Advanced Modelling Methodology for Bearing Chamber In Hot Environment

Deliverable: D5.2 Data Management Plan

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Duration: 66 Months

Dissemination Level		
PU	**Public**	**X**
RE	Restricted to a group specified by the partners of the project	
CO	Confidential, only for partners	

Contents

Document History

Version and date	Changes
1.0 – 27/07/2018	Initial version of the DMP
2.0 – 09/10/2018	Revised version of the DMP, integrating the comments of the Project Officer
2.1 – 07/12/2018	Revised version of the DMP, integrating information about the dataset #4 (see Annex 1)
3.0 – 09/11/2023	Final version: Info on some data sets and their categories ("Open" or "Restricted") is updated.

Introduction

AMBEC is a collaborative research project which foresees collection, generation, processing and exchange of different types of research data, needed to accomplish project tasks. As a project participating in Open Research Data Pilot (ORDP) in Horizon 2020, AMBEC key principle is to be **as open as possible**. On the other hand, AMBEC is a Clean Sky 2 project facilitated by the industrial needs, and some of its outputs will foresee future commercial application. Therefore there will be restrictions on sharing and access to the data which the consortium will decide to protect proprietary or patent. All public disclosure of data will be agreed with the AMBEC Topic Manager representing a Clean Sky 2 JU Partner.

The purpose of this Data Management Plan is outline the research data management principles to be used by the Consortium regarding how the research data collected or generated will be handled during and after a research project. It is a brief plan to define: how the data will be created; how it will be documented; who can access it; where it will be stored; whether it will be shared and where it will be preserved.

This document is the V3.0 of the Plan, which is the final version and includes final info on AMBEC project data sets and their categories ("Open" or "Restricted"), which were defined considering commercial interests of the AMBEC Topic Manager (Safran Aero Engines).

1. Data summary

Research data to be generated or collected and processed by the project are described in the Table 1. In the table we identify two categories of research data:

- **Open Research Data** – any form of non-confidential data needed to validate the results presented in scientific publications resulting from project research activities in Open Access Journals and Non-Confidential products of research (including but not limited to designs, code, etc.) created and/or used in the framework of the project, where "Non-Confidential" means that such data can be made (or is already) publicly available.
- **Restricted Research Data** – any form of confidential data and products of research (including but not limited to datasets, designs, code, etc.) created and/or used in the framework of the project, which will present high innovation level and possibility for commercialization. For this category the Consortium will consider either keeping data restricted for project participants for internal user or apply for a patent in order to commercially exploit (in this case the appropriate IPR protection measures, e.g. NDA, will be taken for data sharing outside the consortium).

This table will be constantly updated during the project, especially regarding Open Research Data.

Table 1 Dataset Summary

No	Dataset name	Category	Related WP(s)	Partners involved in generation/processing	Dataset collection and publication date (for open datasets only)
DS1	Test matrix	Restricted	WP1	KhAI, Ivchenko	30/10/2018
DS2	Test vehicle concept	Restricted	WP1	Ivchenko, KhAI	---
DS3	Test vehicle and test bench design	Restricted	WP2	Ivchenko, Motor Sich	---
DS4	Data on previous research on multiphase flow characteristics and heat transfer phenomena in the bearing chamber	Open	WP3	KhAI	14-07-2018 / 07/12/2018 (see all details in the Annex 1)
DS5	Two-phase modelling results	Restricted	WP3	KhAI	---
DS6	Test data	Restricted	WP4	Ivchenko	---

The category for each dataset specified in Table 1 was discussed by the partners and agreed with the Topic manager.

Table 2 presents the detailed description of project data, purpose of their collection/generation, relation to the objectives of the project, size, types and formats, origin, potential re-use of existing data and data utility, which means to whom these data might be useful.

Table 2 Research data description

No	Description	Purpose and relation to the project objectives	Origin	Format	Expected Size	Tools for accessing and/or processing	Re-use of existing data	Data utility
DS1	Test matrix	To cover representative conditions of engine operation and generate sufficient data in order to understand the heat transfer phenomena.	Typical engine running conditions supplied by the Topic Manager	docx, xls, pdf	Several MB	Word, Excel Adobe Reader	Base for experimental investigation of fluid flows and heat transfer phenomena in the bearing chamber.	Participants of AMBEC project
DS2	Test vehicle concept	To define the test rig of the bearing chamber and its associated systems, which allow to capture the heat transfer in the bearing chamber as function of the variation of the key parameters	Geometry supplied by the Topic Manager.	docx, dwg, pdf	Several MB	Word AutoCAD Adobe Reader	Base for designing of the test rig	Participants of AMBEC project
DS3	Test vehicle and test bench design	To design the test vehicle and test rig systems which enable the integration of a representative bearing chamber in a test rig assembly including the systems capable to conduct the variation of the test parameters defined in the test matrix	The results of DS2 processing	docx, dwg, pdf	Several GB	Word AutoCAD Adobe Reader	Base for manufacturing of test vehicle and test rig systems	Participants of AMBEC project

DS4	Data on previous research on multiphase flow characteristics and heat transfer phenomena in the bearing chamber	Analysis of the current state-of-the-art in the field of investigations of multiphase flow characteristics and heat transfer phenomena in the bearing chamber	Research articles in relevant journals, conference proceedings, summary reports of research project	pdf, txt	Several GB	Web browser Text editor Adobe Reader	Understanding which methodologies are used for multiphase flow modelling. Select best practices for AMBEC project implementation	Participants of AMBEC project Researchers at Universities and research centres working in the field of thermodynamics and heat transfer
DS5	Two-phase modelling results	Development of methodology for calculation of fluid flow and heat transfer coefficient distribution in different zones of the bearing chamber depending on influence of key parameters.	Geometry of the bearing chamber, key parameters	docx, xls, pdf, cas, data	Several GB	Word, Excel Adobe Reader ANSYS	A background for improvement of approaches for simulation of fluid flow and heat transfer in the bearing chamber based on the results of experimental investigation	Participants of AMBEC project, Researchers at Universities and research centres working in the field of thermodynamics and heat transfer
DS6	Test data	To generate sufficient data in order to understand the heat transfer phenomena in the bearing chamber.	Test matrix, test vehicle and test rig	docx, xls, pdf	Several MB	Word, Excel Adobe Reader	Base for refinement of multiphase flows' simulation methods	Participants of AMBEC project, Researchers at Universities and research centres working in the field of thermodynamics and heat transfer

2. FAIR data

2. 1. Making data findable

Metadata

Metadata is the data which enables others identify and find the open research data in a repository. Proper and full metadata will allow other researchers determine the usefulness of specific datasets for their needs and if so reuse the data for their research. Data which will be necessary for validation and support of scientific publications will be made findable through the Zenodo research data repository (https://zenodo.org). In Zenodo all metadata is openly available under CC0 license, and all open content is openly accessible through open APIs. According to Zenodo principles, every published record on Zenodo will be assigned a DOI (Digital object identifier). Zenodo's metadata is compliant with DataCite's Metadata Schema minimum and recommended terms, with a few additional enrichments. Metadata of each record is sent to DataCite servers during DOI registration and indexed there.

According to the requirements of Grant Agreement Article 29.2, the bibliographic data will include:

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

The datasets to be placed in a repository will be supplemented with the information on the methodology used to collect the data, analytical and procedural information, definitions of variables, units of measurement, any assumptions made, the format and file type of the data and software used to collect and/or process the data. If a dataset require any other specific documentation to enable it reuse, it will be mentioned either in a file header, or in a 'readme' text file.

Search keywords

Keywords will be indicated for each entry in the repository to feed search queries and optimize possibilities for re-use. Example keywords include:

- DS5: two-phase modelling, fluid flow, heat transfer coefficient distribution, bearing chamber, etc.

Naming conventions and versions

All files in a datasets placed to the repositories will be structured by using a name convention containing project name, dataset No, dataset name, date and version number:

AMBEC_DSX_Dataset name_xxxx.yy.zz_vX.ext

(where .ext is a generic extension)

2.2. Making data openly accessible

Restricted Research Datasets will be accessible to consortium partners and Topic Manager. Such data will be first of all stored at the PCs of the project participants which generate and/or collect data, or in their institutional secure servers. Internal access to the

data will be provided via the SAFRAN Extranet Portal WeShare or secure ftp server in case of large datasets (will be identified later). Zenodo secure storage will be considered, which provides the possibility to house closed and restricted content, so that artefacts can be captured and stored safely.

Open access will be provided to Non-confidential project outputs. First of all, the scientific articles in Open Access Journals will be published, adhering to suitable "Open Access":

- Self-archiving ("green"): final peer-reviewed manuscript in ZENODO repository. Open access to the publication will be ensured within at most 6 months.
- Open access publishing ("gold"): articles to be published in open access journals, or in hybrid journals that both sell subscriptions and offer the option of making individual articles openly accessible.

The copyright to the research publication will be retained by the author, and adequate licences to publisher will be granted.

At the same time, the **open research data** needed to validate the results presented in such publications will be deposited to the Zenodo repository, to make it possible for third parties to access, mine, exploit, reproduce and disseminate these data. Where required, information about tools and instruments necessary for validating the result will be also provided. Open Access procedures set out in the Grant Agreement and described in the Guidelines will be followed.

Most of the research data will be produced in common electronic document/data/image formats (.docx, .pdf, jpg, .eps, etc.) that can be accessed via commonly-used methods and open software. For CFD-modelling .agdb, .wbpj, .iges, .csdoc, .smdb formats will be used for geometry and meshing, .cas, .data – for solution and results.

2.3. Making data interoperable

To make AMBEC open research data interoperable, which means allowing data exchange and re-use between researchers, institutions, organisations, countries, etc. the standards for formats, as much as possible compliant with available (open) software applications will be applied. In particular, re-combinations with different datasets from different origins will be facilitated.

The distinct and standard terminology will be used in all datasets and in descriptive metadata fields to allow accurate and quick indexing and retrieval of relevant data. Appropriate keywords (see Section 2.1) will be used for indexing and subject headings of data and metadata. The keywords will be updated in the course of project implementation to ensure that the most recent and adequate terminology is applied and so to maintain interoperability.

This will be as well relevant to metadata in Zenodo, which use a formal, accessible, shared, and broadly applicable language for knowledge representation.

2.4. Increase data re-use

Data licensing

AMBEC project will use one or several main Creative Commons licenses to protect an ownership of datasets or their parts (see Table 1). Preliminary, the preference will be given to Attribution-NonCommercial-ShareAlike 4.0 International license (CC BY-NC-SA 4.0).

Decision regarding appropriate licence selection will be done by consortium simultaneously with the making decision as for providing open access to dataset or its specific part.

Date of data release

All open research data will be made available through Zenodo repository immediately after the consortium decision to provide open access. However, an embargo period may be applied in case of data associated with research publication, for which "green" open access is selected. AMBEC team will respect the EC recommendation as for maximum embargo period of 6 months.

Re-use by third parties

Re-use of restricted research data (see Table 1) will be limited to project partners and Topic Manager and is regulated by AMBEC Consortium Agreement and CS2 JU Implementation Agreement.

Re-use by third parties of open research data to be deposited to Zenodo repository will be subjected to standard restrictions of applied license, e.g.:

- Attribution: requires to give appropriate credit, provide a link to the license and indicate if changes were made.
- ShareAlike: requires to use the same licence as original on all derivative works based on original data
- Non-Commercial: prohibits the use of the dataset for commercial purposes.

Open research data deposited to Zenodo repository will remain re-usable throughout the lifetime of the repository.

Data quality

Each partner will be responsible for quality of data it collect and/or produce and will apply its regular procedures and protocols focused on data quality assurance and control.

3. Allocation of resources

Costs for making data FAIR

To respect the requirements of GA article 29.2, AMBEC partners will publish at least 2 scientific articles to disseminate key project results in peer-reviewed journals, which provide "green" or "gold" open access. Average open access fee for AMBEC-relevant scientific journals (e.g. International Journal of Heat and Mass Transfer (ISSN 0017-9310), Aerospace Science and Technology (ISSN 1270-9638), Journal of Engineering for Gas Turbines and Power (ISSN 0742-4795), etc.) is about 2,000 Euro.

Fees associated with open access scientific publications will be responsibility of author(s)' organizations and will be covered by AMBEC project costs. In case of multiple authors from different partners' organizations, open access fee sharing will be an option to be discussed and agreed on a case-by-case basis.

Machine-readable electronic copies of project publications as well as bibliographic metadata and associated research data, needed to validate the results presented in scientific publications, will be deposited to Zenodo research data repository, which is free of charge.

Responsibility for data management

Each partner is solely responsible for management of data it produces, including data capture, data quality, metadata production, data storage and backup, etc. As for open

research data (see Table 1), AMBEC project technical leader Dr. Taras Mykhailenko will be responsible for data management and deposition to Zenodo repository.

Long term data preservation

Issues of long-term preservation of AMBEC research data after the AMBEC project completion (including data selection, data volume, preservation duration, preservation repository(ies) and associated costs) will be studied during the M30-36 and appropriate consortium decision(s) will be taken. Relevant information will be presented in the final DMP.

4. Data security

Data storage and backup

Employees of AMBEC partner organizations, who are involved in research activities, are responsible for storage and regular backups of data they are producing and/or processing. For this purpose, regular practices and company regulations will be applied.

Whatever the case, the following principles will be followed by all AMBEC partners to ensure data security:

- store data in at least two separate storage media (e.g. hard drive and DVD) to avoid data loss;
- check data integrity periodically;
- limit the use of USB flash drivers;
- store data in a proprietary formats, which are widely used.

Datasets will be stored at AMBEC Private Collaborative Area of the SAFRAN Extranet Portal WeShare, which provides secure coproduction, storage, organization, sharing and consulting of information.

Specifically, "Exchange Documents" library will be used to store, organize, sync, and share documents with project participants. WeShare library tool provide opportunities for co-authoring, versioning, and check out to work on documents in parallel mode. Security and preservation of data uploaded by partners to the WeShare will be provided according to the regulations and usual practices of SAFRAN. WeShare portal is available from 8 a.m. to 7 p.m. French hours from Monday to Friday, business days out French holidays.

Two persons per partner organization will have access to AMBEC Private Collaborative Area. For this purpose, they will use personal login and password. User's activity in WeShare will be tracked.

Open research data deposited to Zenodo repository will be stored and backuped in line with repository's policy, which includes multiple file replicas in a distributed file system, backed up to tape on a nightly basis.

Data transfer

Partners will communicate by email, whereas research data exchange will be performed exclusively with the use of WeShare portal, which provide a possibility to notify partners by email about new data deposition.

In future, if necessary, reliable and secure ftp server or Zenodo secure storage will be used for transfer of big data resulted from numerical simulation and real experiments.

5. Ethical aspects

No ethical issues has been identified

6. Other issues

No other issues to report at this time.

ANNEX 1 – Open Datasets Info

Dataset#4: Literature review on multiphase flow characteristics and heat transfer phenomena in the bearing chamber

Name of IADP/ITD/TA/TE2/Domain	Engines ITD
Data Storage	ZENODO
Link to repository	https://zenodo.org/
Dataset Identifier	10.5281/zenodo.2016646
Relevant Keywords	Gas-turbine engine; bearing chamber; multiphase flow characteristics; heat transfer phenomena; mathematical modelling; CFD modelling; experimental studies
Data Licence	CC BY-NC-SA 4.0
Date for Data Publication	07/12/2018
Date of data collection	14/07/2018
Data Version	Zenodo DOI versioning
Data Preservation time	10 year (2028)
Name of the Data Set Responsible (DSR)	Taras Mykhailenko
DSR e-mail	t.mykhailenko@khai.edu
DSR Telephone	+380 57 788 40 60
Funding body(ies)	European Union's H2020 through Clean Sky 2 Programme
Grant number	785493
Partner organisations	Safran Aircraft Engines

Project duration	Start: 2018-05-01 End: 2021-04-31
Date DMP created	2018-07-27
Date last update	2018-07-12
Version	V2.1
Name of the DMPR (responsibilities for data management of the IADP/ITD/TA/TE2)	Taras Mykhailenko
DMPR e-mail	t.mykhailenko@khai.edu
DMPR Telephone	+380 57 788 40 60
Description of the research	Investigation of multiphase flow characteristics and heat transfer phenomena in the bearing chamber of the gas-turbine engine is extremely important works for aviation industry because the results will ensure development of efficient engine lubrication system. These issues are studied by many researchers in various countries, more integrated approach is required. The goal of AMBEC project is to achieve a complete understanding of the physical phenomena in the bearing chamber of gas-turbine engine and to create a reliable methodology able to calculate the heat transfer coefficient and the fluid flows for different zones of the bearing chamber depending on the key engine operation parameters.
Data Collection	This report presents a comprehensive literature review on investigations of multiphase flow characteristics and heat transfer phenomena in the bearing chamber. For the purpose of this report preparation, the research articles published in thematic journals and conference proceedings were reviewed and analysed together with the publicly available results of research projects

	funded by the European Commission's Framework Programmes. Data presented in the report are structured in the frame of three key areas:
	1. Experimental investigations of multiphase flow characteristics and heat transfer phenomena in the bearing chamber
	2. Mathematical models of multiphase flow in the bearing chamber
	3. CFD modelling of multiphase flow in the bearing chamber
Existence of similar data	NA
Nature of the Data	Statistical data
Data Type	Report
Data Format	Pdf
Data Size	33.6 Mb
Number of files	1
Descriptive file	N/A
Data File	AMBEC_deliverable_D3.1 - v1.pdf
Quality/Accuracy	NA
Unit measurement system	SI
Potential Users	Universities, Research Centres
Ethical Issue	NA