embargo period if applicable, and
- a persistent identifier.

The requirement to provide open access to the project's outcome, does not change the obligation to protect results in Article 27, the confidentiality obligations in Article 36, the security-related obligations in Article 37 or the obligations to protect personal data in Article 39, all of which still apply.

As an exception, the beneficiaries do not have to ensure open access to specific parts of their research data if the achievement of the action's main objective, would be jeopardized by making those specific parts of the research data openly accessible. In this case, the data management plan must contain the reasons for not giving access (see section 2.4).

Moreover, the confidentiality aspects have been duly considered in the preparation of this document in order to not compromise the protection of project results and legitimate interests of project partners.

2.2 Open Research Data Pilot (ORDP)

As already described, this deliverable is associated with the Open Research Data Pilot (ORDP) that aims to improve and maximise access to and re-use of research data generated by the projects (e.g. coding, simulations, experiments and surveys). The produced datasets constitute of the various data types that are produced in the context of each project and are stored across repositories and hard drives throughout Europe. The success of the EC's Open Research Data Pilot is therefore dependent on support and infrastructures that acknowledge disciplinary approaches on institutional, national and European levels. The pilot constitutes an excellent opportunity to stimulate and nurture the data-

sharing ecosystem and has the potential to connect researchers interested in sharing and re-using data with the relevant services within their institutions (libraries, IT services), data centres and data scientists. The pilot should serve to promote the value of data sharing to both researchers and funders, as well as to forge connections between the various players in the ecosystem[2].

The HECARRUS project recognizes the value of regulating research data management issues in a proper way, to avoid disclosure of confidential research data. Accordingly, in line with the rules laid down in the Grant Agreement Model, the beneficiaries will deposit relevant project outcome data (results and numbers published in papers and public deliverables) while more specific research data will be publicly released after the approval of all consortium partners, considering the confidentiality that would initially be used to protect the results.

2.2.1 Enabling projects to register discover, access and re-use of research data

Open Research Data Pilot project aims at supporting researchers in the management of research data throughout their whole lifecycle, providing answers to key issues such as "what", "where", "when", "how" and "who" [2], [3].

WHAT: The Open Data Pilot covers all research data and associated metadata resulting from EC-funded (Clean Sky 2 Joint Undertaking is the autonomous legal entity) projects, if they serve as evidence for publicly available project reports and deliverables and/or peer reviewed publications. To support discovery and monitoring of research outputs, metadata have to be made available for all datasets, regardless of whether the dataset itself will be available in Open Access. Data repositories might consider supporting the storage of related project deliverables and reports, in addition to research data.

WHERE: All public released research data has to be registered and deposited into at least one open data repository. This repository should: i) provide public access to the research data (user registration may be asked where necessary); ii) enable data citation through persistent identifiers (DOI, ARK, PURL); iii) link research data to related publications (e.g. journals, data journals, reports, working papers); iv) support acknowledgment of research funding within metadata elements; v) offer the possibility to link to software archives; vi) provide its metadata in a technically and legally open format for European and global re-use by data catalogues and third-party service providers based on wide-spread metadata standards and interoperability guidelines. Data should be deposited in trusted data repositories, if available. These repositories should provide reliable long-term access to managed digital resources and be endorsed by the respective disciplinary community and/or the journal(s) in which related results will be published (e.g. data seal of approval, ISO trusted digital repository checklist).

WHEN: Research data related to research publications should be made available to the reviewers in the peer review process. In parallel to the release of the publication, the underlying research data should be made accessible through an Open Data repository. If the project has produced further research datasets (i.e. not necessarily related to publications) these should be registered and deposited as soon as possible, and made openly accessible as soon as possible, at least at the point in time when used as evidence in the context of publications.

HOW: The use of appropriate licenses for Open Data is highly recommended (e.g. Creative Commons CC0, Open Data Commons Open Database License).

WHO: Responsibility for the deposit of research data resulting from the project lies with the project coordinator (delegated to project partners where appropriate).

To further enhance access to research data and guarantee an efficient data management plan, HECARRUS will emphasize on the widespread dissemination and visibility of its objectives, capabilities, activities and results. The detailed dissemination, communication and exploitation strategy is provided in M6, in the publicly available deliverable D5.3, "Dissemination, Communication and Exploitation plan".

2.3 Research Data Repositories

There are various repositories/cloud-platforms under consideration to serve for the purposes of storing both the internal and external research data. With regard to the internal repository, its purpose is to enable document and archive sharing as a 'cloud' point, with access only allowed among partners. The folders are arranged accordingly, to have dedicated sub-folders that include the data that become available in the HECARRUS Open Research Data Platform. It is noted that at M18, a preliminary analysis will be carried out to identify the data suitable to get open access disclosure. This list will be integrated and confirmed at the end of the project (M36) where all available (for the public domain) data will be uploaded onto a dedicated session of the project website and/or the institutional, external repository. The availability of such repositories and the institutional policies for their use have been examined and will allow for the release of the HECARRUS research data and scientific publications, within the defined timeframe. Additionally, metadata such as keywords will be added to optimize possibilities for data re-use. All data, prior uploading, will be checked for the validity and quality by members of the consortium, responsible for the data management activities.

In addition to the institutional repository and project website, further solutions of suitable repositories are examined, and their use will be justified in a later stage of the project. Some of the repositories under evaluation are the following:

- Repositories of OpenAIRE (Open Access Infrastructure for Research in Europe – www.openaire.eu). OpenAIRE uses data from the Directory of Open Access Repositories, OpenDOAR.
    - Subject based repositories are repositories oriented for research output from one or more well defined research domains. Some examples are ArXiv and Europe PubMed Central. All researchers working in certain subject areas can make use of subject repositories – regardless of their affiliation or geographic location.
    - Institutional Repositories are repositories that are maintained and curated by institutions – very often the library. One such example is the repository that is already mentioned in this section. Repositories collect, curate and make the research output of an institution available on the internet. As a rule, depositing is only possible for researchers affiliated with the institution unless a different arrangement is agreed.
    - A data repository is a digital archive collecting and displaying datasets and their metadata. A lot of data repositories also accept publications and allow linking these publications to the underlying data. Examples include Zenodo, DRYAD, CERN and Figshare and these are all under evaluation for their suitability in this project.
- LIBER (www.libereurope.eu): This repository supports libraries in the development of institutional research data management policies and services. It also enables the exchange of experiences and good practices across Europe. Institutional infrastructures and support services are an emerging area and will be linked to national and international infrastructure

and funder policies. Building capacities and skills, as well as creating a culture of incentives for collaboration on research data management are the core targets of LIBER.

- Other tools include DMP online and platforms for making individual scientific observations available such as ScienceMatters.

It should be noted that the HECARRUS consortium will meet with other 'sister' projects in relevant CS2 workshops, in the framework of Small Air Transport (SAT) platform. The main objective of all projects will be to develop the conceptual design of the 19-passenger commuter aircraft, aiming for near zero emissions. The collaboration of all projects can stimulate a mutual benefit of sharing data, also useful to strengthen the future exploitation of the results of the project.

2.4 Potential Exceptions to Open Access

The HECARRUS configurations will be properly studied and verified via specific optimization modules, which will be developed particularly for the hybridization of the small commuter aircraft. The models will be initially kept confidential until they are validated and protected. Access to data and results will become available, in line with the open access mandates.

It should be noted that the level of confidentiality of gathered data will be verified and checked by the partner responsible for the activity (work package leader) in which the data has been collected and potentially the data owners, if, for example, confidential input is provided by any of the members of the 'Technical Advisory Board' that is established within this project. This will lead in the decision of either disclosing the data or not. For this reason, a written confirmation to publish data in the HECARRUS Open Access Repository will be asked via e-mail by the work package leader to the data owner. Hence, it will be possible to make such data available only following the received confirmation provided by the data owner. No confidential data generated within the project will be made available in digital form. This part will constitute the potential exception to open access where the beneficiaries are not obliged to ensure open access to specific parts of their research data.

2.5 Scientific Research Articles

A major means of reaching the targeted scientific audience of the HECARRUS project is to publish the project results in the International scientific/technical literature. Additionally, results will be presented at relevant conferences, symposia, seminars, workshops and other events either through oral or poster presentations. The publications that will be delivered throughout the entire duration of the project, will be also made available online through the project's website, whilst safeguarding at the same time the rights of the consortium partners to protect their IP. The project will furthermore promote its results at the National level in the various Member States of the partners. A tentative list of the conferences and journal articles is provided in Table 1. A more detailed list is provided in the dissemination plan (D5.3) of the project.

Table 1. Preliminary conference and journal identification.

Conferences/Symposia	Journals
ICAS Congress	Elsevier Journals
ASME Turbo Expo	RAeS the Aeronautical Journal
AIAA/IEEE Electric Aircraft Technologies Symposium	AIAA Journal
Global Power and Propulsion Society (GPPS)	GPPS Journal
Electric & Hybrid Aerospace Technology Symposium	MDPI Aerospace
ISABE Conference	Journal of Turbomachinery

Some of the publishers described in the previous table may include high costs with regard to the open access requirements. The consortium will identify suitable solutions with the lowest possible

costs for publication to ensure open access and high quality in the peer review process. Moreover, repositories that may claim rights over the deposited project publications will be eliminated from the evaluation of the consortium's available options.

3. Data Management Plan

3.1 Overview

Data Management Plans (DMPs) are a key element of good data management. A DMP describes the data management life cycle for the data to be collected, processed and/or generated by a Horizon 2020 project. As part of making research data Findable, Accessible, Interoperable and Re-usable (FAIR), a DMP should include information on:

- the handling of research data during & after the end of the project;
- what data will be collected, processed and/or generated;
- which methodology & standards will be applied;
- whether data will be shared/made open access and;
- how data will be curated & preserved (including after the end of the project).

The nature of the HECARRUS project dataset generated, handled and preserved primarily consists of numerical and software toolsets. There is also the potential of incorporating some micro-scale experimental results that may be carried out at the premises of the institutional partners, to validate the numerical models that will be mainly used throughout the project's duration. The generation of numerical data will emerge from 2D/3D CFD (Computational Fluid Dynamics), structural and thermal models, 1D and 0D whole-engine/aircraft performance cycles based on either empirical or physics-based analytical solutions. In-house tools will be also employed, for the assessment of the environmental impact of the novel propulsion cycles (EVA framework [4]), as well as the radical exploration of the design space available for the engine and whole propulsive system conceptual design. Moreover, commercial packages (e.g. JPL, Dymola) that have been validated and used extensively in the industry will be employed in some aspects of the project. Lastly, the effective realization of the final deliverables of this project require the application of multi-disciplinary frameworks. As such, data will be also generated from similar tools [5] focusing on gradient-based optimization and taking into consideration the effect of the different components of the powertrain. The generation of several geometrical/topological configurations are also considered in the datasets that will be generated by the project, through CAE software [6] and parametric aircraft geometry tools [7]. Additionally, datasets on costs are expected to occur during the second year of the project, where the preliminary techno-economic analysis will take place. The source code management is a self-managed procedure and is undertaken by the consortium, by utilising git-based repositories (GitLab, GitHub etc.). The summary of the DMP is provided at the end of this section, in sub-section 3.7.

3.2 Data Summary

In order to provide an overview of the different datasets that are produced over HECARRUS project life cycle, Table 2 presents the details of the data type, origin and format extension. Data types include numerical datasets, computer codes, text data, technical figures, contact lists, survey and workshops data. Primary data correspond to the main output that undergoes the already described confidentiality control, before it is made publicly available.

Table 2. Information on the data types that will be used within the project.

No.	Data Type/Purpose of Data	Origin	WP	Format extension
1	State-of-the-art reviews and similar documentation	Publicly available data	1	.docx, .xls
2	Sizing of components	Primary data & Publicly available data	1	.docx, .xls
3	Performance data	Primary data	1	.docx, .xls
4	Quantitative survey data	Primary data & Publicly available data	1, 2, 3, 4	.csv, .xls
5	Geometrical data	Primary data & Publicly available data	1, 3	.stp, .igs, .stl, .vsp3, .ansa, .cas,
6	Source code files	Primary data	1, 2, 3, 4	.txt, .dat, .py, .c, .h, .m, .mo
7	Stakeholder contacts list	Primary data	5	.xls
8	Technical Advisory Board input data	Primary data & Publicly available data	5	.docx, .xls
9	Workshops' data	Primary data & Publicly available data	All	.docx, .xls, .txt
10	Potential micro-scale experiments	Primary data	1, 2, 3	.csv, .xls, .txt
11	Portable document format and graphic data	Publicly available data	All	.pdf, .png, .tif, .ppts, .mp4

It is noted that all research data presented may additionally include formats as methodologies, protocols and workflows, since this is the inherent nature of this work that investigates the conceptual design of the light commuter aircraft.

3.3 FAIR data

According to [8], the HECARRUS partners must ensure that research data that will be released as Open Access must be findable, accessible, interoperable and re-usable. TABLE summarizes the FAIR guiding principles for scientific data management and stewardship [9].

Table 3. FAIR Guiding Principles.

FINDABLE	**F1:** (meta)data are assigned a globally unique and eternally persistent identifier **F2:** data are described with rich metadata **F3:** metadata clearly and explicitly include the identifier of the data it describes **F4:** (meta)data are registered or indexed in a searchable resource
ACCESSIBLE	**A1:** (meta)data are retrievable by their identifier using a standardized communications protocol **A1.1:** the protocol is open, free, and universally implementable **A1.2:** the protocol allows for an authentication and authorization procedure, where necessary **A2:** metadata are accessible, even when the data are no longer available
INTEROPERABLE	**I1:** (meta)data use a formal, accessible, shared and broadly applicable language for knowledge representation **I2:** (meta)data use vocabularies that follow FAIR principles **I3:** (meta)data include qualified references to other (meta)data
RE-USABLE	**R1:** meta(data) are richly described with a plurality of accurate and relevant attributes **R1.1:** (meta)data are released with a clear and accessible data usage license **R1.2:** (meta)data are associated with detailed provenance **R1.3:** (meta)data meet domain-relevant community standards

3.3.1 Making data findable, including provisions for metadata

In order to address the following sections that are linked to FAIR data, the work presented is based on the template provided by Horizon 2020 on DMP [10] and other DMPs from Clean Sky 2 research

projects [11]. The data that will be produced and used in the project will be discoverable with metadata, and also, identifiable and locatable by means of standard identification mechanisms. These include Digital Object Identifiers (DOI) that will be ensured through all open-access publications and unique identification mechanisms on the file names of the numerical data. Moreover, the research data and the metadata file names will include the project name, the WP number, the specific topic and a clear version number, that will make the data identifiable and hence, findable. Other metadata such as keywords will be added to optimize the possibilities for re-use. Additionally, *readme*.txt files will provide a list of the contents of each directory and standard file nomenclature.

3.3.2 Making Data Openly Accessible

This section describes which data are produced and used in the project and which of the data will be made publicly available (Table 4). Moreover, an explanation of the reasons that some datasets cannot be shared is provided and, in that case, an alternative solution is provided. In all cases, the data will be made accessible by depositing it in the repositories as they are described in section 2.3 of this deliverable. As already highlighted, datasets with background Intellectual Property that belong to either the partners of the project or the members of the Technical Advisory Board will not be made openly available unless a different agreement is made. Specific cooperation agreements between the Consortium and the members of the Board will disclose those datasets and any other sensitive information in confidence.

Any other datasets that do not contain specific IP background will be made openly available. In this context, any of the HECARRUS project output data will be post-processed in such a way as to remove any background IP to make it publicly accessible. Moreover, all peer-reviewed scientific publications resulting from the project will be Open Access where possible and most of the corresponding datasets will go along with those publications.

The software codes that will be used from the project partners will not be made available unless it is decided differently during the project's progress and after the partners agreement to provide any bits of the codes in an open source form. Additionally, if it is deemed important, a data access committee will be decided and will specifically work on this part so as to put the required restrictions in the accessibility of the datasets, ascertaining the identity of the people who will be accessing the data.

Table 4. Dataset that will be used and made openly available.

No.	Data Type/Purpose of Data	Data openly available (y/n)	Justification	Alternative Solution
1	State-of-the-art reviews and similar documentation	Yes	-	-
2	Sizing of components	Yes	-	-
3	Performance data	Yes	-	-
4	Quantitative survey data	Yes	-	-
5	Geometrical data	No	Datasets restricted by IP will not be made available.	Output data will be post-processed in such a way as to remove any background IP and make it publicly accessible.
6	Source code files	No	Some of the data files will not be shared due to confidentiality issues.	Output data will be post-processed in such a way as to remove any background IP and make it publicly accessible.

7	Stakeholder contacts list	No	Despite that the stakeholders will be well known professionals, the list cannot be shared due to misuse issues of spamming programs.	More information about the stakeholder data, opportunities and issues that arise during the project's progress will be provided in D5.4 in the project's final plan for use and dissemination.
8	Technical Advisory Board input data	No	The data coming from the board will not be published due to privacy, security and confidentiality concerns.	Data coming from the Technical Advisory Board and available in the public domain will be also shared after the board's consent.
9	Workshops' data	No	The data from the workshops cannot be made publicly available.	Data will be post-processed in such a way as to remove any background IP and make it publicly accessible.
10	Potential micro-scale experiments	Yes	-	-
11	Portable document format and graphic files	Yes	-	-

3.3.3 Making data interoperable

Interoperability of data coming from different sources, is an essential part that needs to be considered in order to allow for other researchers, institutions, organisations and countries to facilitate re-combinations with different datasets from the various origins.

In particular, the data developed in HECARRUS will be fully documented and accompanied with detailed metadata supported by a set of keywords, to facilitate automatic discovery and integration for other purposes. In addition to usual metadata standards, technical aspects such as units (complying with SI standards) and spatial and temporal references will be supplied. All data will be provided in generally used extensions, adopting the formats (e.g. .docx, .csv) that were described in section 2.2, which will also facilitate its use by other parties. In case of executable files, an additional *readme*.txt file with metadata content will be provided. An exception for the interoperability will apply for the data that will be covered by IP rights and which will be exchanged in particular formats, decided within the consortium.

3.3.4 Increase Data Re-use (through clarifying licenses)

In order to permit the widest re-use possible, the data must be licensed in a proper manner. As such, research data will become available as soon as possible in the form of machine-readable electronic copies of peer-reviewed articles (conference/journal paper). The work may be protected by the use of appropriate licenses (Creative commons appropriate licenses). As a result, the data originating from research publications will be made available for re-use based on the time required to get peer-reviewed and the final publication acceptance. The research data will become available as soon as the corresponding deliverables are accepted and post-processed to remove IP background. Most of the research data are expected to become available after the end of the project as this is when most of the crucial deliverables are expected to be delivered. Moreover, the sensitive data that require protection or post-processing before publication will remain restricted and will become available for re-use as soon as they are protected through IP rights or post-processed for publication. It is expected that the complete datasets become publicly available for re-use after the full completion of the project. Until that point, information will be provided through peer-reviewed publications.

To facilitate and guarantee the re-use of data, a clear history of origin, methodology, data workflows and references will be provided in the final reports. This will be established through the

large number of public deliverables that is foreseen for the project. Moreover, keywords will be used to enable more efficient data re-use.

3.4 Allocation of Resources

In order to make data FAIR in HECARRUS project, specific costs have been foreseen during the proposal submission phase with regard to dissemination and workshops running. Open access to research publications where most of the important data will be included, will be ensured throughout the entire project's duration. Moreover, if deemed necessary, costs related to open access to further research data will be justified and claimed in accordance with the Grant Agreement Model. Apart from the main data manager of the project who is the project coordinator (AUTH), each partner will be responsible for their own confidential data management and will inform the other collaborators on which data is sensitive and requires protection or specific post-processing.

As far as the repositories are concerned, the datasets stored there will be free-of-charge to facilitate ease of access and enable further research. Overall, the allocation of resources for FAIR data will enhance open access principles and ensure openness for a significant amount of time until data is preserved from open access.

3.5 Data Security

An aspect that requires consideration when sharing data, is to ensure that all researchers keep up the principles of lawful and ethical data management along the whole project duration and after its successful realization. It should be noted that even at this early stage of the project (M3) some details are defined with regard to data security. However, there are still uncertainties about the collection of data and the way this will be secured and adapted, based on the means of collection.

First and foremost, it has been defined during the project proposal phase that the proposed project does not involve anything related to:

- Activities or results raising security issues; 'EU-classified information' as background or results.
- Potential for military applications.
- Any material imported from non-EU countries into the EU.
- Any material exported from the EU to non-EU countries.

Moving on to the individual data security, each researcher is solely responsible for the collection and security of his/her own data. Information not directly related to the goal of his/her research is outside his/her scope and is not to be collected and secured by him/her.

Concerning the personal information included, researchers have to indicate what data contains personal details. When the dataset contains personal information or otherwise information that needs to be kept confidential, the following privacy principles should be considered:

- Sensitive data should be stored at either the dedicated trial site server or encrypted in the repository that will be used.
- In the case of personal data collected in physical form (e.g. papers, folders etc.) it will be stored in restricted-access areas where only authorized staff of the corresponding HECARRUS partners has access.

In the case of collecting personal information such as stakeholders' contacts, informed consent from the participants in the list must be ensured. Consent must cover all processing activities carried out for the same purpose or purposes. When the proposing has multiple purposes, consent should be given for all of them. The people of which data will be kept in a form of the project's datasets have

the 'end-users' right to see which information about them is kept in the corresponding files and request for his data to be deleted.

Personal and sensitive user data will be stored safely and in a secure environment at each partner site. Monthly backups will be performed to secure server data management and will be in line with GDPR. A security protocol will be established once the project reaches the maturity level, for all the partners storing personal data (defining authentication, authorization and encryption; protection against unauthorized access, internal threats, human errors, etc.). Lastly, a specific project 'Privacy Policy' will be defined during the project.

All in all, the privacy of the project's participants both directly or indirectly involved will be kept at high level of importance. The same will apply for any rising confidentialities and also, for the data that will be made openly accessible.

3.6 Ethical Principles

Article 34.1 describes the obligation of the beneficiaries to comply with ethical and research integrity principles. The research produced within the context of HECARRUS will ensure that the ethical principles are applied in the scope of the activities performed during the project's life cycle. Moreover, the project beneficiaries will respect the principles of research integrity. This implies compliance with the fundamental principles of reliability, honesty and respect. Considering the users' personal data (names, emails and affiliation) collected through all means, they will be collected, retained, filed and processed in full compliance with the General Data Protection Regulation (GDPR).

3.7 Summary

A summary of the actions described is provided in Table 5 below.

Table 5. Summary of the Data Management Plan (DMP).

DMP component	Issues to be addressed
1. Data Summary	► State the purpose of the data collection/generation *Data types will include numerical datasets, computer codes, text data, technical figures, contact lists, survey and workshops data. Numerical and software toolsets, mainly consisting of generated codes and/or geometries of specific elements of the aircraft will be used to size and evaluate the performance of the aircraft components. Experiments are optional and may be employed as side actions to validate the numerical models.* ► Explain the relation to the objectives of the project *The aforementioned tools are needed to address the component level, the systems' level and the aircraft level analysis. Considering the environmental impact, the novel propulsion cycles, in-house validated tools will be used and generate the associated data.* ► Specify the types and formats of data generated/collected *Documentation of data (.docx, .xls, .csv), code files (.txt, .dat, .py, .c, .h, .m, .mo), geometrical data (.stp, .igs, .stl, .vsp3, .ansa, .cas), graphic data (.pdf, .png, .tif, .ppts, .mp4)* ► Specify if existing data is being re-used (if any) *Re-used data will emerge from literature surveys that will be conducted. The origin of all emerging numerical data is coming from the current project itself as well as information existing in the public domain.* ► Specify the origin of the data *The generation of numerical data will emerge from high-fidelity 2D/3D CFD (Computational Fluid Dynamics), low-fidelity structural and thermal models, 1D and 0D whole-engine/aircraft performance cycles based on either empirical or physics-based analytical solutions. Primary data correspond to the main outputs of the project while publicly available data constitute information of the public domain.* ► State the expected size of the data (if known)

	The generated data size is ambiguous at the time of this document's preparation. It will however exceed the amount of at least 1TB of data, due to the project's inherent numerical nature. ► Outline the data utility: to whom will it be useful *The methodologies and tools developed within the HECARRUS framework will be useful to the academic and industrial societies of aerospace engineering, aiming to electrify the aircraft of the future. Moreover, the datasets will be useful to the Small Air Transport community to identify the scientific and technical challenges existing for the deployment of hybrid (or fully) -electric architectures to a commuter size aircraft. Besides, the generated data will assist in all key enabling technologies to reach higher technological readiness levels (TRLs).*
2. FAIR Data 2.1 Making data findable, including provisions for metadata	► Outline the discoverability of data (metadata provision) *The data that will be produced and used in the project will be discoverable with file names, nomenclature and metadata.* ► Outline the identifiability of data and refer to standard identification mechanism. Do you make use of persistent and unique identifiers such as Digital Object Identifiers? *Data will be identifiable and locatable by means of standards identification mechanisms (e.g. DOI, ARK, PURL).* ► Outline naming conventions used *Unique identification mechanisms on the file names of the numerical data are used. The research data and the metadata file names will include the project name, the WP number, the specific topic and a clear version number.* ► Outline the approach towards search keyword *Metadata such as keywords is used to optimise possibilities for re-use.* ► Outline the approach for clear versioning *Based on the type of dataset produced, the filename will initially include the name of the project, a description indicative of the file's nature will follow and lastly, the version that is shared. e.g. Filename: HECARRUS_[EventName_WPnumber_DeliverableNumber]_Version.* ► Specify standards for metadata creation (if any). If there are no standards in your discipline describe what type of metadata will be created and how *This part is under consideration. A preliminary list of metadata standards is initiated, including the following: DIF-Directory Interchange Format, ISO/IEC19506 – Software systems, ICAO Annex [12], INSPIRE directive [13].*
2.2 Making data openly accessible	► Specify which data will be made openly available? If some data is kept closed provide rationale for doing so *Datasets with background Intellectual Property that will belong to either the partners of the project or the members of the Technical Advisory Board will not be made openly available. Any other datasets that do not contain specific IP background will be made openly available.* ► Specify how the data will be made available *All peer-reviewed scientific publications resulting from the project will be Open Access where possible and most of the corresponding datasets will go along with those publications.* ► Specify what methods or software tools are needed to access the data? Is documentation about the software needed to access the data included? Is it possible to include the relevant software (e.g. in open source code)? *Any of the HECARRUS project output data will be post-processed in such a way as to remove any background IP to make it publicly accessible. If it is deemed necessary, information on how to easily access and use the datasets will be provided by 'readme' files included in the corresponding folders.* ► Specify where the data and associated metadata, documentation and code are deposited *The available for publication datasets will be uploaded onto external institutional repositories either directly linked with the project's website, or as individual entities.*

	► Specify how access will be provided in case there are any restrictions *If it is deemed necessary, a data access committee will be decided and will specifically identify the required restrictions in the accessibility of the datasets, ascertaining the identity of the people who will be accessing the data.*
2.3 Making data interoperable	► Assess the interoperability of your data. Specify what data and metadata vocabularies, standards or methodologies you will follow to facilitate interoperability. *The data developed in HECARRUS will be fully documented and accompanied with detailed metadata supported by a set of keywords, to facilitate automatic discovery and integration of HECARRUS data for other purposes. In addition to usual metadata standards, technical aspects such as units (complying with SI standards) and spatial and temporal references will be supplied. All data will be provided in generally used extensions, adopting the formats (e.g. .docx, .csv), which will also facilitate its use by other parties. In case of executable files, an additional readme.txt file with metadata content will be provided. An exception for the interoperability will apply for the data that will be covered by IP rights and which will be exchanged in particular formats, decided within the consortium.* ► Specify whether you will be using standard vocabulary for all data types present in your data set, to allow inter-disciplinary interoperability? If not, will you provide mapping to more commonly used ontologies? *Standard vocabularies will be used for all data types to allow inter-disciplinary interoperability.*
2.4 Increase data re-use (through clarifying licenses)	► Specify how the data will be licenced to permit the widest reuse possible *Research data will become available as soon as possible in the form of machine-readable electronic copies of peer-reviewed articles (conference/journal paper). The work may be protected by the use of appropriate licenses (Creative commons appropriate licenses).* ► Specify when the data will be made available for re-use. If applicable, specify why and for what period a data embargo is needed *The data originating from research publications will be made available for re-use based on the time required to get peer-reviewed and the final publication acceptance. The research data of the project will become available as soon as the corresponding deliverables are accepted and post-processed so as to remove IP rights. Most of the research data are expected to become available after the end of the project as this is when most of the crucial deliverables are expected to be delivered.* ► Specify whether the data produced and/or used in the project is useable by third parties, in particular after the end of the project? If the re-use of some data is restricted, explain why *The sensitive data that require protection or post-processing before publication will remain restricted and will become available for re-use as soon as they are protected through IP rights or post-processed for publication. It is expected that the complete datasets become publicly available for re-use after the full completion of the project. Until that point, information will be provided through peer-reviewed publications.* ► Describe data quality assurance processes *To facilitate and guarantee the re-use of data, a clear history of origin, methodology, data workflows and references will be provided in the final reports. The coordinator will ensure that each delivered dataset and research publication has followed the appropriate verification and approval process, including internal peer review process.* ► Specify the length of time for which the data will remain re-usable *Data will remain re-usable for at least 3 years after the project's completion. This is subject to IP and discussions with the Project Officer.*
3. Allocation of resources	► Estimate the costs for making your data FAIR. Describe how you intend to cover these costs *In order to make data FAIR in HECARRUS project, specific costs have been foreseen during the proposal submission phase with regard to dissemination and workshops running. Open access to research publications where most of the important data will be included, will be ensured throughout the entire project's duration. Moreover, if deemed necessary costs related to allowing for open access to further research data will be justified and claimed in accordance with the Grant Agreement Model.*

	► Clearly identify responsibilities for data management in your project *Apart from the main data manager of the project who is the coordinator partner (AUTH), each partner will be responsible for their own confidential data management and will inform the other collaborators on which data is sensitive and requires protection or specific post-processing.* ► Describe costs and potential value of long-term preservation *Costs of long-term preservation are taken into consideration and will be discussed during the project's physical meetings so as to avoid any potential lack of resources which will restrict access to the open access data.*
4. Data security	► Address data recovery as well as secure storage and transfer of sensitive data *With regard to individual data security, each researcher is solely responsible for the collection and security of his/her own data. Information not directly related to the goal of his/her research is outside his/her scope and is not to be collected and secured by him/her. When the dataset contains personal information or otherwise information that needs to be kept confidential, the following privacy principles should be considered:* *• Sensitive data should be stored at either the dedicated trial site server or encrypted in the repository that will be used.* *• In the case of personal data collected in physical form (e.g. papers, folders etc.) it will be stored in restricted-access areas where only authorized staff of the corresponding HECARRUS partners has access.* *Personal and sensitive user data will be stored safely and in a secure environment at each partner site. Monthly backups will be performed to secure server data management and will be in line with GDPR. A security protocol will be established once the project reaches the maturity level, for all the partners storing personal data (defining authentication, authorization and encryption; protection against unauthorized access, internal threats, human errors, etc.). Lastly, a specific project 'Privacy policy' will be defined during the project.* *All in all, the privacy of the project's participants both directly or indirectly involved will be kept at high level of importance. The same will apply for any rising confidentialities and also for the data that will be made open access. Security will remain of primary importance.*
5. Ethical aspects	► To be covered in the context of the ethics review, ethics section of DoA and ethics deliverables. Include references and related technical aspects if not covered by the former. *The research produced within the context of HECARRUS will ensure that the ethical principles are applied in the scope of the activities performed during the project's life cycle. Moreover, the project beneficiaries will respect the principles of research integrity.*
6. Other(s)	► Refer to other national/funder/sectorial/departmental procedures for data management that you are using (if any) *Part of the requested budget for this project is targeted mainly for guaranteeing open access to data developed during the 3-year period.*

4. Project Executive Planning

4.1 Overview

After the description of the DMP and the open-access strategy, a project executive planning is provided as it is directly linked to the actions that need to be carried out throughout the project and will include the exchange of several datasets. The scope of this section is limited to the planning of actions that have a direct or indirect effect on the data collection, generation and exchange. Moreover, a thorough analysis of the project level risks is included, associated with the data exchange, resources to be exchanged and overall project planning. Effective mitigation actions are also provided. As it is mentioned in the previous sections, and, even though most of the actions have already been planned and defined, possible changes or additions may be included in the upcoming milestones, reports and deliverables with regard to the planning and risk assessment of the project.

4.2 Methodology of the Project Implementation

The project will last 36 months and is divided into 5 Work Packages (WP), each targeting to concur as a whole to the achievement of the project's objectives (Figure 1). WP1 focuses on the efficiency and TRL of each component of the powertrain starting from literature reviews to state-of-the-art technologies up to individual component assessments that will enable better aircraft efficiencies. WP2 examines the powertrain architectures available, incorporates inputs from the WP1 results and aims to optimize for the overall efficiency, weight and inherent issues at systems' level. Feasibility and benefits of alternative power train concepts for the small commuter aircraft of the future is also examined as part of the work through various assessments, and evolutionary concepts to be achieved in the longer-term future will be provided in the upcoming deliverables of the project. WP3 focuses on the aircraft level and the integration of the powertrain components in the airframe. A holistic optimization and full-loop design is also planned to be provided at the end of the project, resulting in the final conceptual design of the selected architecture. WP4 provides quantified environmental performance predictions for the selected architecture and preliminary techno-economic assessments to evaluate the associated direct operating costs for the selected designs. The necessity for specific inputs from the research done in the first three work packages endorses that this WP has to start at the beginning of the second year of the project (M13). WP5 includes the activities related to project coordination, management, dissemination, communication and cost reporting.

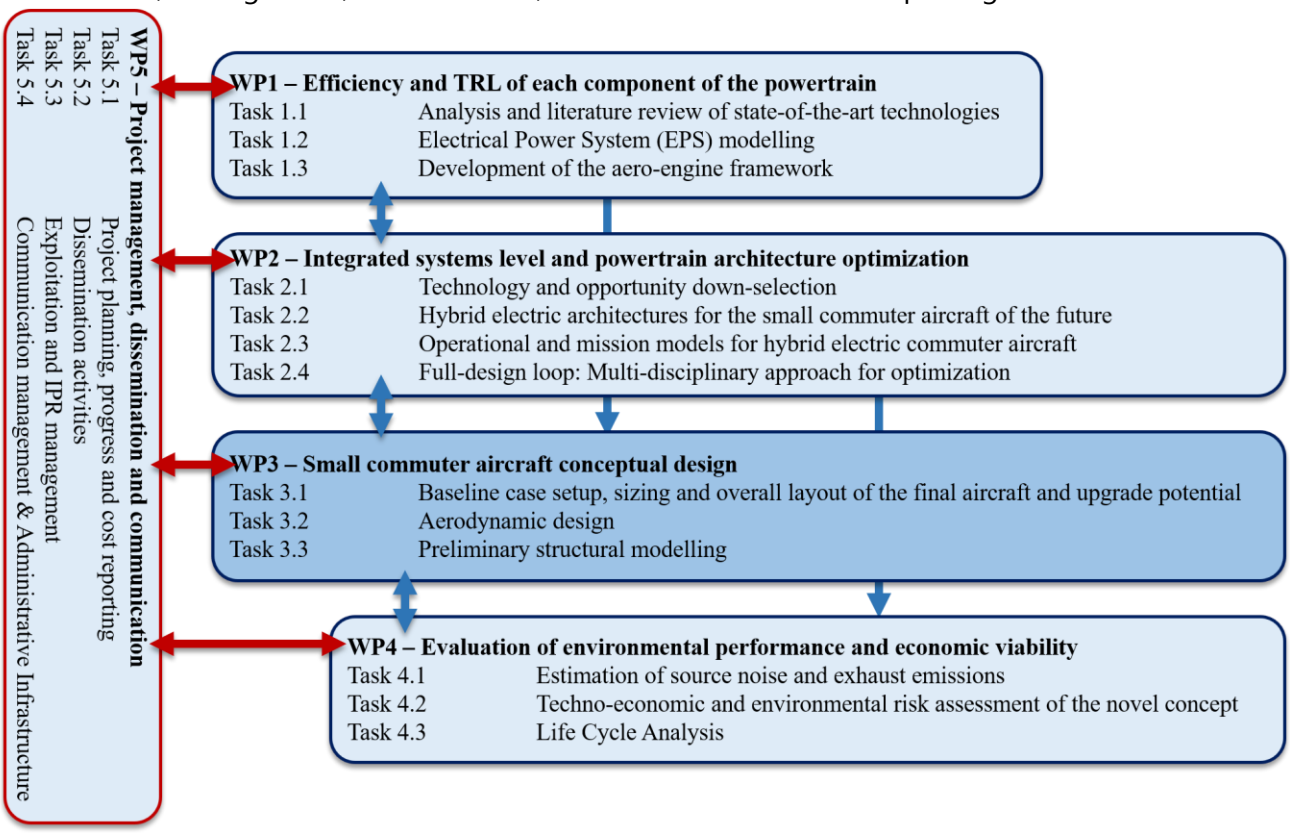

Figure 1. Project work overall structure.

To effectively achieve the goals set in the project workplan and complete the associated tasks of each WP, a breakdown strategy is developed to foster the maximum possible quality and impact of the results. At the very beginning of the project, a review of the state-of-the-art technologies is performed, and a dataset of the requirements and performance needs is created. In parallel to the literature survey actions, a technology and opportunity down-selection assessment is done for the

most suitable hybrid-electric architectures to power a 19-seater commuter aircraft. The aim here is to develop a pool of conceptual architectures out of which the most suitable will be down-selected. The aircraft mission profile is also a part of the ongoing work of the first year's parallel tasks. This process will define the Key Performance Indicators (KPIs) for the selected powertrain architectures. These indicators are measurable criteria and parameters essential in the performance evaluation of alternative propulsion architectures. Moreover, in parallel to the aforementioned actions, a report on numerical methods used to model and simulate advanced GT engines, operating in hybrid-electric architectures is created. One of the consortium's priorities will be to disseminate and communicate the findings and generated datasets as soon as possible, in accordance to the open access requirements and data management planning. Overall, the work described so far is required to reach the first major milestone at the end of year-one.

The second year of the project delves into a detailed analysis of the various aircraft concepts. Optimization of the mission model is required and also, a report on the electrical powertrain consisting of the energy storage, power generation, distribution and management which is to be finalised. This part also includes preliminary aerodynamics, as well as structural aspects of the investigated concepts. In addition to the generated datasets from the previously mentioned studies, an initial dataset of the stakeholders' contacts will be formed, to discuss and decide some final details of the investigated concepts.

The third and final year of the project consists of the most important datasets and results that will describe the conceptual design of the commuter aircraft. Optimization tasks, techno-economic and life-cycle analyses will be based on the work done in the first two years, which underlines the importance in the tasks foreseen for the starting and middle points of the project.

To guarantee the quality and impact of the findings, a Technical Advisory Board is formed, consisting of experts in different segments of the aerospace engineering field. Moreover, the board will enhance the project's links to the industry and pave the way for efficient dissemination and communication of the project's findings.

The abovementioned description is mainly driven by numerical investigations and coding setups. Several datasets will be developed throughout this process. The format, the type and the overall nature of the latter is described in section 3 of this deliverable.

4.3 Planning Elements

Data Management responsible people

It is out of the scope of this deliverable to go through detailed governance structure of the project. In its generic form, Figure 2 describes the involved parties that guarantee that the project meets its main objectives in time, with sufficient resources allocation and the highest quality and impact of the results. In line with the DMP described so far, data will be managed by each partner and will be checked for validity and quality.

Internal Consortium Agreement

An internal project Consortium Agreement (CA) has been signed in M1 to establish the participants' internal arrangements regarding their operation and co-ordination and ensure the proper implementation of the action. The CA between the partners covers:

i. internal organization of the consortium;
ii. distribution of JU funding;
iii. principles of the Technical Advisory Board (TAB);

iv. settlement of internal disputes;

v. liability, indemnification and confidentiality arrangements between the beneficiaries.

The internal CA also includes definitions relating to background and data exchange and overall way of know-how and information potential disclosure.

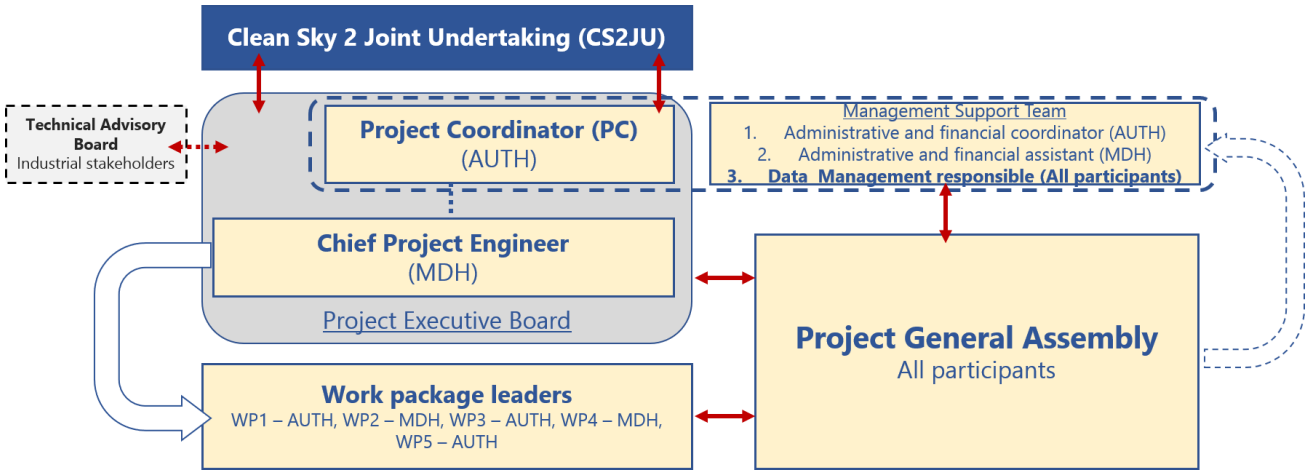

Figure 2. Organizational structure and management.

Work Package leaders

For the successful implementation of the workplan, each work package has its own work package leader. The following partners are currently leading the corresponding work packages:

- WP1: AUTH
- WP2: MDH
- WP3: AUTH (Co-led with LSC)
- WP4: MDH
- WP5: AUTH

The WP leaders are responsible for managing their WP as a self-contained entity. The scope of their responsibilities includes coordinating, monitoring and assessing the progress of the WP to ensure that output performance, budget, deliverables and timelines are met. In cooperation with the project coordinator, WP leaders are responsible for the integration of their results into succeeding work packages or tasks. Regarding the various datasets generated in each WP, the corresponding WP leaders have to verify and check the level of confidentiality of the gathered data.

WP leaders' regular meetings

As a measure of decision making, issues' resolution and quality monitoring, the HECARRUS consortium has planned for several internal meetings between the WP leaders. These meetings constitute of regularly planned meetings where progress is monitored, new findings are evaluated, issues and emerging risks are discussed with effective contingency measures. Upcoming meetings, deliverables and potential deviations from the original plan are also discussed with the ultimate goal being to address the project's main objectives in an optimal manner. Data management and open access is also a topic of consideration that defines the level of treatment required for each bit of information exchanged for the purposes of the WP operability.

HECARRUS Boards and Committees

HECARRUS project is a Small Collaborative Project, consisting of three partners of the EU. As a result, its structure is oriented towards the successful implementation of the technical subject that is

examined. The Project Executive Board (PEB) consists of the project coordinator and chief engineer, as the supervisory body for the execution of the project. For the efficient data management and procurement and maintenance, the 'management support team' includes a data management person from each partner, responsible to discuss and decide with the PEB the aspects that have to be considered about the generated datasets, according to the DMP that is prepared for the purposes of this project. Moreover, WP leaders will raise all issues that concern the data management during the project's online physical (e.g. general assemblies) and online meetings. Lastly, the Technical Advisory Board which is formed to assist and facilitate the decisions made by the General Assembly, will need to adhere to confidentiality issues and the consortium itself, must protect any data issues that will accompany the Board's inputs.

4.4 Risk Assessment and Mitigation Measures

The planning of an action includes implicit risks that need to be anticipated over the entire project life cycle. For this reason, effective measures must be adopted to mitigate the risks, as part of a contingency plan. A preliminary risk assessment has already been done at the proposal preparation phase, including several technical risks that were identified at that time. In order to manage HECARRUS in a professional and efficient manner, the list of measures for avoiding risks related to administrative, financial, legal and technical aspects is included in this deliverable (Table 6) and will be upgraded in parallel to the project's progress since the first month of implementation. As this deliverable is oriented towards the data management and planning, emphasis is put on the associated risks that include the generation and exchange of datasets in either a direct or indirect manner. It should be noted that risk priority is out of the scope of this table but is an internal consideration of the project's executive planning. Moreover, positive risks are also not included in this work but means of exploitation if these occur, are included within the consortium's risk management protocol.

Considering the status of use of resources, these are included in the table due to the need to properly allocate resources for open-access, dissemination and communication purposes. An analytical update of the use of resources is planned to be provided in the project's various intermediate reports. In addition to what is already described and the information provided in Table 6 below, a thorough risk assessment for techno-economic and environmental sustainability is planned in deliverable D4.1, "Techno-economic and environmental risk assessment", planned for M30 of the project. This is directly linked to the conceptual, early-stage of design that characterizes this project and constitutes the reason for including one such deliverable in the workplan. The work at this level will set the necessary base for an assessment methodology than can quantify the risks and assess the impact of the proposed engine/aircraft designs on the environment by comparing and assisting to rank future technologies and design concepts for civil aviation on a formal and consistent basis.

Table 6. Critical risks for implementation – 2nd phase of risk analysis.

Type of risk	Description of risk	WP	Risk	Impact	Likelihood to occur	Proposed risk-mitigation measures
Administrative, Financial & Legal	HECARRUS consists of a small consortium with partners mainly coming from the academia. This implies relatively weak links to industry.	WP5	H	M	H	This risk is remedied by the constitution of the project's Technical Advisory Board. The Board consists of experts in different segments of the aerospace engineering field and its role is to assist and facilitate the decisions made by the project's consortium.
	The constitution of the Technical Advisory Board implies that several datasets will be exchanged including technical assessments, quality assurance etc. Confidentiality issues arise.	WP5	H	H	L	This risk is remedied by the signature of non-disclosure agreements (NDAs) and by foreseeing specific measures of data exchange and confidentiality in the DMP and the project's Internal Consortium Agreement.
	The Stakeholders' contact list remains poor and the engagement of relevant people from both the industry and academia is low. This will influence the project's effective dissemination, communication and exploitation.	WP5	L	M	M	The establishment of the Technical Advisory Board, including world-recognized experts in the field and the leading people of the HECARRUS consortium which are active members in the committees of world known conferences (ASME Turbo expo, Global Power and Propulsion Society etc.) will ensure an effective stakeholder engagement. Project workshop(s) open to the public are also considered.
	Budget allocation: i) lower resources to complete some of the actions included in the Description of Action (e.g. to ensure open-access in all project aspects), ii) higher resources are claimed than the delivered work – cut in PMs	WP5	M	L	M	A constant resource monitoring is applied by the HECARRUS consortium and 4 assessments are performed (M9 – internal, M18 – periodic report, M27 – internal, M36 – final report) Moreover, re-allocation of resources is considered prior to potential resource depletion in each specific category (e.g. travel, equipment, dissemination), in accordance to the Grant Agreement Model about eligible costs resource allocation.
	Privacy and personal information protection regarding data exchange and open-access strategy.	WP5	L	L	L	The users' personal data collected through all project means (e.g. datasets, website publications etc.) will be collected, retained, filed and processed in full compliance with the General Data Protection Regulation (GDPR).
	Delays in realization of project's tasks and deliverables and low communication between the beneficiaries of the consortium.	WP5	L	M	L	The peer review process and the project deliverables' internal deadlines are foreseen to guarantee the required quality assessment of all output. The project WP regular meetings are also established to ensure the best possible way of communication and address all occurring or pending issues.

Technical	HECARRUS selected in-house and/or commercial tools/methodologies are not effective to fulfill the hybrid-electric aircraft requirements regarding the complete powertrain	WP1 WP2 WP3	L	H	L	The prior experience of the partners participating in the consortium, the in-house modelling tools which are influenced and validated over the last 10-15 years through peer-review exercises with specialists from the EU aviation industry and also, well-recognized commercial packages exclusively selected for specific analyses in the project ensure that this risk is mitigated.
	Several candidate technologies are identified in more than one component at the literature review of state-of-the-art technologies research phase	WP1	L	M	L	Constraints are considered and also certification specifications for normal-category aircraft (CS23).
	Integration of the selected component technologies is not appropriate for the selected architecture. This may affect the final configuration selection upon which the conceptual design will be considered.	WP1 WP2 WP3 WP4	L	M	L	A 'technology and opportunity down-selection' process is foreseen at the beginning of the project to mitigate such anticipated risks and establish the two configurations that will be examined over the project life cycle.
	Impact of technology shortcomings: New technologies associated with electrification of aircrafts are characterized by great uncertainty (e.g. battery deterioration).	WP1 WP2 WP3 WP4	M	M	M	This will be an actual outcome of this project to exhaustively investigate each component and provide as deliverable all of its risk associated analysis and will propose concepts for mitigation and improvement
	The accuracy of the developed models is insufficient or key operational aspects are not considered.	WP2 WP3	L	M	M	Validation will follow all critical steps in the modelling chain. The design methods will first be used to design conventional aircrafts (reference vehicles) with the same top-level requirements as the reference vehicle. Small-scale in-lab experiments may also be considered for further validation of the models.
	Aircraft requirements not clearly expressed and staying at too general level.	All	L	M	L	Use of efficient requirement engineering methods and close communication/collaboration with the CS2JU society and the project's Technical Advisory Board.
	Most of the employed technologies are currently at a low TRL and may lead to un-realistic aircraft configurations or extraordinary costs of production which will make the design infeasible	All	H	M	L	Two aircraft configurations are studied in project HECARRUS. One of the two employs the more 'exotic' characteristics while the second one is the "cheapest", quicker-to-enter the market solution, with a lower performance and a lower risk of development and certification.

5. Remarks

This deliverable (D5.2) provides the 'Data Management Plan' of the HECARRUS project. Its purpose is to lay down the guidelines for the treatment of internal and external research data. Additionally, it includes an overview of the planning for the various actions of the project and an overall project risk assessment with the corresponding mitigation actions. It can be considered as a 'breathing' document since it will be constantly updated and adapted to the needs and progress of the project. Updated versions will be included in the project's reporting periods (M18 and M36).

Even if the document is due at M3 and project activities are at the beginning, a tentative description of the expected datasets generated is carried out, trying to establish the framework that will be used to ensure that data is secured, shared and exploited in the most systematic way during project development. The most important outcomes of this document are the following:

- **Open Access:** HECARRUS prioritizes the widespread dissemination and visibility of its objectives, capabilities, activities and results by ensuring open access to a large number of produced scientific research articles and research data. To further enhance this comment, most of the deliverables produced within the project are publicly available (11 out of 15 deliverables).
- **Data Management Plan:** The analysis in this work shows that so far, there are eleven data sets that will be produced as part of the project activities and are relevant to be included in the Data Management Plan (DMP). The datasets range from the collection of reviews and surveys on existing state-of-the-art technologies of alternative propulsion powertrains and raw data emerging from the simulations, to stakeholder contacts and workshop data.
- **Risk Assessment:** Regarding the risks concerned, it is observed that high-level risks have already been mitigated with effective measures whereas contingency plans are designed for the remaining risks that the project may encounter.

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