



Ref: PJP-COM-LH-D-61-rev1



# Plasma Jet Pack

## Open Research Data Pilot

### Data Management Plan update

Project acronym: PJP  
Grant Agreement no: 870444

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## Revision

<i>Rev.</i>	<i>Date</i>	<i>Description</i>
1	21/06/2023	Initial version

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# 1 Introduction

## 1.1 Subject

This document presents an update of the data management plan for the PJP project. The PJP project generated data about vacuum arc science and space propulsion. The vacuum arc technology is not well known for space propulsion purposes. All the physics progress were published (data, publications, trial results) in dedicated journal. As a participant of the Open Research Data Pilot (ORDP) in Horizon 2020, the PJP project has data findable, accessible, interoperable and reusable (FAIR). A dedicated list of the publications has been added to the Data Management plan to realise the Open Research Data Pilot document.

However, all technological issues must remain confidential to the Consortium in order to preserve industrial know-how and commercialisation. Moreover, applicable results to space propulsion will be patented in order to fix the commercial position (as stated in Guidelines on FAIR Data Management in Horizon 2020).

The DMP presents the main elements of the data management policy used by the Consortium. It describes the types and formats of data to be generated or collected and the data preservation and sharing methods.

## 1.2 Table of acronyms

<i>Acronym</i>	<i>Meaning</i>
ABCL	As Built Configuration List
AIT	Assembly, Integration and Tests
PA	Product Assurance
BB	Bread Board model
CDR	Critical Design Review
EGSE	Electrical Ground Support Equipment
EM	Engineering Model
EMC	Electro Magnetic Compatibility
EQM	Engineering Qualification Model
FM	Flight Model
FME(C)A	Failure Model and Effect (Critical) Analysis
GIE	Gridded Ion Engine
GSE	Ground Support Equipment
HW	Hardware
HET	Hall Effect Thruster
ICD	Interface Control Document
IF	Interface
KO	Kick Off meeting
KP	Key Point
MAIT	Manufacturing, Assembly, Integration and Tests
MLI	Multi-layer Insulation
MRB	Manufacturing review Board
MRR	Manufacturing readiness review
PDR	Preliminary Design Review
PJP	Plasma Jet Pack
PPT	Pulsed Plasma Thruster
QR	Qualification Review
SRR	System Requirement Review
N/A	Non applicable
TRR	Test Readiness Review
TRB	Test Readiness Board
VAT	Vacuum Arc Thruster
DMP	Data management plan
GA	Grant Agreement

CA	Consortium Agreement
ORDP	Open research data pilot
WP	Work Package
DoA	Description of Actions

## 2 Data Management Plan Overview

The Plasma Jet Pack project was a research & innovation project aimed at developing knowledge on Vacuum Arc applied to space propulsion.

We performed classification into three kinds of datasets:

- Physical data,
- Technological data,
- Missions and needs data.

The work page and associated categories are presented hereafter:

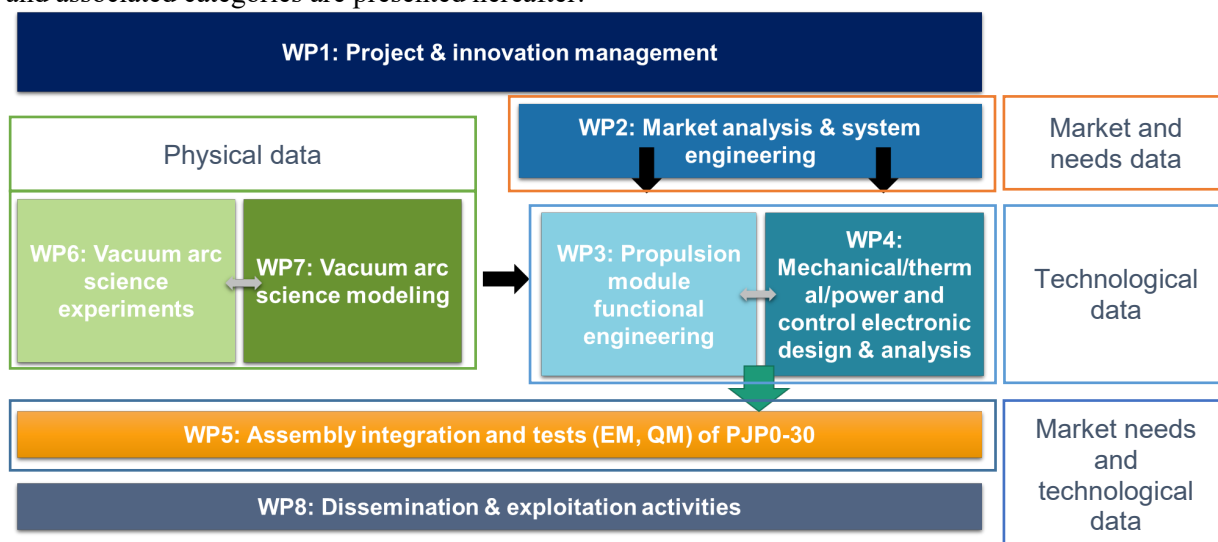


Figure 1: PJP Pert Diagram

The data types will be detailed in the following chapter.



### 3 List of deliverables and classification

The deliverable list and related status are presented hereafter:

<i>Number</i>	<i>Relative Number in WP</i>	<i>Lead Beneficiary</i>	<i>Title</i>	<i>Due Date (in months)</i>	<i>Due Date</i>	<i>Nature</i>	<i>Status</i>
D1	D1.1	COMAT	Project handbook	3	31/03/2020	Report	Submitted
D54	D1.10	COMAT	Key Performance Indicators 3/3	38	21/02/2023	Report	Submitted
D57	D1.11	COMAT	Ethics report	24	28/02/2022	Report	Submitted
D2	D1.2	COMAT	Long-term impact roadmap	40	15/04/2023	Report	Submitted
D3	D1.3	COMAT	COST assessment	40	15/04/2023	Report	Submitted
D4	D1.4	COMAT	Yearly Risk Assessment and Contingency Analysis report V1/4	1	31/01/2020	Report	Submitted
D42	D1.5	COMAT	Yearly Risk Assessment and Contingency Analysis report V2/4	12	23/12/2020	Report	Submitted
D43	D1.6	COMAT	Yearly Risk Assessment and Contingency Analysis report V3/4	24	28/02/2022	Report	Submitted
D44	D1.7	COMAT	Yearly Risk Assessment and Contingency Analysis report V4/4	40	15/04/2023	Report	Submitted
D52	D1.8	COMAT	Key Performance Indicators 1/3	9	30/09/2020	Report	Submitted
D53	D1.9	COMAT	Key Performance Indicators 2/3	21	30/09/2021	Report	Submitted
D5	D2.1	TASF	Customers' needs and applications report-SRR	6	30/06/2020	Report	Submitted
D6	D2.2	TASF	Mission analysis & system constraints for Plasma Jet Pack-SRR	6	30/06/2020	Report	Submitted
D7	D2.3	TASF	Impact at satellite level-SRR	6	30/06/2020	Report	Submitted
D8	D2.4	OHB SWEDEN AB	Plasma Jet Pack specifications SRR & CDR V1/2	6	30/06/2020	Report	Submitted
D10	D2.5	OHB SWEDEN	Satellite integration report	24	28/02/2022	Report	Submitted



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		AB					
D9	D2.6	OHB SWEDEN AB	Plasma Jet Pack specifications SRR & CDR V2/2	24	28/02/2022	Report	Submitted
D11	D3.1	COMAT	Technical requirements description	6	30/06/2020	Report	Submitted
D12	D3.2	COMAT	Architecture description PDR & SRR V1/2	12	23/12/2020	Report	Submitted
D13	D3.3	COMAT	Specifications breakdown	12	23/12/2020	Report	Submitted
D14	D3.4	COMAT	Accommodation description	12	23/12/2020	Report	Submitted
D15	D3.5	COMAT	Functional description and analysis PDR & CDR V1/2	12	23/12/2020	Report	Submitted
D45	D3.6	COMAT	Architecture description PDR & SRR V2/2	24	28/02/2022	Report	Submitted
D46	D3.7	COMAT	Functional description and analysis PDR & CDR V2/2	24	28/02/2022	Report	Submitted
D58	D3.8	COMAT	Architecture and scalability of 80W and 150W	24	28/02/2022	Report	Submitted
D16	D4.1	COMAT	Mechanical design and analysis report of Building blocks V1/2	12	23/12/2020	Report	Submitted
D17	D4.2	COMAT	Thermal design and analysis report of Building blocks V1/2	12	23/12/2020	Report	Submitted
D18	D4.3	COMAT	Electrical design and analysis report of PPSCU	12	23/12/2020	Report	Submitted
D19	D4.4	COMAT	PPSCU validation report	12	23/12/2020	Report	Submitted
D20	D4.5	COMAT	Capacitors bank characterization report	12	23/12/2020	Report	Submitted
D47	D4.6	COMAT	Thermal design and analysis report of Building blocks V2/2	24	24/06/2022	Report	Submitted
D48	D4.7	COMAT	Mechanical design and analysis report of Building blocks V2/2	24	24/06/2022	Report	Submitted
D21	D5.1	COMAT	Design description of PJP0-30 V1/2	12	23/12/2020	Report	Submitted
D22	D5.2	COMAT	EM validation report	24	24/06/2022	Report	Submitted
D23	D5.3	COMAT	QM qualification report	40	30/04/2023	Report	Submitted
D49	D5.4	COMAT	Design description of PJP0-30 V2/2	24	28/02/2022	Report	Submitted

D24	D6.1	MUNICH UNI	Triggering system characterization report	24	28/02/2022	Report	Submitted
D25	D6.2	CNRS	Cathode spot characterization report	24	28/02/2022	Report	Submitted
D26	D6.3	CNRS	Plasma Plume Expansion characterization	24	28/02/2022	Report	Submitted
D27	D6.4	MUNICH UNI	Magnetic nozzle characterization	24	28/02/2022	Report	Submitted
D28	D7.1	COMAT	Triggering system modeling report	12	23/12/2020	Report	Submitted
D29	D7.2	PlasmaSolve	Cathode spot modeling report	8	31/08/2020	Report	Submitted
D30	D7.3	PlasmaSolve	Plasma Plume Expansion modeling	18	30/06/2021	Report	Submitted
D31	D7.4	PlasmaSolve	Magnetic nozzle modeling	24	28/02/2022	Report	Submitted
D32	D7.5	COMAT	Synthesis report	24	28/02/2022	Report	Submitted
D33	D8.1	COMAT	Project website and social network account (100 new followers / year - 1 update / month)	2	28/02/2020	Report	Submitted
D51	D8.10	COMAT	Plans for exploitation of the results V3/3	38	21/02/2023	Report	Submitted
D55	D8.11	COMAT	Data Management Plan	6	30/06/2020	Report	Submitted
D56	D8.12	COMAT	Market analysis	8	31/08/2020	Report	Submitted
D34	D8.2	COMAT	Plans for dissemination of the results	6	30/06/2020	Report	Submitted
D35	D8.3	COMAT	Plans for exploitation of the results V1/3	6	30/06/2020	Report	Submitted
D36	D8.4	COMAT	Demonstrator workshop report	38	15/02/2023	Report	Submitted
D37	D8.5	COMAT	Final report on dissemination activities	40	15/04/2023	Report	Submitted
D38	D8.6	COMAT	Business case	40	15/04/2023	Report	Submitted
D39	D8.7	COMAT	Final exploitation plan	40	15/04/2023	Report	Submitted
D40	D8.8	COMAT	Open Research Data Pilot	40	15/04/2023	Report	Submitted
D50	D8.9	COMAT	Plans for exploitation of the results V2/3	18	30/06/2021	Report	Submitted
D41	D9.1	COMAT	GEN - Requirement No. 2 : Ethics	3	31/03/2020	Report	Submitted

As mentioned above, all technological, market and physics documents directly related to the product are confidential. Only data related to physics (experiments & simulations) will be published or presented during conferences or meetings.

## 4 Data classification

In this project we handled three kinds of data:

### 4.1 Physical data

The physical data are related to the behaviour of vacuum arc in various configurations. The understanding of phenomena are in open access through publications.

The scientific publications produced by our project are open-accessed in order to be compliant with the general principle of the Horizon 2020 funding programmes. This was achieved by mainly targeting publishers that provide ‘gold’ access, either by making the articles immediately accessed online for free, or by having each affiliated partner to cover the relevant cost. Whenever the ‘gold’ access model was not applicable, we took the benefits of the ‘green’ model instead, by additionally publishing the relevant articles to an online repository. Furthermore, many publishers also allowed the publication for educational purposes of the accepted papers. We strongly believe that giving open access to our scientific publications will aim to speed up important breakthroughs by the European researchers that will lead to boost knowledge and competitiveness in Europe.

### 4.2 Technological data

The technological data related to design technology and manufacturing remain in the Consortium and the data will not be in open access.

### 4.3 Market needs and mission data

The data related to the markets, needs and missions can be shared with other members of the research group.

The sensitive data released by large-scale integrators remain confidential on request.

## 5 Data collection

All the data were collected thanks to the Project NetBoard platform. This solution allows to store and share data in a dedicated server. It made easier exchange between all partners. All bibliography research and deliverables are stored in this tool.



project netboard

Figure 2: project netboard frontpage

## 6 Intellectual and Property Rights

A Consortium agreement was negotiated and signed by all the parties in order to inter alia specify the terms and conditions pertaining to ownership, access rights, exploitation of background and results and dissemination of results, in compliance with the grant agreement and Regulation n°1290/2013 of December 11th, 2013. The Consortium agreement is based on the DESCA Horizon 2020 Model Consortium Agreement with the necessary adaptations considering the specific context and the parties involved in the project. The basic principles were as follows:

- The parties have identified the background intellectual property they would bring to the project, and assessed its availability for access rights as regards potential third parties' rights over such background as far as this information is known to the respective party at the moment of the assessment;
- Ownership of results including joint results generated by two or more parties went to the party(ies) having generated such results;
- The owning parties took all appropriate measures for the protection of the results capable of commercial or industrial exploitation, notably through intellectual property rights when relevant;
- The parties used reasonable efforts to exploit and disseminate the results, either directly or indirectly, for instance by out-licensing said results;
- Each party gave access rights (through licenses) to their background and results to the other parties for the implementation of the project and/or for the exploitation of those other parties' own results (under fair and reasonable conditions).

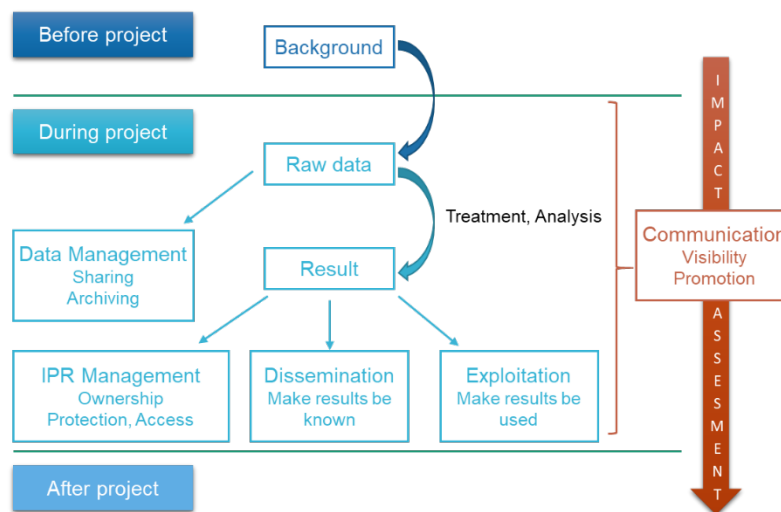


Figure 3: IPR activities according to the different project phases

## 7 Archiving and preservation

All data were shared through Project NetBoard during the duration of the project. Moreover, the data will be stored on the COMAT project server in the dedicated folder after the end of the Project NetBoard contract.

The COMAT project server is duplicated every day on two media types and one copy is done on another remote site (location). The 3-2-1 rule is presented hereafter:

## 3-2-1 Rule

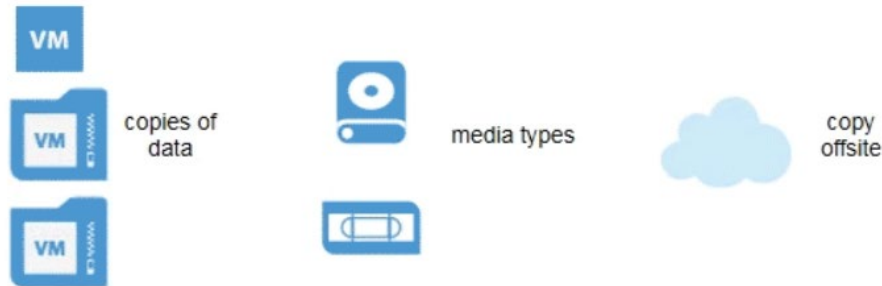


Figure 4: 3-2-1 rules presentation

## 8 Data security

The security of the data stored in Project Netboard is insured by Absiskey (provider of this platform).

The security of the data in the COMAT project server is insured by COMAT's IT team. The IT team follows the requirements of « Guide des bonnes pratiques de l'informatique » by ANSSI. The network is segmented as function of project access and the data flow is monitored on the server.

## 9 List of publications

During this project, ten scientific publications have been published in relevant journal or conference around the world. These publications reflect the experimental and theoretical scientific work performed during the project. These articles are focused on plasma diagnostics and numerical modelling of the PJP plume.

Final/Conf	Comp/Lab	Article Title	Author 1	Author 2	Author 3	Publication date
IEPC 2022	COMAT	"Ion jet properties in a high current - short duration vacuum arc thruster"	A.BLANCHET	T.YUNG	L.HERRERO	2022
JEP	ICARE	"Time evolution of plasma parameters in the jet of low power vacuum arc thruster"	E.MICHAUX	S.MAZOUFFRE	A.BLANCHET	2022
IEPC 2022	ICARE	"Spatial and temporal evolution of ion and electron parameters in the plasma jet of a 30W VAT"	E.MICHAUX	R.FRITZSCHE	S.MAZOUFFRE	2022
IEPC 2022	LAPLACE	"Generation of multiply charged ions in the context of a vacuum arc thruster"	L.GARRIGUES	P.SARRAILH		2022
SP 2022	BUM	"Optical ion velocity measurement of a vacuum arc thruster"	R.FORSTER	J.SCHEIN		2022
IEPC 2022	PLASMA SOLVE	"A 3D hydrodynamic model of a vacuum arc thruster"	K.MROZEK			2022
SP 2022	PLASMA SOLVE	"3D modeling of vacuum arc thruster"	K.MROZEK			2022
SP 2022	ICARE	"Evolution in time and space of ion and electron properties in the jet of a lowpower Vacuum Arc Thruster"	E.MICHAUX	S.MAZOUFFRE	R.FRITZSCHE	2022
Vacuum	ICARE	"Fractal dimension of Cathode Spots in a High-Current Vacuum Arc Thruster"	E.MICHAUX	A.E.VINCI	S.MAZOUFFRE	2022
MDPI	BUM	"Plasma Expansion Characterization of a Vacuum Arc Thruster with Stereo Imaging"	R.FORSTER	J.SCHEIN		2022

Link to some major articles:

- [Spatial and temporal evolution of ion and electron parameters in the plasma jet of a 30 W VAT \(hal.science\)](#)
- [Time evolution of plasma parameters in the jet of a low-power vacuum arc thruster \(hal.science\)](#)
- [Generation of multiply charged ions in the context of a vacuum arc thruster - Archive ouverte HAL](#)
- [Applied Sciences | Free Full-Text | Plasma Expansion Characterization of a Vacuum Arc Thruster with Stereo Imaging \(mdpi.com\)](#)



Additionally, the ICARE Laboratory published a dedicated article for the International Low Temperature Plasma Community (march 2022):

→ [MIPSE | ILTPC Newsletter 21 \(umich.edu\)](#)

The major part of articles are in open access and accessible through the given link.

## 10 Ethical aspects

The Consortium partners are aware of possible dual-use issues and confirm that they have taken steps to identify whether the technologies involved would be subject to Regulation 428/2009 or national export controls on dual-use items of the member state(s) involved.

Sufficient expertise is made available within the Consortium to properly arrange for any authorisations required for technology transfer or export (of hardware as well as software).

In particular, COMAT wants to export the products resulting from the research, and in particular the Plasma Jet Pack propulsion module. Different steps have been achieved as regards export control towards the French government (department of Defence):

- Materiel de Guerre et Assimilé (MGA): the Plasma Jet Pack is confirmed as not classified.
- Dual-Use: the Plasma Jet Pack is confirmed as not classified.

Regarding material and/or project data that are to be transferred from any members of Consortium to outside the EU including to, if applicable, non-EU shareholders of multinational consortium members, the Consortium is aware of export requirements that would be invoked in case of dual-use. COMAT has identified early this subject and has already approached the French authorities (CNES, DGA and French embassy), in particular in the frame of its commercial action toward China. Helped with recommended consultancy, COMAT received an active support from the authorities, both in term of IP protection, requirement identification, conformance to export applicable regulations and administrative back office.

Practically, no data were transferred to the customer, at the exception of the PJP user manual and interface requirements. The hardware was delivered as a black box with measures preventing dismounting and/or components identification.

A deliverable at Month 24 (D1.11) provided a status on dual-use aspects regarding export.

## 11 Other issues

N/A