

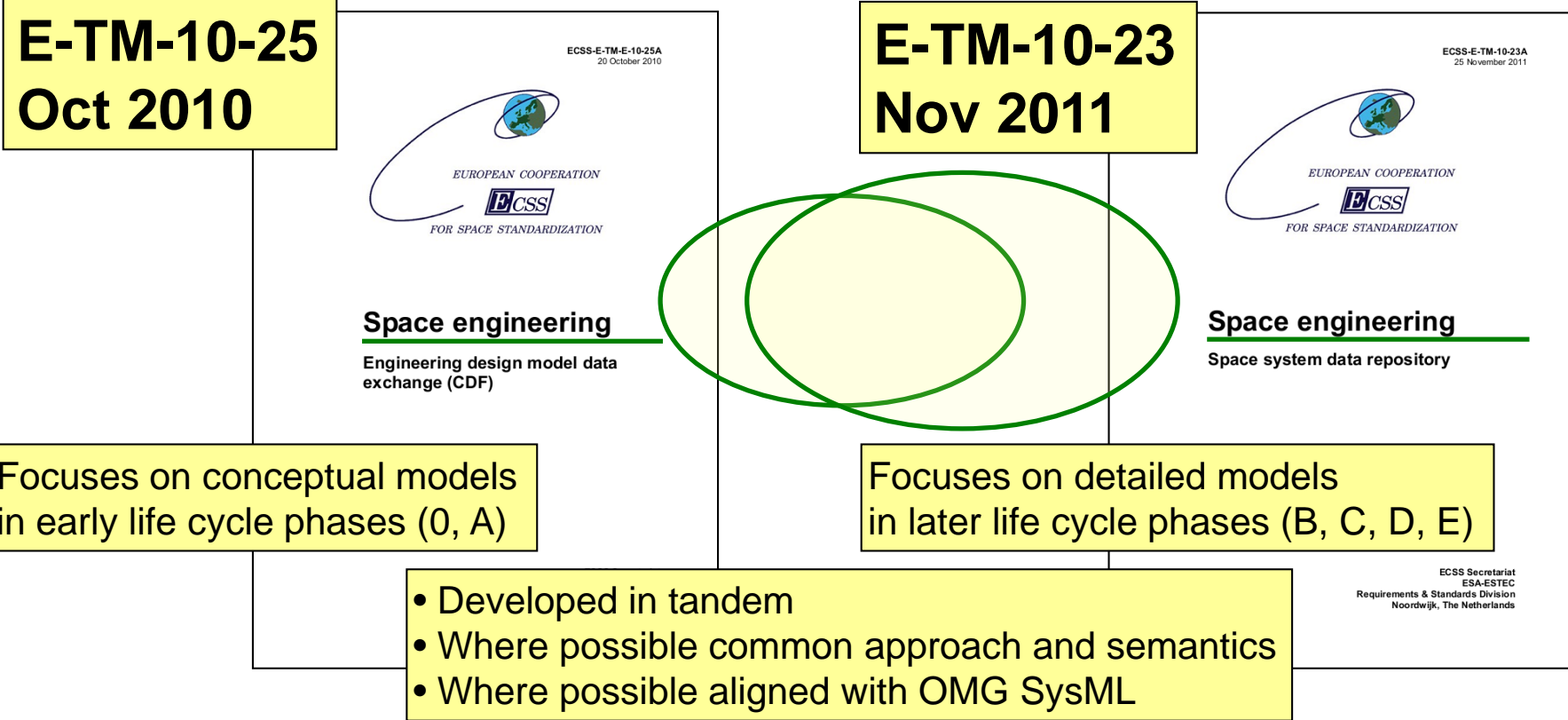
# ECSS-E-TM-10-25 & Quantities, Units, Dimensions and Values

Hans Peter de Koning – ESA

25 June 2019, Space System Ontology – Brainstorming Workshop

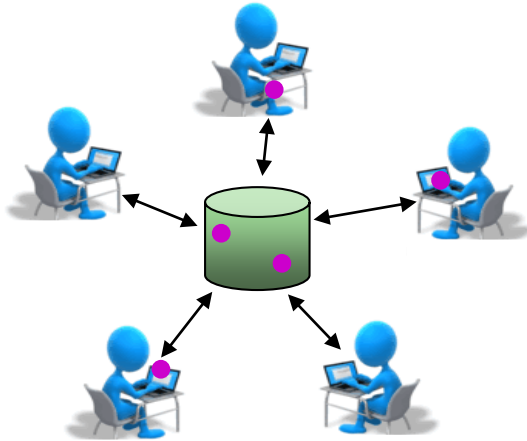
ESA/ESTEC – Noordwijk – The Netherlands

# ECSS 'Sister' TMs for Space System Data / Info



# Why two TMs? Concurrent vs Collaborative ...

## Early Phases (0, A)



## Later Phases (B, C, D, E)

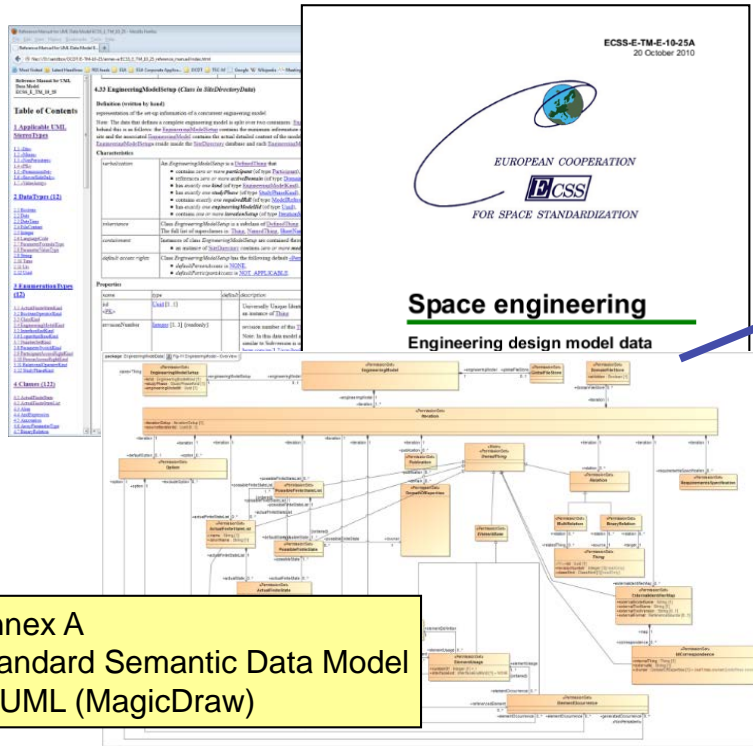


- Tens of users
- One or few organisations
- Near-real-time info sharing in minutes, hours, days
- Trade studies / strawman models
- Requirements in flux – being negotiated
- Support decision making / architectural design
- Few relatively small models
- Fine-grained version control (object level)

- Hundreds of users
- Tens of organisations
- Synchronisation intervals in days, weeks, months
- Formal configuration and version control
- Strict requirements baseline and change control
- Formal, detailed V&V
- Orders of magnitude more models and information
- Coarser-grained version control (“dataset” level)

→ time

# Model Based SW Engineering & Automated Code Generation



xmi\_verter  
(OCDT  
code generator)


- SQL database scripts
- JSON meta-model / REST API
- Annex C  
REST API (JSON bodies)  
JSON Exchange File Format
- C# SDK
- Python SDK
- TypeScript SDK
- XML Schema
- Excel workbook  
for data model analysis
- Java SDK



# E-TM-10-25 Implementation in Open Concurrent Design Tool (2012-2014)



ECSS-E-TM-E-10-25A  
30 October 2010



**Space engineering**  
Engineering design model data exchange (CDF)

Table of Contents

1. Applicable ETSI

2. Data Types (12)

3. Data Types (12)

4. Data Types (12)

4.1. Data Types (12)

4.2. Data Types (12)

4.3. Data Types (12)

4.4. Data Types (12)

4.5. Data Types (12)

4.6. Data Types (12)

4.7. Data Types (12)

4.8. Data Types (12)

4.9. Data Types (12)

4.10. Data Types (12)

4.11. Data Types (12)

4.12. Data Types (12)

4.13. Data Types (12)

4.14. Data Types (12)

4.15. Data Types (12)

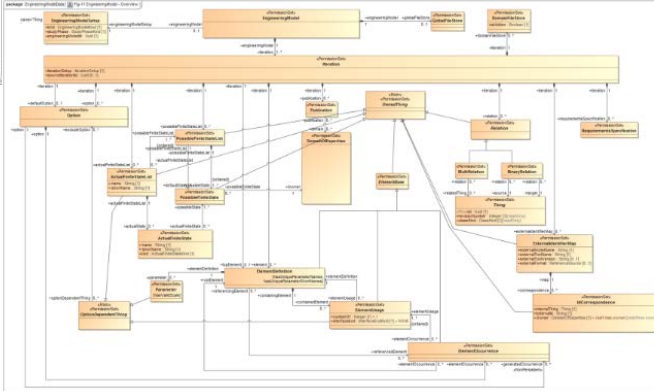
4.16. Data Types (12)

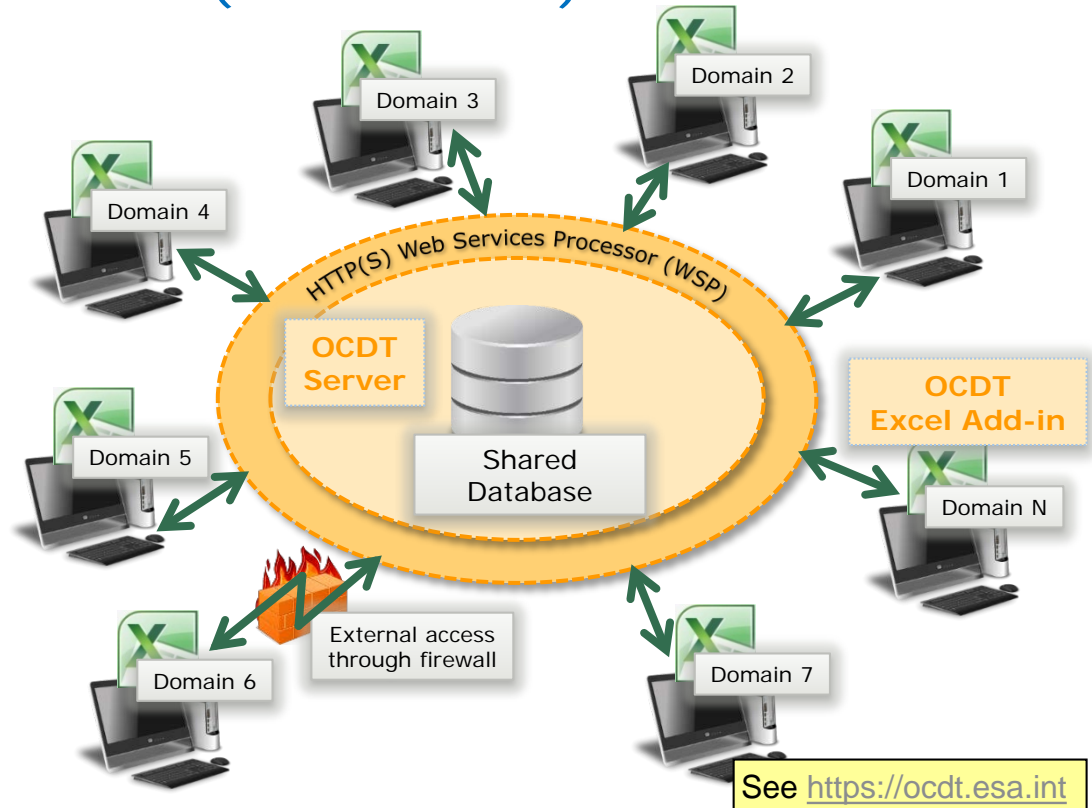
4.17. Data Types (12)

4.18. Data Types (12)

4.19. Data Types (12)

4.20. Data Types (12)





# Common 'QUDV' in ECSS and OMG SysML



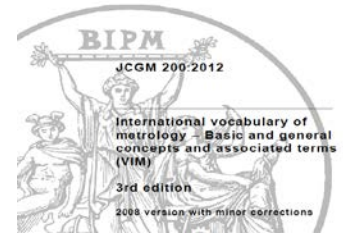
- Quantities, Units (and Scales), (Physical) Dimensions & Values
- First in SysML v1.2 (published 2010) – updates in v1.3, 1.4, 1.5, 1.6
- Same info model in E-TM-10-25 and E-TM-10-23
  - Improved version in progress in SysML v2 ...
- Models quantities and units model of ISO/IEC 80000 ('SI') and International Vocabulary of Metrology (VIM) by BIPM
- Support all info to perform automated unit / scale conversion
  - Including US Customary Units



# QUDV – References



- BIPM VIM, 3rd Edition, “International Vocabulary of Metrology”
  - [https://www.bipm.org/utils/common/documents/jcgm/JCGM\\_200\\_2012.pdf](https://www.bipm.org/utils/common/documents/jcgm/JCGM_200_2012.pdf)
- ISO/IEC 80000 Quantities and Units
  - <https://www.iso.org/standard/30669.html>
- The NIST Reference on Constants, Units, and Uncertainty
  - <https://physics.nist.gov/cuu/index.html>
- NIST SP811, 2008 Edition,  
“Guide for the Use of the International System of Units”,  
in particular Appendix B “Conversion Factors”
  - <https://www.nist.gov/physical-measurement-laboratory/special-publication-811>



ISO 80000 consists of the following parts, under the general title Quantities and units:

- Part 1: General
- Part 2: Mathematical signs and symbols to be used in the natural sciences and technology
- Part 3: Space and time
- Part 4: Mechanics
- Part 5: Thermodynamics
- Part 7: Light
- Part 8: Acoustics
- Part 9: Physical chemistry and molecular physics
- Part 10: Atomic and nuclear physics
- Part 11: Characteristic numbers
- Part 12: Solid state physics

IEC 80000 consists of the following parts, under the general title Quantities and units:

- Part 6: Electromagnetism
- Part 13: Information science and technology
- Part 14: Telebiometrics related to human physiology

