ENG-411
Concurrent Engineering of Space Missions

Source: ESA

Lecture 1 - Introduction

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EPFL Space Center

Education

Agenda for today

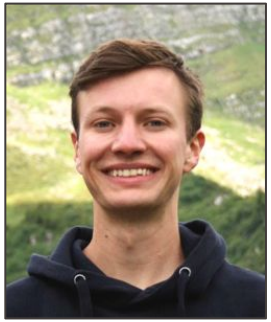
1. General introduction + course information (how)
   a. Semester planning
   b. Concurrent design sessions
   c. Grading

2. Concurrent Engineering (theory of)

3. Introduction to subsystems / domains

4. First introduction to COMET

Instructors / facilitators



Mathieu Udriot
(ESC)

Marnix Verkammen
(ESC)

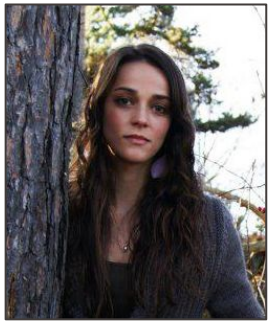
Christian Cardinaux
(ESC)

Acting customers

Andrew Price
(CV lab, ESC)

Stephan Hellmich
(LASTRO, ESC)

Technical Support



Candice Norhadian
(Admin, ESC)

John Maxwell
(IT, ESC)

Welcome

Goal

To learn the **fundamentals** of concurrent engineering/design, specially when applied to space.

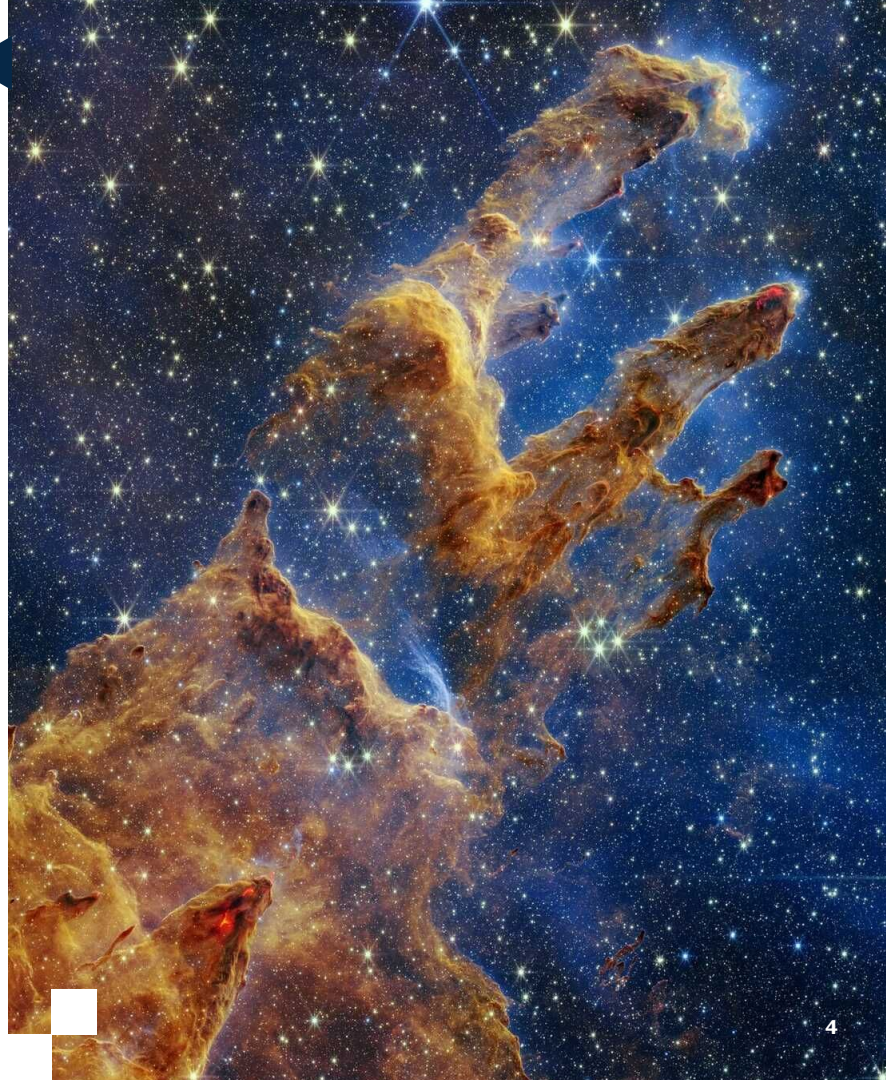
This is a high-intensity **hands-on** course. No exam. Lots of thinking. Plenty of doing. Tight deadlines.

Anti-goals

To become an expert on your assigned specialty within the team.

To work alone on your assigned task.

To study the different design philosophies and theories behind systems design.



Source: NASA/JWST

Source: ESA

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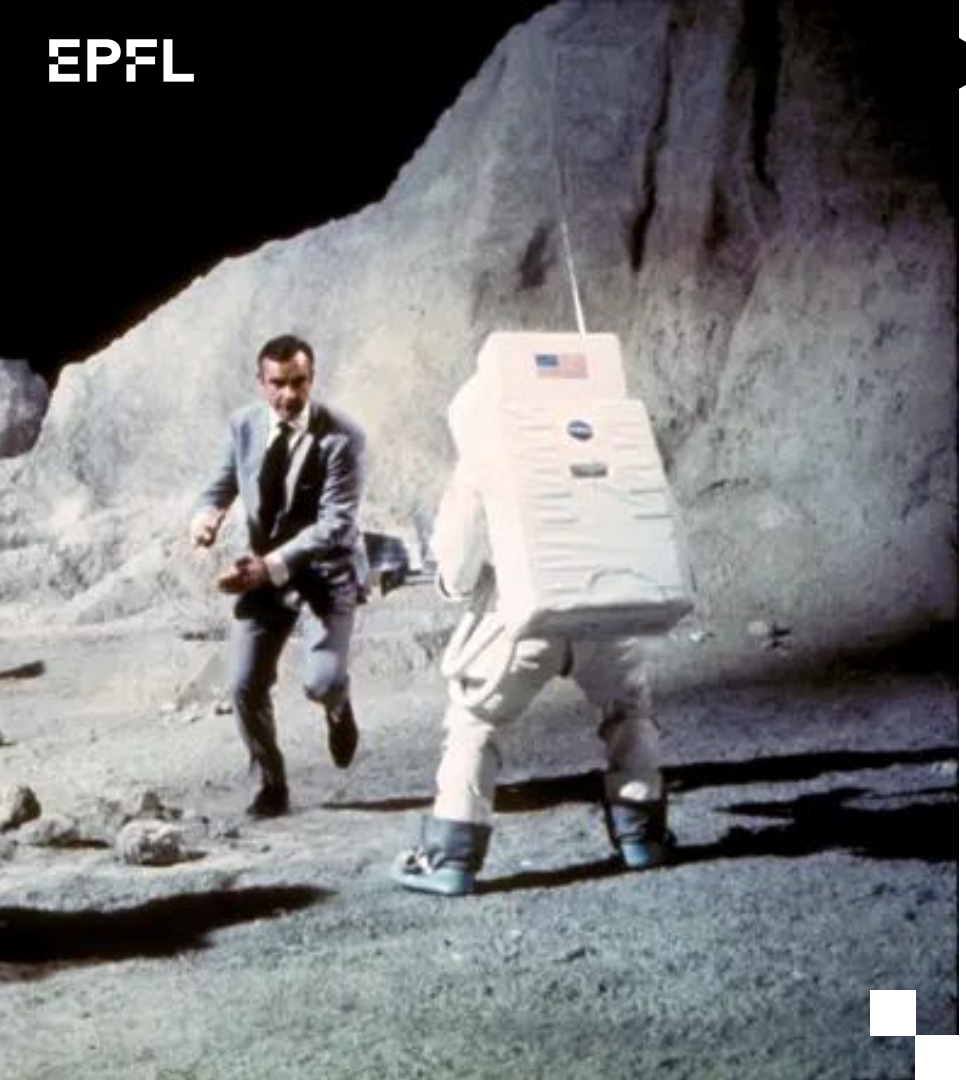
TeamWork
30%



Welcome

Learning outcomes

1. What concurrent engineering is and its principles.
2. Why concurrent engineering is used and when to use it effectively.
3. How to apply concurrent engineering as a tool for rapid problem solving and concept design of complex systems.
4. How concurrent engineering is used today in the space sector.
5. The pros and cons of applying concurrent engineering principles and approaches to the design of space missions and systems.
6. Teamwork and why inter/intra-team communication is always the issue.
7. Basic system-level thinking for productive discussions and rapid ideation.

Sources: Allstar/UNITED ARTISTS

How

Structure

7 weeks (first half of the semester)

2 sessions of theory / introduction (today and next week)

In **CM 0 13**

5 afternoons of assisted concurrent design sessions with your team

In **PPH 332** (CDF)

Mid-study presentation with experts

Final presentations with experts

Space Center staff always available during sessions.

Week	Date	Topic (1:15pm - 5pm)	Room
1	19.02	Introduction Concurrent Engineering theory Introduction to COMET Help with installation	~~GC A3 31~~ **CM 0 13**
2	26.02	The challenge (mission to be designed) - intro by customers Demonstration on COMET and playing around System engineering preparation (all together) Define roles for the design sessions COMET by subsystems External testimony → Moved to April 16th (5pm)	~~GC A3 31~~ **CM 0 13**
3	05.03	Design session - iteration 1	**PPH 332**
4	12.03	Design session - iteration 2	**PPH 332**
5	19.03	Design session - iteration 3	**PPH 332**
6	26.03	Design session - iteration 4	**PPH 332**
7	02.04	Design session - iteration 5	**PPH 332**

Concurrent Design Facility, an essential tool for studying future space missions

WEDNESDAY
16| Apr. | 2025

17h00 -18h00

SPEAKER:
Justin Bourgois

ZOOM ID: 647 1584 8200

https://espace.epfl.ch/event/justin-bourgois/

How

Structure

5x 4 hours-long design sessions.

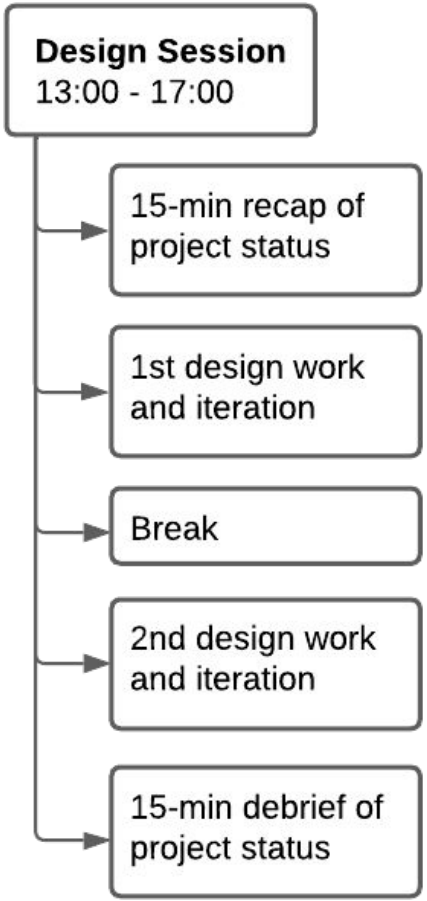
Each design session should be kicked off by a recap of the project status and wrapped up by a debrief of work done during the day.

Attendance to your team's design sessions is **mandatory**.

(Partially) missed sessions should be adequately justified and will be penalising the grade.

Every person counts. No show negatively affects your team.

Online attendance of a design session is only possible if adequately justified and as an exception.



How

Grading & Assignments

There will be **NO final exam**.

Grade >= 4 → Pass
2 ECTS

→ Deliverables: project presentations and team's final report.

Your grade will be based on:

[50%] **Final project presentation** (20%) **and report** (30%)

A final presentation together with a final report describing the outcome of your team's design study. Final report formatted using wiki's template and guidelines.

[20%] **Engagement**

Concurrent engineering is all about involvement, engagement, and active participation. Your degree of engagement during the design sessions will be accounted for.

[20%] **Presence**

Given the high intensity of the course and the responsibilities of each of the subsystems toward the final design, your **presence at every design session is critical** for the success of your team.

[10%] **Team members' assessment**

Teamwork is an absolute necessity in concurrent engineering. We expect that team members will work together to generate the technical content and solve each mission-specific problem. Assessment of your performance by your teammates.

How

Requirements & prerequisites

Required courses

- Space mission design and operations (EE-585) by Thibault Kuntzer (already taken)

Recommended courses

- Spacecraft design and system engineering (EE-584) by EPFL Space Center
- (Course on systems Engineering)

Some practical engineering team project experience is a plus.

How

Team

You will be ALL part of the same **team.**

Your team will be tasked with the design of **a mission** and provided with a **data pack** (i.e., basic background information about the design problem and selected resources).

This is a **cooperative challenge**.

On the last day of the course, your team will **present its own final mission design**.

There are no right or wrong solutions.

How

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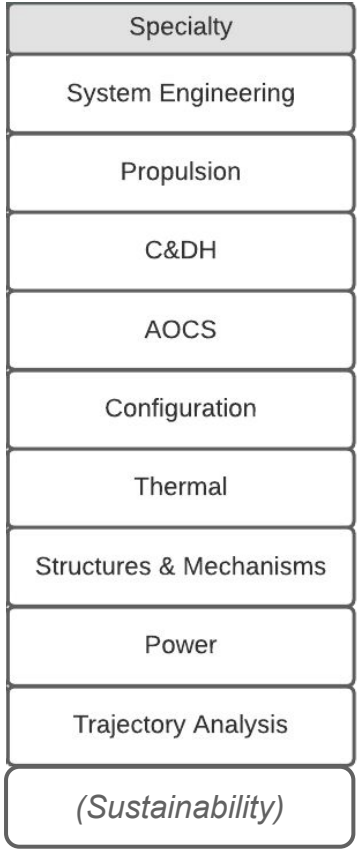

Roles will be assigned next week (trying to fulfill your **preference**)

Resources

Specific SW tools and books are available and can be used within the CDF. Use of the whiteboard and rapid ideation material is encouraged.

All information about the course can be found in:
https://cdf.epfl.ch/en/eng411

eSpace Concurrent Engineering Wiki:
https://cdf.epfl.ch/

Previous CE studies done at EPFL
https://cdf.epfl.ch/en/ce_studies

Concurrent design study report for this year:
https://cdf.epfl.ch/ce_studies/2025_ENG-411

"*Space Mission Analysis and Design*", by W. Larson and J. Wertz
Available in the CDF or at the library

COMET software

If you have not installed COMET, please do the following now:

1. Go to https://comet.epfl.ch/
2. Click on the URL for the Desktop app
3. Scroll down until you find the latest stable version → version 10.0.2.0

NOTE: it does not work on Apple or Linux devices.

Let us know if you have one of those.

Any questions?

Parting thoughts

We are open to your feedback!

We are here to help you learn. Anything you may need help with or anything on your mind on how to make the course better, let us know.

Contact: mathieu.udriot@epfl.ch