Plan Overview

A Data Management Plan created using DMPonline

Title: On-Orbit scavenging and Recycling of Dead Satellites

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Template: DCC Template

Project abstract:

The issue of orbital space debris is well known, but it continues to be a significant challenge to find economically viable approaches to reducing existing debris. The concept of treating debris objects as a resource, to be collected and reused or recycled into useful new spacecraft parts, is an emerging idea which could address this challenge. The proposed PhD research links with current research in Cranfield, where "scavenger spacecraft"(SS) rendezvous with dead satellites, scavenge useful parts and materials, and deliver them to an orbital recycling station, where they are processed into new structures and components. The aspects to be considered by this PhD mainly concern the way the scavenger can achieve its goal of successfully collecting debris and delivering it to the recycling space station (RSS). This will involve identification of the most suitable orbits and debris targets, the manoeuvres and orbital operations required to achieve successful and efficient collection and delivery of the scavenged debris material, and relevant system engineering and design considerations.

ID: 92470

Start date: 01-06-2021

End date: 26-01-2028

Last modified: 21-04-2025

Copyright information:

On-Orbit scavenging and Recycling of Dead Satellites

Data Collection

What data will you collect or create?

The data that will be collected is the technical information of the satellites in geostationary orbit (GEO). The information that is going to be collected are but not limited to the following items:

Orbit Category	Text
International Number	Alphanumeric
Spacecraft Status	Text
Spacecraft Name	Text
Active or Inactive	Text
Spacecraft Owner	Text
Sector	Text
Mission - Primary	Text
Launch Date	Date
Design Life (years)	Numeric
Expected Life (years)	Numeric
Current Age (years)	Numeric
Inactive Date	Date
Inclination Initial Op. (deg)	Numeric
Inclination TLE Latest (deg)	Numeric
Altitude TLE Latest (km)	Numeric
Apogee TLE Latest (km)	Numeric
Latitude TLE Latest (deg)	Numeric
Longitude TLE Latest (- is west deg)	Numeric
Perigee TLE Latest (km)	Numeric
Prime CURRENT Manufacturer	Text
Bus CURRENT Manufacturer	Text
Bus Family	Text
Bus Type	Alphanumeric
Bus Type Production Status	Text
Engine Manufacturer (Original)	Text
Battery Manufacturer (Original)	Text
Solar Array Manufacturer (Original)	Text
Communication Payload Manufacturer (Original)	Text
Communication Payload Manufacturer Country	Text
Comm Sensor Name	Text
Number of Spare Transponders	Numeric
Number of Operational Transponders	Numeric
Comm Band	Text
Nav Hosted For Company	Text
Nav Hosted For Company Country	Text

Navigation Payload Manufacturer (Original)	Text
Navigation Payload Manufacturer (Original) Country	Text
Navigation Payload Clock Type	Alphanumeric
Navigation Payload Sensor Name	Text
Nav Partner Spacecraft	Text
Radar Hosted For Company	Text
Radar Hosted For Company Country	Text
Radar Payload Category	Text
Radar Payload Manufacturer (Original)	Text
Radar Payload Manufacturer (Original) Country	Text
Radar Sensor Name	Text
Radar Bandwidth (MHz)	Numeric
Radar Frequency (GHz)	Numeric
Radar Frequency Band	Text
Radar Partner Spacecraft	Text
Optical Hosted For Company	Text
Optical Hosted For Company Country	Text
Imaging Payload Category	Text
Optical Payload Manufacturer (Original)	Text
Optical Payload Manufacturer (Original) Country	Text
Optical Sensor Name	Text
Spectral Band	Text
Scientific Hosted For Company	Text
Scientific Hosted For Company Country	Text
Scientific Or Other Payload Category	Text
Scientific Or Other Payload Manufacturer (Original)	Text
Scientific Or Other Payload Manufacturer (Original) Country	Text
Scientific Sensor Name	Text
Scientific Sensor Frequency Band	Text

Some, not all the information is available for all the satellites. The data contained in this particular database is not considered public; academic credentials are needed for access.

All the data comes from the free website database SpaceTrak (https://spacetrak.seradata.com/). Further more detailed information is going to be requested via email from the manufacturers as it could be considered not public, but can be obtained under special requests and circumstances.

The information is stored in personal computer device and OneDrive online storage using a Cranfield University domain.

It is expected not to exceed 1 TB of data.

This information is managed as a spreadsheet and as a database. The format is xls and csv when possible. . The software MATLAB is going to be used to generate indicators and statistics from this data. This files are generated with .fig and .jbg formats.

How will the data be collected or created?

The majority of data related to the satellites will be collected from special website SpaceTrak (https://spacetrak.seradata.com/), available public information from official sites of the manufacturers. The more detailed information will be requested directly to the manufacturers by e-mail.

Documentation and Metadata

What documentation and metadata will accompany the data?

The research data will be classified ISO 8601 format (dates) for databases.

For reference data like books, articles, chapters, the ISO 8601 format will continue for a future CORD metadata.

The txt. file presents the main format for the research data files:
YYYYMMDD_Typeofdata_Primaryobject_firstderivation_Revisionnumber
Example:
20231223_Database_Bus_analysis_R2

Ethics and Legal Compliance

How will you manage any ethical issues?

No data requires CURES approval at this moment.

How will you manage copyright and Intellectual Property Rights (IPR) issues?

Cranfield University and I own the data.

Storage and Backup

How will the data be stored and backed up during the research?

The information will be stored and backed up in:

1. Personal laptop with password
2. Personal Hard-drive with password
3. Personal iCloud payed service with password and two-step verification code
4. OneDrive shared folders with Cranfield University´s domain.

How will you manage access and security?

As this is not a team project, I will be accessing my data in my devices and cloud service. The shared folder with Cranfield University's domain will be managed by me and my supervisors.

Selection and Preservation

Which data are of long-term value and should be retained, shared, and/or preserved?

All data will be preserved under CORD terms.

What is the long-term preservation plan for the dataset?

All data will be preserved under CORD terms.

Data Sharing

How will you share the data?

All data will be shared. The information will be available, searchable and could be used by other researchers and potentially any organisation related to the space recycling issue. The data will be available once the project is finished.

Are any restrictions on data sharing required?

No restrictions at the moment.

Responsibilities and Resources

Who will be responsible for data management?

I will be responsible foe the data management. My supervisors Dr. Jennifer Kingston and Dr. Leonard Felicetti can also checked the data.

What resources will you require to deliver your plan?

The MATLAB software is used for analysing the data and for generating the graphics, so this could represent an extra cost. Also, might be necessary to use a 3D modeling software as Solidworks.

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