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Institut Supérieur de l'Aéronautique et de l'Espace
SUPAERO

From stakeholder needs towards functions and physical architectures and detailed system design

Educating engineers for complex systems

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Excellence with Passion



1 / Complexity calls for a new kind of engineer

THE CHALLENGE

Strong disciplinary expertise

Essential, but no longer sufficient on its own.

Components and the whole

How does each component contribute to overall system performance.

Decisions that ripple

A choice made at one level affects the entire system.

How do we educate engineers for this?

2 / From the why – to the what – to the how

THE JOURNEY

WHY

Stakeholder needs

What do industry, governments, people and society need?

→

WHAT

System functions

What must the system do? How well/fast/...? Under what constraints? …

→

HOW

Physical architecture

Which components realize the functions?

→

HOW

Detailed system design

How is each element specified in detail?

Each level must trace back to the one before it.

3 / Five educational priorities

- Systems thinking as the outset
- Interdisciplinary collaboration and concurrent engineering
- Learning through industrial challenges and capstone projects
- Digital engineering and AI, used critically
- Decision-making under uncertainty

3 / Thinking in systems, working across disciplines

1

Systems thinking as the outset

- Frames the whole journey from needs to functions, architectures and detailed design
- Shows how each component serves overall system performance
- Comes first, so disciplinary knowledge has a place to land

2

Interdisciplinary collaboration and concurrent engineering

- Disciplines design together, not one after another
- Students feel how a choice in one field constrains the others
- Trade-offs surface early, while they are still cheap to resolve

3 / Learning through industrial challenges

3

Real problems, growing responsibility

- Industrial challenges bring real stakeholders and real ambiguity
- Capstone projects integrate knowledge across disciplines
- Students take on system-level responsibility step by step



Scope and system-level responsibility grow at each step.

3 / Using tools critically, deciding under uncertainty

4

Digital engineering and AI as support tools

- Master digital engineering and AI as tools and approaches
- Understand both their capabilities and their limitations
- Use them critically: the engineer stays accountable

5

Decision-making under uncertainty

- Needs shift, data are imperfect, information is incomplete
- Practice weighing options when no answer is certain
- Own and justify the decision, document it, not only compute it

4 / Connecting the levels of engineering design

CLOSING MESSAGE

Why	What	How
Stakeholder needs	System functions	Physical realization

With growing complexity, digitalization and AI, the ability to connect these levels may become one of the most important competencies of the next generation of engineers.

Don’t forget to be an engineer!

… and master the application you are working on…

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