DUAL-STAGE HIGH PRECISION LINE OF SIGHT STABILISATION SYSTEM FOR SMALLSATS

A Data Management Plan created using DMPonline.be

Creator: Leonardo Peri

Affiliation: KU Leuven (KUL)

Funder: Fonds voor Wetenschappelijk Onderzoek - Research Foundation Flanders (FWO)

Template: FWO DMP (Flemish Standard DMP)

Grant number / URL: 1SHD624N

ID: 206100

Start date: 01-11-2023

End date: 31-10-2027

Project abstract:

This project is a fundamental feasibility study on the concept and the components of a highperformance pointing platform (HPPP) capable of providing line of sight stabilisation in SmallSat payloads with a pointing accuracy in the order of 1 arcsec. The scope of the research is generic so as to be applicable to missions including Earth Observation, astronomy and also non-imaging payloads. SmallSats bring a significant reduction of the mission cost, but these platforms are sensitive to vibration disturbances. The Attitude & Orbit Control System (AOCS) is not able to keep the desired pointing accuracy. The innovative idea is to investigate a two-stage stabilisation platform where the spacecraft AOCS compensates for the large amplitude disturbances of the complete spacecraft and a fine-pointing platform provides an additional correction to the payload only. The entire control system consists of a set of sensors and actuators for the spacecraft, including star trackers and reaction wheels, complemented with piezo-actuators for the instrument. The project concerns the complete measurement, actuation and control system, with specific attention on the interaction between AOCS and HPPP. The work covers the complete cycle including selection of mechanical components, investigation of control strategies, numerical simulations for virtual testing, realisation of a breadboard, execution of tests and modification of the entire system to meet the project requirements.

Last modified: 15-04-2024

DUAL-STAGE HIGH PRECISION LINE OF SIGHT STABILISATION SYSTEM FOR SMALLSATS
FWO DMP (Flemish Standard DMP)

1. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data.

				Only for digital data	Only for digital data	Only for digital data	Only for physical data
Dataset Name	Description	New or reused	Digital or Physical	Digital Data Type	Digital Data format	Digital data volume (MB/GB/TB)	Physical volume
Simulation outputs	Data generated from Matlab/Simulink simulations	Generate new data	Digital	Simulation data	.mat	<100 GB	NA
Experiment outputs	Data generated from experimental set-up	Generate new data	Digital	Experimental data	.mat	<100 GB	NA
Simulation models	Simulation of AOCS - HPPP systems	Generate new data	Digital	Simulation data	.slx .mat	<1 GB	NA

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type:

NA

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Will you process personal data? If so, briefly describe the kind of personal data you will use in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, …)? If so, please comment per dataset or data type where appropriate.

- Yes

Data can be valuable for companies working on SmallSat AOCS development. LRD will be consulted before disseminating data.

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements/ research

collaboration agreements)? If so, please explain in the comment section to what data they relate and what restrictions are in place.

- No

Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain in the comment section to what data they relate and which restrictions will be asserted.

- No

2. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep data understandable and usable, for yourself and others, now and in the future (e.g., in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).

1. Code for simulations and code for data processing is accompanied by:

- a README.txt file explaining the code's purpose, inputs, outputs, connection to other models
- files, assumptions, scope
- a documentation heading explaining the code's purpose, inputs, outputs
- assumptions, paper on which it is based
- comments throughout the code for clarification
- units and a brief explanation after the declaration of each variable

2. Each newly generated data set is accompanied by an experiment report which describes/contains:

- the goal of the experiment
- the operational conditions
- the data acquisition settings and measurement procedures
- the structure of the generated data (folder structures and file names)
- the logbook

Will a metadata standard be used to make it easier to find and reuse the data? If so, please specify (where appropriate per dataset or data type) which metadata standard will be used. If not, please specify (where appropriate per dataset or data type) which metadata will be created to make the data easier to find and reuse.

- No

3. Data storage & back-up during the research project

Where will the data be stored?

- Simulation data and models will be saved on an external hard drive.
- Simulation data and models will be saved on a large volume storage: a shared file system available to members of the group via PCs and laptops managed by ICTS

KU Leuven or our local KU Leuven IT department.
- Code will be saved on KU Leuven OneDrive and the research group's GitLab

How will the data be backed up?

- Standard back-up provided by KU Leuven ICTS.
- Back-up on external hard drive.
- GITLab and OneDrive.

Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely.
If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.

- Yes

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

The project will not use any personal data. All generated data is stored securely on KU Leuven's servers (GitLab, OneDrive) and behind proper authentication. During the project, the researcher and the promotor will evaluate how and when to share data. Sharing of data will occur through a secure channel.

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

- Data storage costs on GitLab and OneDrive and hard drive capacity on the research laptop are covered by the internal ICT contributions.
- The cost of large-volume storage (€ 104,42 / TB / year) and storage on the external hard drive (estimated € < 70 / TB) will be covered by available internal funds.

4. Data preservation after the end of the research project

Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).

All data will be retained and possibly reused for future research projects.

Where will these data be archived (stored and curated for the long-term)?

The data will be stored on the external hard drives and on the large volume storages.
The data will possibly be uploaded to the KU Leuven repository Lirias and the division's GitLab.

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?

The cost of large-volume storage (€ 104,42 / TB / year) will be covered by available internal funds.

5. Data sharing and reuse

Will the data (or part of the data) be made available for reuse after/during the project? In the comment section please explain per dataset or data type which data will be made available.

- Yes, in a restricted access repository (after approval, institutional access only, …)

The full dataset and code and documentation will be deposited in the KU Leuven Research Data Repository.

If access is restricted, please specify who will be able to access the data and under what conditions.

Members of the research group will be able to access the data.
In future, the data can be shared in possible collaborations with other researchers/research groups.

Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain in the comment section per dataset or data type where appropriate.

- No

Where will the data be made available? If already known, please provide a repository per dataset or data type.

The full dataset and code and documentation will be deposited in the KU Leuven Research Data Repository.

When will the data be made available?

Datasets and software will be published and released as soon as we see fit and definitely upon publication of the research results.

Which data usage licenses are you going to provide? If none, please explain why.

We will provide the Creative Commons Attribution (CC-BY-4.0) license. This is the standard creative commons license that gives others maximum freedom to do what they want with our work (they are free to share and adapt), but they need to give appropriate credit and indicate if changes were made.

Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, you have the option to provide it in the comment section.

- Yes

What are the expected costs for data sharing? How will these costs be covered?

The cost for data sharing in the RDR are covered by the institution's internal ICT contributions. Datasets that are relevant for this research work are expected to be small anyway.

6. Responsibilities

Who will manage data documentation and metadata during the research project?

The researcher will manage the code and datasets with proper metadata.

Who will manage data storage and backup during the research project?

The researcher will manage data storage and backup during the research project. This is supervised by Dirk Vandepitte, the promotor.

Who will manage data preservation and sharing?

The researcher is responsible for ensuring data preservation and reuse. This is supervised by Dirk Vandepitte, the promotor.

Who will update and implement this DMP?

The researcher bears the end responsibility of updating & implementing this DMP.