

United Nations/Austria Symposium

# **ESA**

## **Concurrent Design Facility**

### **CDF**

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Graz, Sep. 5<sup>th</sup>, 2017

# CDF: applying concurrent engineering to spacecraft design



Process



Facility



→ AN INNOVATIVE TEAMWORKING METHOD

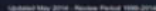
Team



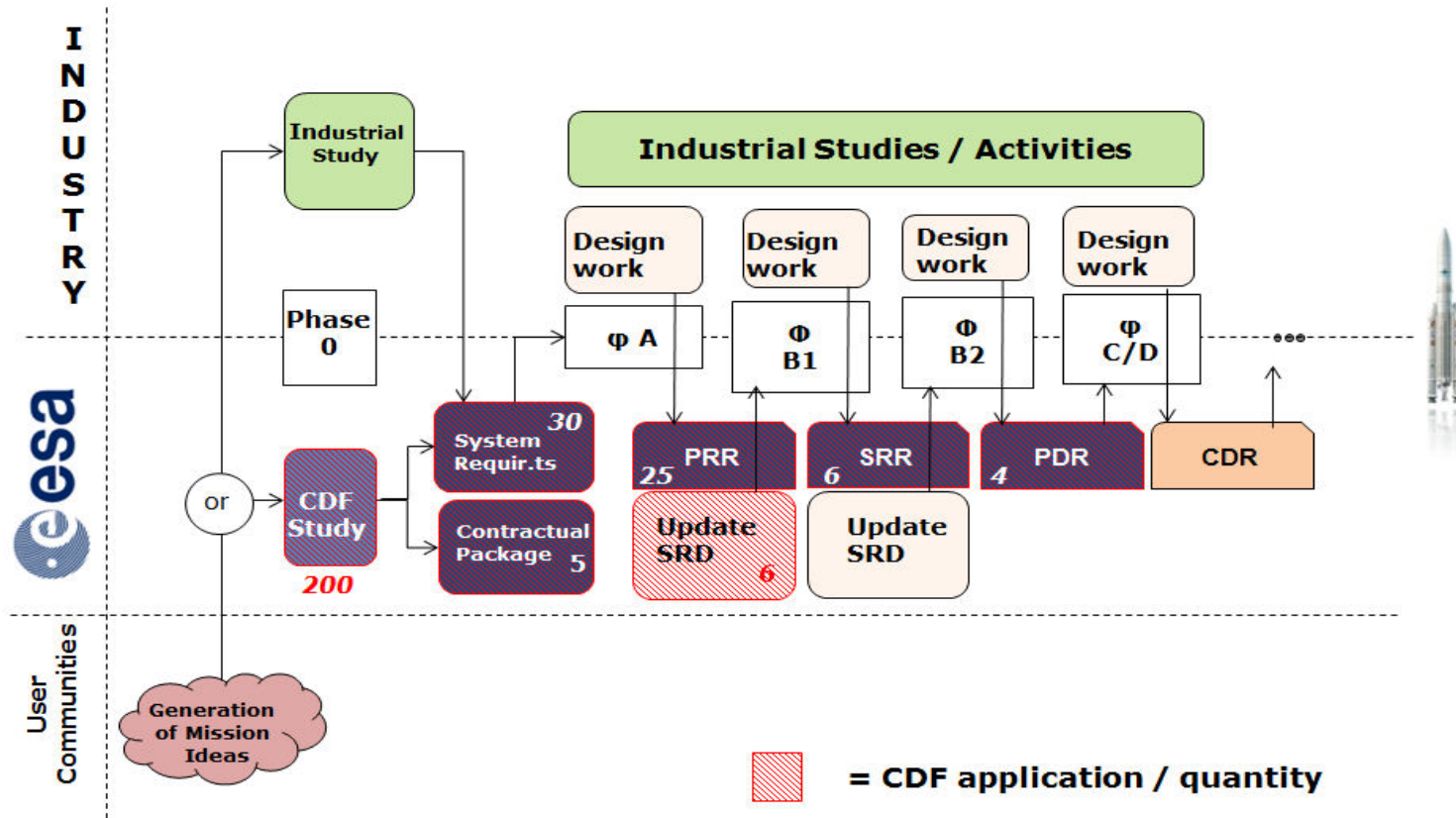
Model  
IT infra-  
structure







# Why the CDF is an essential tool to support ESA Decision Making



# The facility

Effective communication obtained by means of:

- Lay-out
- Customer participation
- Large screens
- Smartboards
- VC's + microphones
- visualizers

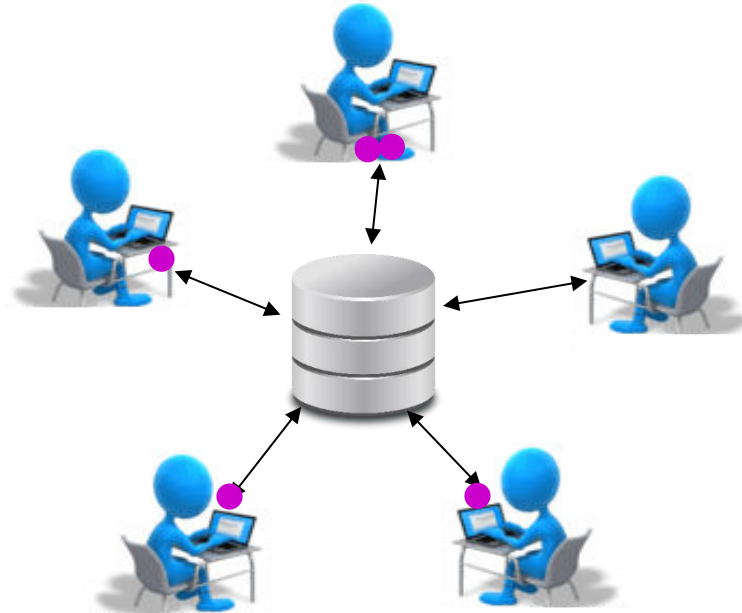


Effective rendering obtained by means of:

- models linked to graphical representations
- 3-dimensional (3D) computer-aided design (CAD)
- simulation
- digital mock-up
- stereo projection -> possibly AR in future
- rapid prototyping (RP)



# Model based Concurrent Engineering





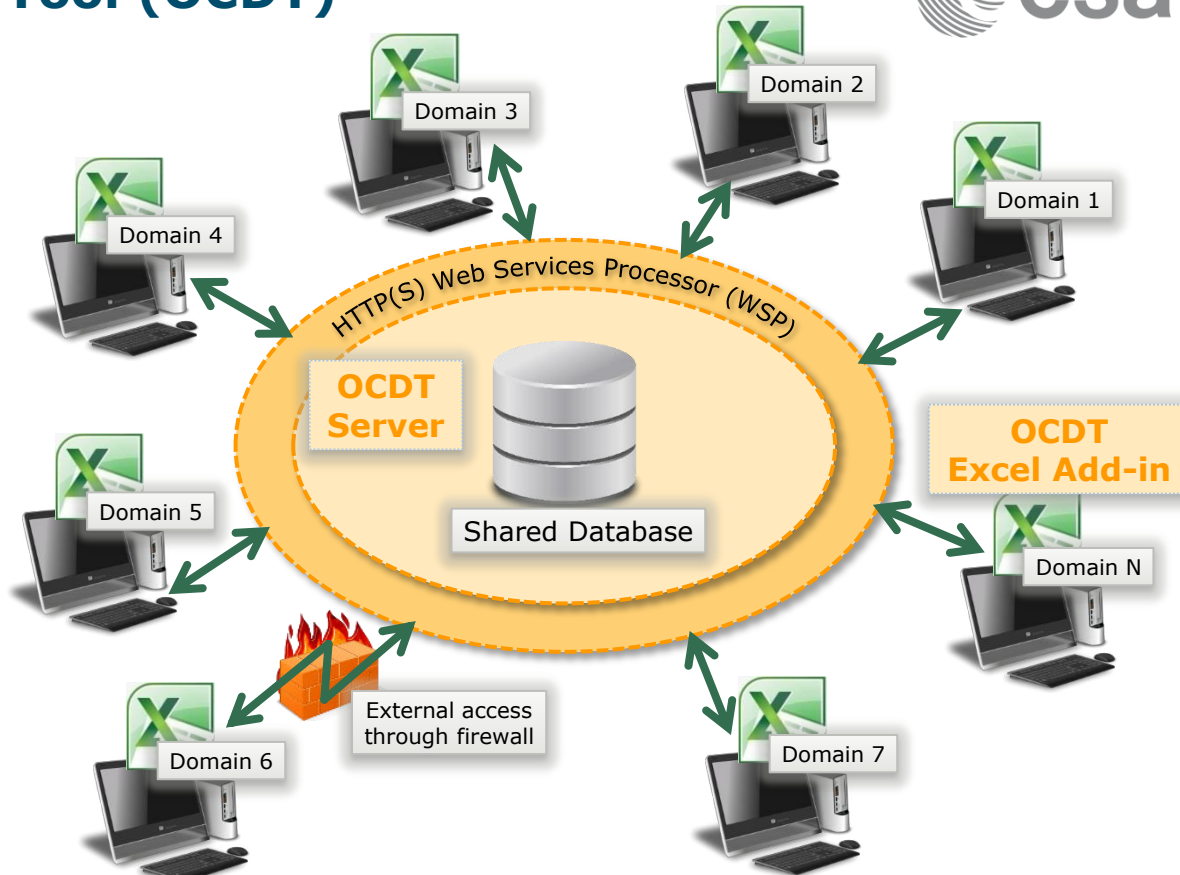
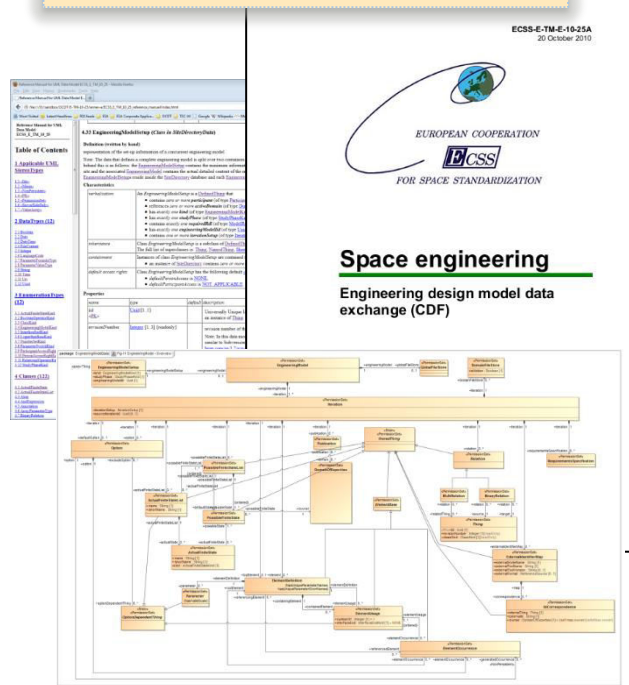
# Open Concurrent Design Tool (OCDT)

## ECSS-E-TM-10-25 Standard Data Model and Protocol

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

EUROPEAN COOPERATION  
**ECSS**  
FOR SPACE STANDARDIZATION

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



- **Performances** (typical pre-Phase A study):
  - Study duration (Design phase): 3-6 weeks (cp. 6-9 months!)
  - Factor 4 reduction in time
  - Factor 2 reduction in cost (for the Customer)
  - Increased nr of studies per year, compatibly with max 2 parallel studies
- Improvement in quality, providing quick, consistent and complete mission design, incl. technical feasibility, programmatics, risk, cost
- Technical report becomes part of the specs for subsequent industrial activity, Cost report remains the ESA independent reference
- Capitalisation of corporate knowledge for further reusability

**CDF has become an essential tool to support ESA Decision Making and Risk Management processes**



# Achievements



- Operational since 2000: 17 years
- Nr of studies performed: > 200
- Nr of users: > 2000 scientists and engineers have worked in CDF
- Nr of technical domains: 15-20 / Study, 5-7 / MICRA study
- Nr of sessions (typical): 8 / Study, 4 / MICRA study
- ...
- Visitors: 600-800 / year (every year!)

# CE team work



- 15-20 specialists per study
- Specialists are selected for each study, based on experience for the type of study (e.g. human mission, Mars lander etc.)
- All ESA member states nationalities
- Motivations:
  - Team members learn from each other
  - Learn about new / future ESA missions
  - 'Cool' working environment
- Often requests from ESA staff to be part of CDF team



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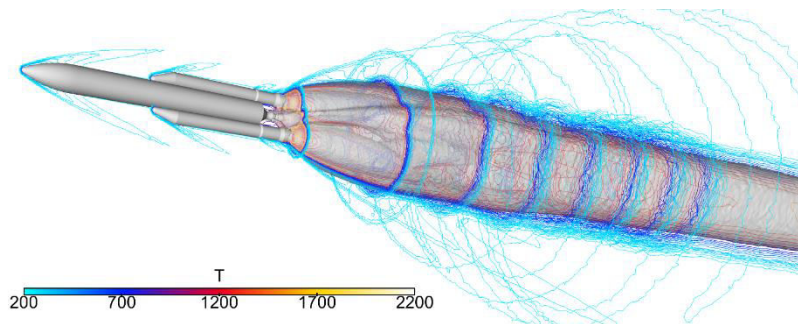
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European Space Agency

- CDF helped developing an eco design tool which enables the environmental impacts of space missions to be automatically calculated
- This will also allow the engineers and mission designer to investigate changing certain options to design the mission in the most environmentally friendly way
- Given that many missions at ESA begin in the CDF, environmental considerations will be taken into account from the earliest stage
- First Lifecycle assessment of a satellite in the CDF in 2012
- Tools are now applied outside CDF, such as launcher design



# Other Concurrent Design Centres

## European Space Sector



### United Kingdom

- CDF at **Univ. of Strathclyde**, Glasgow
- SDO at **Airbus/Astrium**, Stevenage
- CDF at **Univ. of Southampton**, Southampton
- CDF at **Harwell Institute**, Oxford

### The Netherlands

- CDF at **ESA/ESTEC**, Noordwijk

### Germany

- CEF at **DLR**, Bremen
- SDO at **Airbus DS**, Friedrichshafen

### France

- CDF at **ISU**, Strasbourg
- PASO at **CNES**, Toulouse
- SDO at **Airbus DS**, Toulouse
- CDF at **Thales Alenia Space**, Cannes

### Switzerland

- CDF at **EPFL**, Lausanne

### Portugal

- CDF at **Univ. Técnica de Lisboa**, Lisbon

### Italy

- COSE at **Thales Alenia Space**, Torino
- ISDEC at **Thales Alenia Space**, Roma
- CDF at **La Sapienza Univ.**, Roma
- CEF at **ASI**, Roma

**Legend:**  
**Agency**  
**Industry**  
**University**



# ESA Institutional partners



**CNES – CIC**  
**Inauguration Nov. 2005**

**DLR (Bremen) CEF**  
**Inauguration 8 Dec. 2008**



**ASI CEF**  
**First implementation: 13 July 2008**  
**New facility inaugurated: 25 Nov. 2013**



## TAS-I & F (Torino, Roma, Cannes) - CDF



## Airbus Bremen - SpaceCode



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## OHB Systems - CEFO



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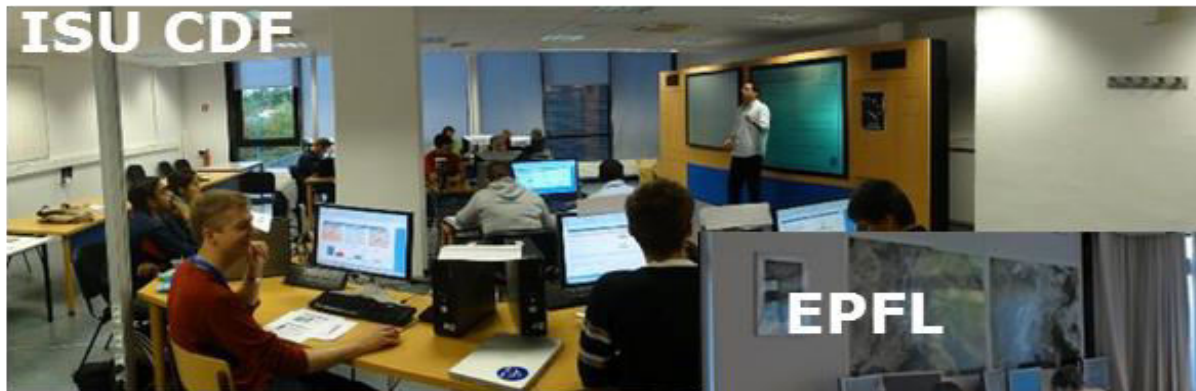
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## TLC Inauguration March 2016

Bachelor-PHD level  
2-3 Studies / year  
Feedback of both interesting  
ideas and qualified engineers  
into ESA









# Thanks for your attention!!



For more information:

- ESA CDF Web site: <http://www.esa.int/CDF>
- OCDDT/ECSS-E-10-25: <http://ocdt.esa.int>