

# Appendix A

## 1 SRDB data exchange software libraries

### 1.1 EDS processing libraries

In order to export and import TMTC data in and from EDS files, SRDBs could rely on software libraries that we summarized in Table 1.

### 1.2 XTCE Libraries and supporting software

[1] referred to the wide availability of low-cost and open-source XTCE implementations which contribute in adopting XTCE more easily. However, the authors did not review these implementations. We have identified the list of XTCE libraries in Table 2.

### 1.3 MIB Libraries and supporting software

Table 3 summarizes libraries and software applications related to MIB data exchange format.

### 1.4 EGS-CC Libraries and supporting software

As EGS-CC CDM is community sourced, we could not find publicly available implementations of CDM libraries. We summarized the implementations that have been mentioned in the literature in Table 4.

## References

- [1] Irvin D. et al. “Reducing the Cost of Small Satellite Ground System Development Using XTCE”. In: *Annual AIAA/USU Small Satellite Conference 2016*. GSFC-E-DAA-TN44423. 2016.
- [2] *AURIS*. <https://github.com/oswald2/AURIS>. Accessed: 3/4/2023. 2023.
- [3] Julien et al. Baclet. “TeePee4Space: a practical application of Information Sharing in Extended Enterprise to the space industry”. In: *MBSE 2021 - Model Based Space Systems and Software Engineering (The European Space Agency)*. 2021.

Library	Reference	Summary
CCSDS EDS Reference Tooling	[8]	Library to parse, verify and validate SEDS data sheets.
CCSDS SEDS tool and library	[9] as an implementation of [7, 26, 6]	This is a set of libraries that aim to parse EDS files in order to generate C files that will be part of the OBSW to command and control on-board systems. This is why the authors state that this library is not intended to be used alone. It should be considered in the global workflow of developing the OBSW
SEDS compiler	[14]	XXX
SEDS Editor	[22]	Generate a SEDS editor from EMF(XXX)
SOIS OWL tools	[7]	Capturing the DoT of SEDS in OWL ontology files
SECT (SAVOIR EDS Common Tooling)	[21, 23, 17]	SEDS library to parse, verify and validate SEDS data sheets
TASTE SedsConverter	[10, 21, 28]	Tool that provides SEDS import/export capabilities to TASTE. Link to TASTE is <a href="https://taste.tuxfamily.org/wiki/index.php?title=Main_Page#TASTE">https://taste.tuxfamily.org/wiki/index.php?title=Main_Page#TASTE</a> XXX
OSRAD, TDEFSTSA, STBSW	[21]	Activities on SEDS for different purposes: OBSW, Simulator
OCDT, Teepee and MOISE	<a href="https://ocdt.esa.int/">https://ocdt.esa.int/</a> and [3]	Platforms to exchange EDS files

Table 1: Works on EDS libraries

- [4] Christian et al. Bracco. “SCOPE product: the Thales Alenia Space Unified Operations Preparation Environment”. In: *2018 SpaceOps Conference*. 2018, p. 2313.
- [5] Armin Braun et al. “XTCE at GSOC-First experiences adopting a new standard”. In: *SpaceOps 2010 Conference by AIAA*. 2010, p. 2015.
- [6] CCSDS. *Spacecraft onboard interface services - Informational Report - Green Book*. <https://shorturl.at/brzNP>. Accessed: 3/4/2023. 2013.
- [7] CCSDS. *Spacecraft onboard interface services - XML specification for electronic data sheets – blue book*. <https://public.ccsds.org/Pubs/876x0b1.pdf>. Accessed: 3/4/2023. 2019.

Library	Reference	Summary
XTCE tools	[30]	An Application Programming Interface (API) to parse, verify and validate XTCE files
XTCE generator	[5, 29]	A tool to generate XTCE files from SQLite database that can be used with YAMCS[18, 24]
XTCE Space Packet Parser	[25]	A library to encode and decode TMTC data defined in XTCE
XTCE modeling	[13]	Graphical definition of TMTC data in XTCE

Table 2: Works on XTCE libraries

Library	Reference	Summary
TMPropagator	[20]	Display the measurements reported by TM packets defines in MIB files
SpacePyLibrary	[27]	Encode and decode TMTC data defined in MIB files
AURIS-Postgres	[2]	MIB-based MCS
SCOPUS	[16]	Parse PUS-type packets flows in raw format and interpret them using an MIB data files
PySCOS2000	[15]	Parse and check MIB data files with Python

Table 3: Works on MIB libraries

- [8] *CCSDS EDS Reference Tooling tools*. <https://essr.esa.int/project/ccsds-eds-reference-tooling>. Accessed: 3/4/2023. 2021.
- [9] *CCSDS SOIS Electronic Data Sheet Tool and Library*. <https://github.com/nasa/EdsLib>. Accessed: 3/4/2023. 2023.
- [10] Julien Delange, Felice Torelli, and Jean-Loup Terraillon. “Implementation of sois in TASTE”. In: *DASIA 2012-Data Systems In Aerospace* 701 (2012), p. 19.
- [11] *EGS-CC CDM*. <https://github.com/ASofterSpace/cdm>. Accessed: 3/4/2023. 2023.
- [12] Harald et al. Eisenmann. “RangeDB the product to meet the challenges of nowadays system database”. In: *9th ESA Workshop on Simulation for European Space Programmes*. 2015.
- [13] Jerome Ferreira et al. “OASIS, the first XTCE-compliant modeling tool”. In: *SpaceOps 2008 Conference*. 2008, p. 3453.

Library	Reference	Summary
Accepto along with RangeDB	[19, 12]	Proprietary implementation of EGS-CC-CDM
SCOPE	[4]	A framework that accepts EGS-CDM as an exchange format
ASofterSpace	[11]	Modify EGS-CC CDM with a command line

Table 4: Works on EGS-CC-CDM libraries

- [14] Matthias Holm. “SOIS EDS Compiler”. In: *ESA: The Software Systems Division (TEC-SW) and Data Systems Division (TEC-ED) 2020*. 2020. URL: <https://shorturl.at/mrvZ9>.
- [15] Robert Labudda. *PySCOS2000*. <https://gitlab.irf.se/irf/pyscos2000>. Accessed: 3/4/2023. 2023.
- [16] Robert Labudda. *SCOPUS*. <https://gitlab.irf.se/irf/scopus>. Accessed: 3/4/2023. 2023.
- [17] Deredempt Marie-Helene et al. “SAVOIR EDS: A Digital Capability for Avionics Architecture Co-Design”. In: *DASIA 2019-Data Systems In Aerospace*. Vol. 736. 2019.
- [18] Nicolae Mihalache and Leif Steinicke. “YAMCS-A Lightweight Open-Source Mission Control Systems Used In Columbus Payloads Operations”. In: *DASIA 2011-Data Systems In Aerospace* 694 (2011), p. 12.
- [19] Pascal Parmentier. “ACCEPTO - Airbus DS Command Control EGS-CC based Product line for Tests and Operations”. In: *The Workshop on Simulation for European Space Programmes (SESP) 2015*. 2015.
- [20] C Peat. *TM Propagator*. <https://bit.ly/3J51sxM>. Accessed: 3/4/2023. 2021.
- [21] David Perillo. “Electronic Datasheets”. In: *The 16th ESA Workshop on Avionics, Data, Control and Software Systems (ADCSS)*. 2021.
- [22] L Petersson. “Leveraging the Eclipse Modeling Framework to work with Electronic Datasheets”. In: *MBSE 2021 - Model Based Space Systems and Software Engineering (The European Space Agency)*. 2021.
- [23] Marek Prochazka. “SAVOIR Electronic Data Sheet Definition: Overview and Status”. In: *The 14th ESA Workshop on Avionics, Data, Control and Software Systems (ADCSS)*. 2020.
- [24] Mathieu Schmitt, Fabian Diet, and Nicolae Mihalache. “Yamcs for lean Commercial Control Centres: The ICE Cubes Control Centre”. In: *2018 SpaceOps Conference*. 2018, p. 2682.
- [25] *Space Packet Parser*. [https://github.com/medley56/space\\_packet\\_parser](https://github.com/medley56/space_packet_parser). Accessed: 3/4/2023. 2023.

- [26] *Spacecraft onboard interface services—specification for dictionary of terms for electronic data sheets*. <https://shorturl.at/lmwQW>. Accessed: 3/4/2023. 2022.
- [27] *SpacePyLibrary*. <https://github.com/Stefan-Korner/SpacePyLibrary/tree/6a9f0827005c03cbc59557def78bbc035a97bbea/Tutorial>. Accessed: 3/4/2023. 2019.
- [28] Felice Torelli et al. “Overview on CCSDS SOIS and Electronic Data Sheets”. In: (2014).
- [29] *XTCE Generator*. <https://pypi.org/project/xtce-generator/>. Accessed: 3/4/2023. 2023.
- [30] *XTCE tools*. <https://gitlab.com/philipbrack/xtcetools>. Accessed: 3/4/2023. 2023.