Project-oriented education: from engineering school to engineering jobs

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Create the Change, Design the Future

EPF Presentation
A UNIQUE HISTORY

• Founded in 1925 by Marie-Louise Paris, as Ecole Polytechnique Féminine,
• EPF was one of the first engineering schools in France to train women.
• It has been co-educational since 1994,
  ➔ EPF is still an active advocate for gender equality policies and remains one of the schools with the highest rate of female students (35% against 25% on average in other French engineering schools).

Focused on academic excellence, professional training and innovative teaching methods, EPF also plays a pioneering role in the promotion of diversity and equal opportunity in higher education.
Three dynamic & innovative campuses, one unique school

- 20 minutes away from Paris City centre
- 1200 students

- In the city centre
- 500 students

- Tech Lab on each campus

- In Champagne, beautiful historical region (1h30 from Paris)
- 300 students
DIPLOMAS & PROGRAMMES

EPF delivers 4 diplomas:

- Polytechnic generalist engineer diploma
- Digital & industrial systems engineer diploma (Apprenticeship training in Sceaux)
- Digital & industrial systems engineer diploma (Apprenticeship training in Montpellier)
- Franco-German production & automatisation engineer diploma (Joint programme with Munich Hochschule)

All programmes lead to a 5-year degree (Master’s Degree)

All diplomas are accredited by the CTI (French Commission for engineering qualifications)
GRADUATE STUDIES

Polytechnic generalist engineer diploma

English Tracks

- Bac + 4: Master 2nd year (partner university)
- Bac + 5: Substitution of the 5th Year
  - S9
  - S10: Stage FE

Year 4
- Major's Project
- Serious Game
- 24h Innovation Hackathon

Year 5
- Majors’s Project

MAJORS
- AERONAUTICS AND SPACE
  - SCEAUX
- STRUCTURES & MATERIALS
  - SCEAUX
- ENGINEERING & DIGITAL TECHNOLOGIES
  - SCEAUX
- ENGINEERING & MANAGEMENT
  - SCEAUX
- ENGINEERING & HEALTH
  - SCEAUX
- ENERGY AND ENVIRONMENT
  - MONTPELLIER
- BUILDINGS & ECO CITIES
  - TROYES

MS: Innovation, Creation & Entrepreneurship (100% in English)

Final Project Internship
INNOVATIVE TEACHING METHODS

EPF has recently created a working group on ‘Digital & Teaching Methods Innovations’

Our students are actors of their own education through:

- Serious game
- Inverted classes
- Blended learning
- Self-teaching on collaborative platforms
- Project-based education

The goal is to train responsible, adaptable and multi-skilled engineers

✓ Relational capacity and collaborative skills
✓ Ability to ‘learn how to learn’ throughout their whole career
Aeronautics & Space Major

Create the Change, Design the Future
Target Jobs

Jobs

• Business Engineer
• System Engineer / System Architect
• Design Engineer (Structure, Electrical System, Control)
• R&D Engineer (...., Aerodynamics, ....)
• Integration / Test Engineer
• Industrialisation Engineer
• Production Engineer
• Operations Engineer (Space)
• Exploitation Engineer (Aeronautics)
• Exploitation Engineer (Space)
• Maintenance Engineer
• Quality Engineer

5th Year Tracks

R&D Design/Sizing (Track 1)

Industrialisation Production (Track 3)

Operation Maintenance (Track 3)
Project Presentation
Aims and stakes of the project

• Aims :
  • Design of a drone in response to a preliminary statement of needs*
  • Realization of a demonstrator of it

• Stakes :
  • Cost price ➔ increase of the distributor profitability
  • Ease of use ➔ attract customer
  • Respect of the safety and regulatory aspects ➔ compulsory

*gutters surveillance
*detection of crack and quality issues in manufacturing & maintenance
*manutention in a warehouse
*drop of lifebuoys at sea to assist cost lifeguards

*handling in hostile environment
*zone observation with a large autonomy
Project deliverables

- At the end of 1st semester (February ➔ June):
  - A design dossier
    - Geometry
    - Materials
    - Method of production or suppliers
  - A design justification dossier ➔ Every choice should be justified
  - An economic dossier
    - Cost price breakdown

- At the end of 2nd semester (September ➔ January):
  - A « demonstrator » that should demonstrate the drone abilities to achieve the mission

ALM

Respect of the given budget

SYSTEMS ENGINEERING
In real-life situation

Drone Project

- MATLAB/SIMULINK
- AMESIM
- CATIA
- ABAQUS

As a Real Study
Design & Integration phases

Realization
Demonstrator

As a Professional Project
Conditions of a response to a call for tenders

Familiarisation
Aeronautic design

Full scale practice
Technical project management

Use of Digital Tools
Modeling and Prototyping

Professional Engineering Process
Design/Validation of flying systems
Application of company rules

• Same level of requirements (work and behaviour)
  • Deliverables
  • Reviews
  • Engagement

• As well as in a company, a member may be excluded from the project team by a company manager (Programme Director or Technical Director)
In a professional situation

**Project Owner**
- Customer
  - Contract of Objectives
  - Final deliverables

**Call for tenders**
- Response to a call for tenders

**Main contractor**

**Programme Director**
- Progress of the project
- Holding of the internal objectives

**Technical Director**
- Respect of technological rules
- Pertinence of arbitrations
- Relevance of the technological solutions

**Customer**
- Contract of Objectives
- Final deliverables

**Engineering consultants**
Role playing

Customer representatives:
*Internal professors acting as / Forward real companies*

Programme Director
*Internal Professor with a Professional expertise as Design Engineer, and as Systems Engineering Consultant*

Technical Director
*External Professor with a Professional expertise in Aeronautic industry as Test Means Engineer*

Call for tenders:
the design of a drone with preliminary statement of needs

Engineering consultants (Flying vehicles)
- 5 Students teams / call for tenders
- Teams in competition
Teams organisation

Technical Director

Technical Chief Engineer

Programmes Director

Projet leader

One team project
In-flight tests / Customer tests

Given to students:
• Test scenarios
• For each scenario:
  • Acceptance criteria
  • Performance criteria

“multi-copters”
In a gymnasium

“flying wing”
In an open area: a civil drone cluster
(former military air base)
Acceptance and Performances criteria

• Acceptance
  • Compliance to the current legislation
  • Respect of size
  • Respect of scenario
  • No « eliminatory » incident
    • Contact with one environmental element (in particular the ground)
    • Lost of flight control
    • Disability to stay in a flight corridor

• Performances
  • Time needed from A→B
  • Time needed from B→A
  • Energy consumption
Teaching Methods

Students

• Courses :
  • Project Management
  • Systems Engineering

• Tutoring :
  • Project Management
  • Systems Engineering
  • Technical

• Videos :
  • Review preparation

Professionals

• Project Reviews

• Contract documents
Project Reviews

- Kick-Off Meeting [KOM]
- Functional Architecture Review [FAR]
- Preliminary Design Review [PDR]
- Detailed Design Review [DDR]
- Critical Design Review [CDR]
- Critical Orders Review [COR]
- Test Readiness Review [TRR]
- Final Acceptance Review [OKM]

Same teams throughout the project (4A and 5A)
**Project Management**

- Project Reviews & Project Deliverables
- Steering / Internal coordination
- Technical Steering
- Technical Tutoring
- Technical meetings and tech. deliverables

**Project**

- Functional Design
- Preliminary Design
- Detailed Design
- Realization
- Tests Means and Procedures
- Integration and Test
- Technical Steering

**Engineering**

- Functional Logic
- Eligible Concepts
- Product Arborescence
- Components Specifications*
- Digital Mock-Up
- Order for purchased components
- Acceptance Test Procedure
- Receipt of components & conformity assessment
- Components and sub-systems assembly and tests
- System Assembly and tests
- Customer tests

- Eligible Concepts Modeling
- Performances Simulation
- Justification Documentation
- Order for raw materials
- Design of Test and integration devices
- Work Order

- Justification Documentation
- Justification Documentation
- Production of not purchased components
- System Assembly and on ground and in flight tests
- Realization of Test and integration devices
- Design of Test and integration devices

* or suppliers references for ordered components
Conclusion

• Systems Engineering
• Multi-disciplinarity
• Innovation
• Professional (contract, deadlines, deliverables, budget, competitors, ...)
• A large resonance with Studies Final Internship offers

http://www.epf.fr/en/studies/majors/aeronautics-space archived as http://archive.is/lzc00
Thank you for your attention