UNIVERSIDAD POLITÉCNICA DE MADRID

ETS DE INGENIERÍA AERONÁUTICA Y DEL ESPACIO

Is the European Aerospace Engineering Education Ecosystem Prepared for the Transformation of Aerospace?

October 17, 2025

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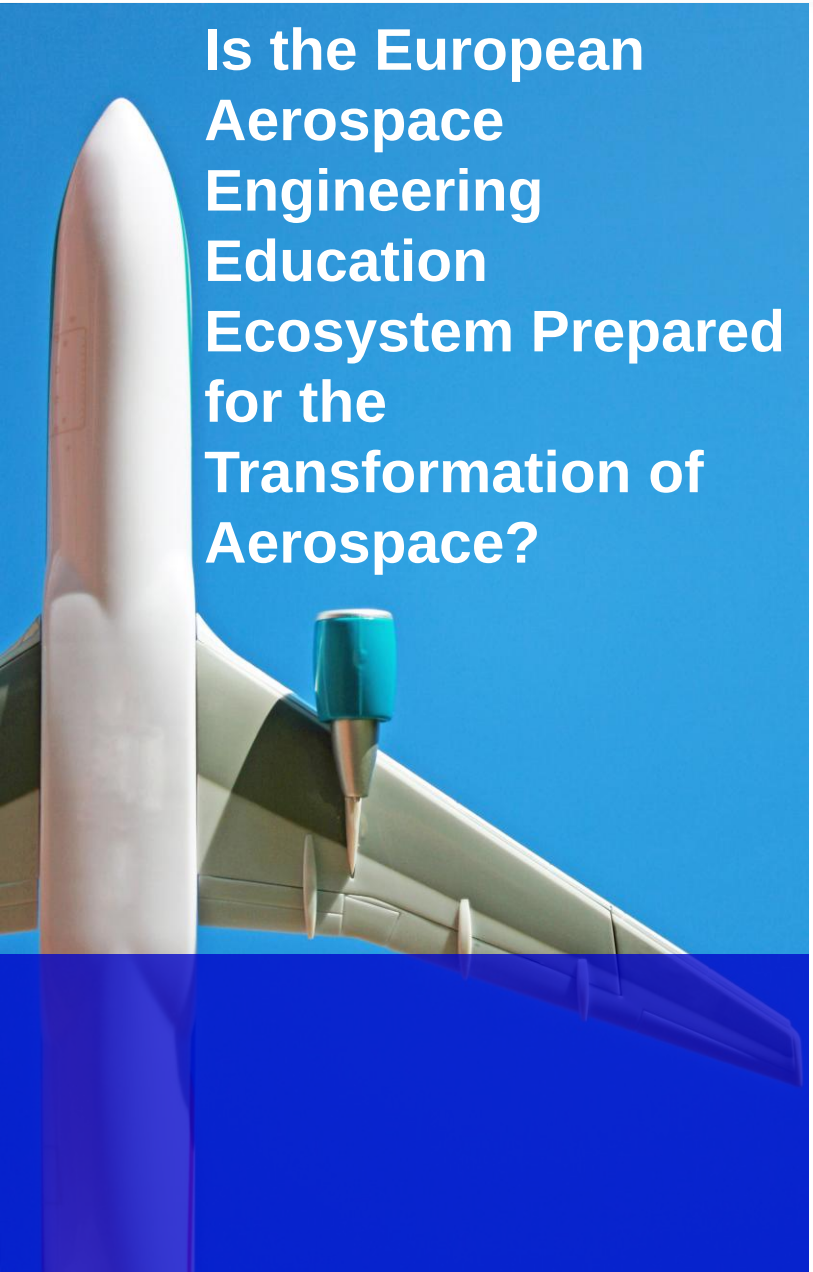


Is the European Aerospace Engineering Education Ecosystem Prepared for the Transformation of Aerospace?

CONTENTS

Drivers of change

- Sustainability
- Digitalization & AI
- Social Shifts
- Geopolitics

Future of Jobs Report 2025

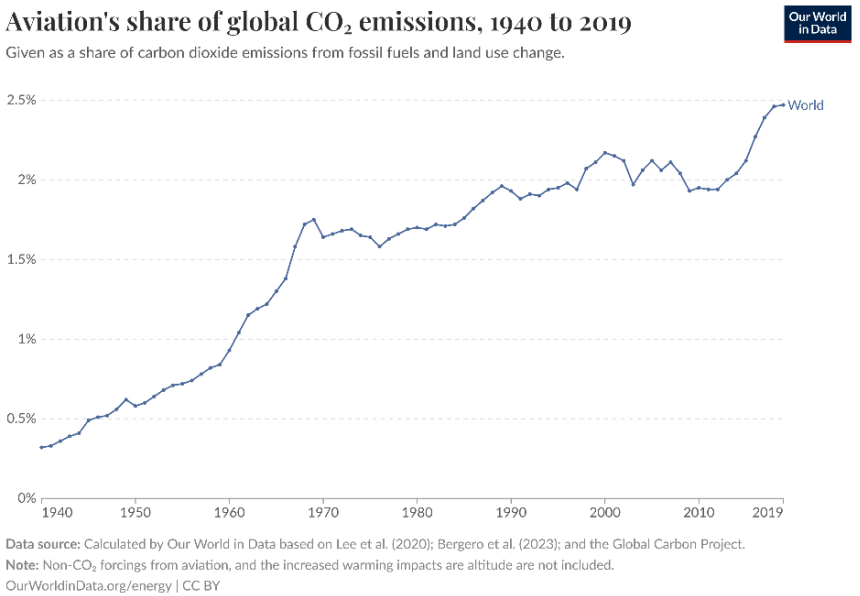
Five key labour-market drivers

WORLD ECONOMIC FORUM

Source: World Economic Forum. (2025). *Future of Jobs Report 2025*.

Drivers of change: environmental issues

- Climate change and population response to the impact of air travel
- Limitations on infrastructure development (airports, airways) due to environmental concerns
- Regulation on noise and polluting gas emissions
- Tourist saturation in some regions



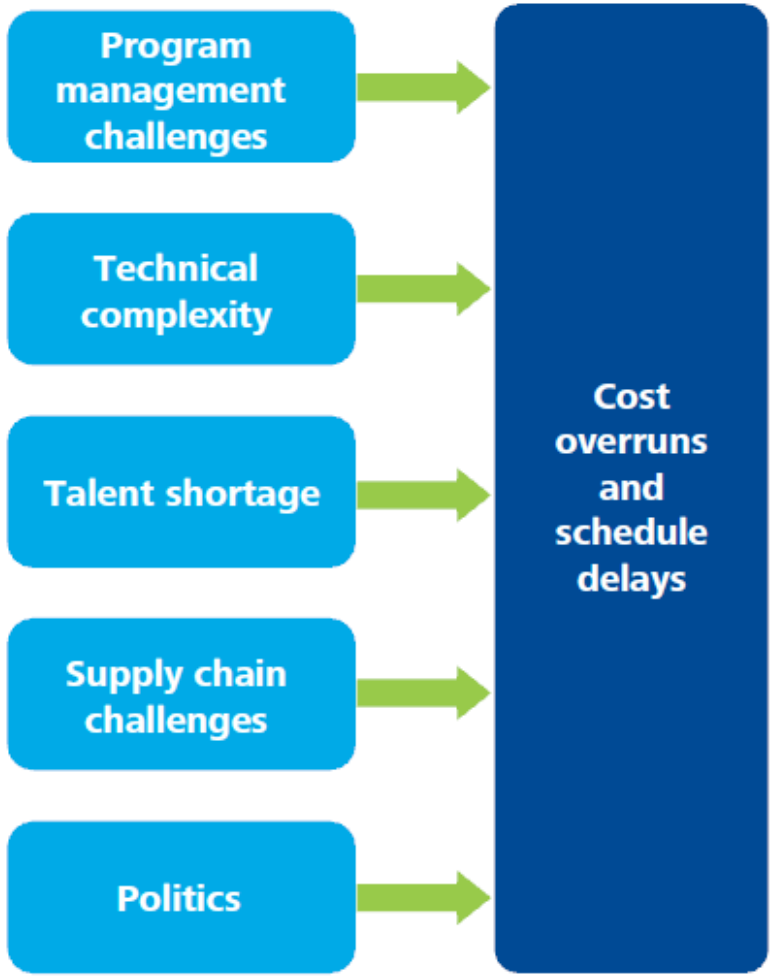
Drivers of change: increased project complexity

- High Complexity
- Multidisciplinary
- Cost & Time

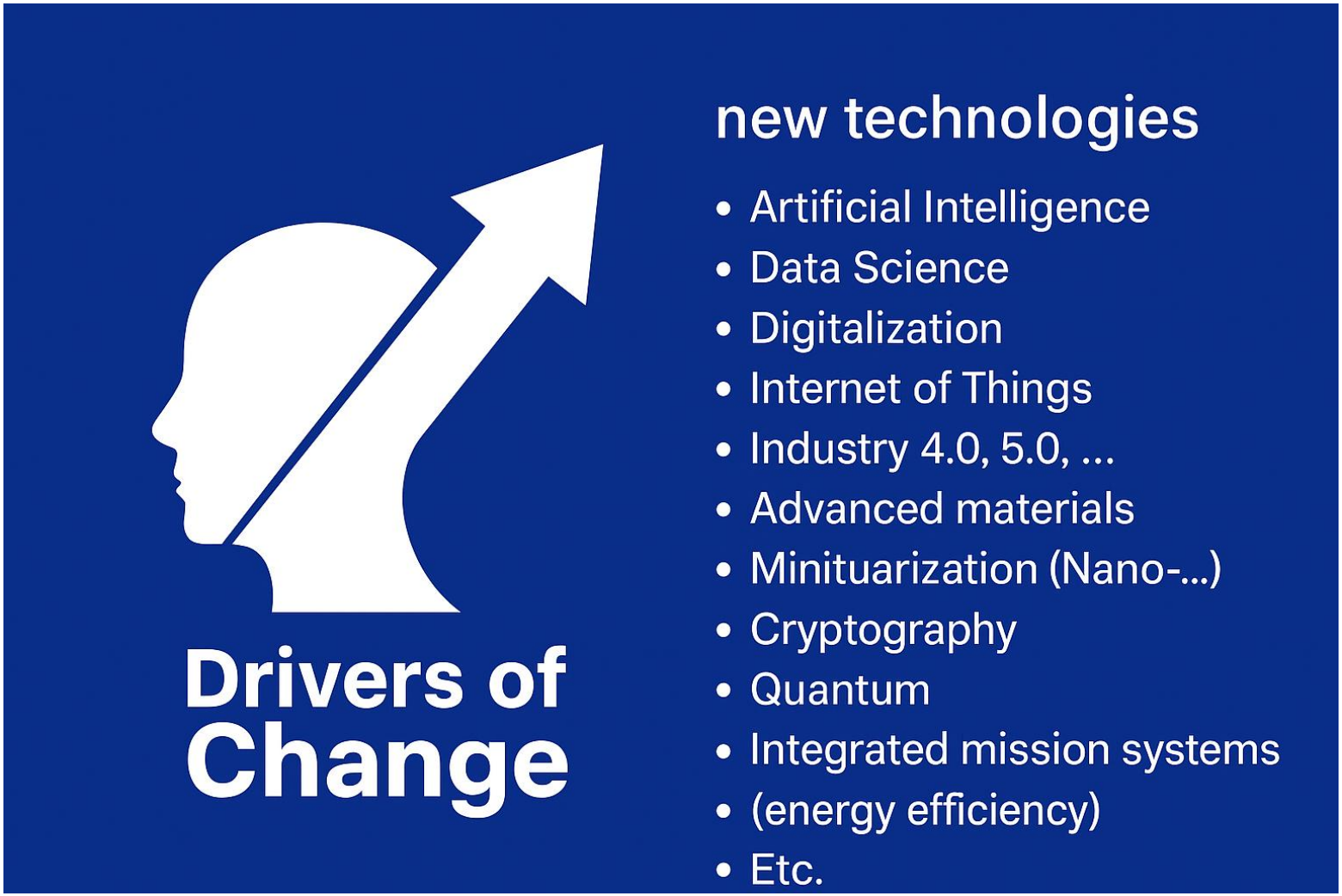
Drivers of change: increased project complexity

"Late and Over-Budget"

The challenges associated with **technical complexity continue to grow over time**



Drivers of change: new technologies



Drivers of change: new people

- Digital natives
- Accelerated gap
- New training methodologies: innovation in education (Project Based Learning, etc.)
- New formats (remote vs. onsite learning, etc.)
- **New competences needed**

Drivers of change: new competences

Future of Jobs Report 2025

Core skills in 2025

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1. Analytical thinking
2. Resilience, flexibility and agility
3. Leadership and social influence
4. Creative thinking
5. Motivation and self-awareness
6. Technological literacy
7. Empathy and active listening
8. Curiosity and lifelong learning
9. Talent management
10. Service orientation and customer service

Cognitive skills · Self-efficacy · Working with others · Management skills · Technology skills · Engagement skills

Note: The skills selected by surveyed organizations to be of greatest importance to workers at the time of the survey.
Source: World Economic Forum. (2025). *Future of Jobs Report 2025*.

Future of Jobs Report 2025

Top 10 fastest growing skills by 2030

WORLD ECONOMIC FORUM

1. AI and big data
2. Networks and cybersecurity
3. Technological literacy
4. Creative thinking
5. Resilience, flexibility and agility
6. Curiosity and lifelong learning
7. Leadership and social influence
8. Talent management
9. Analytical thinking
10. Environmental stewardship

Cognitive skills · Self-efficacy · Working with others · Management skills · Technology skills · Ethics

Note: The skills selected by surveyed organizations to be increasing most rapidly in importance by 2030.
Source: World Economic Forum. (2025). *Future of Jobs Report 2025*.

Drivers of change

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Five key labour-market drivers

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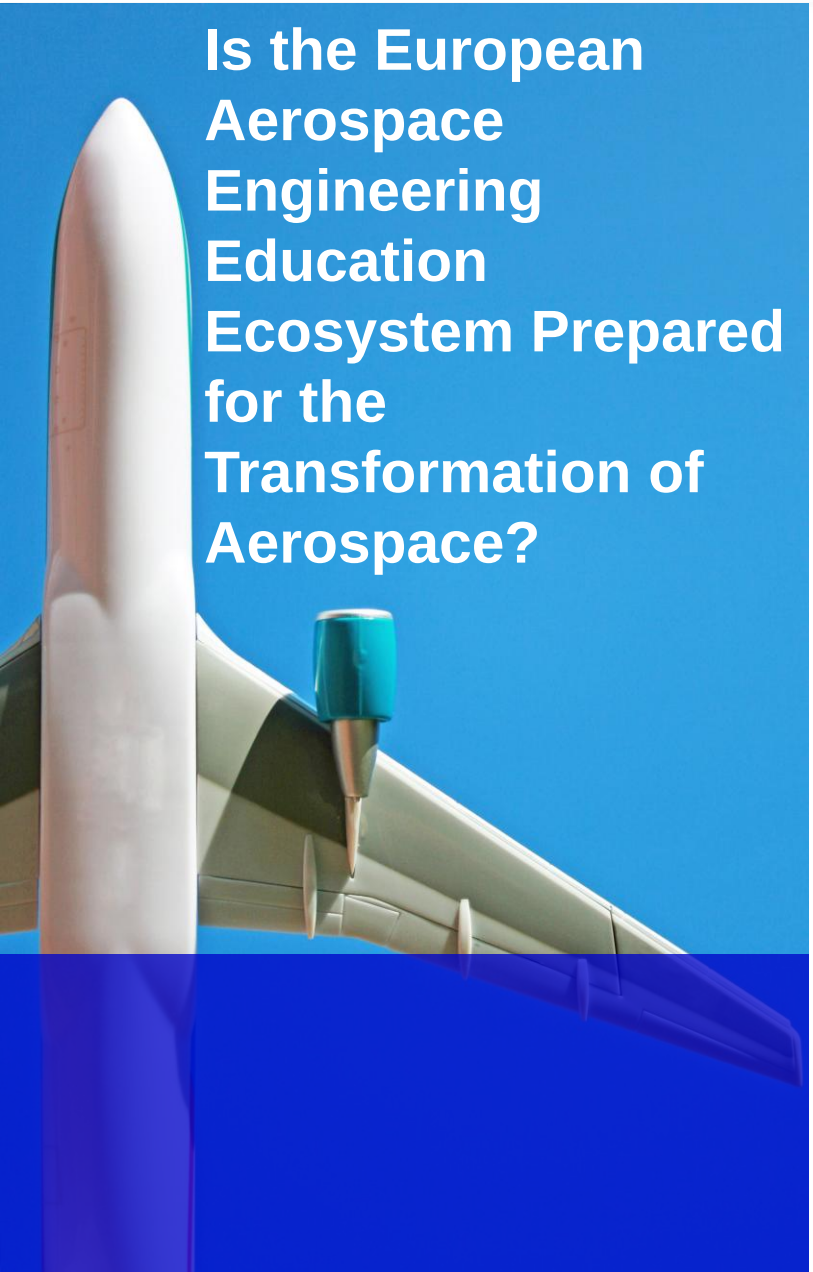

Is the European Aerospace Engineering Education Ecosystem Prepared for the Transformation of Aerospace?

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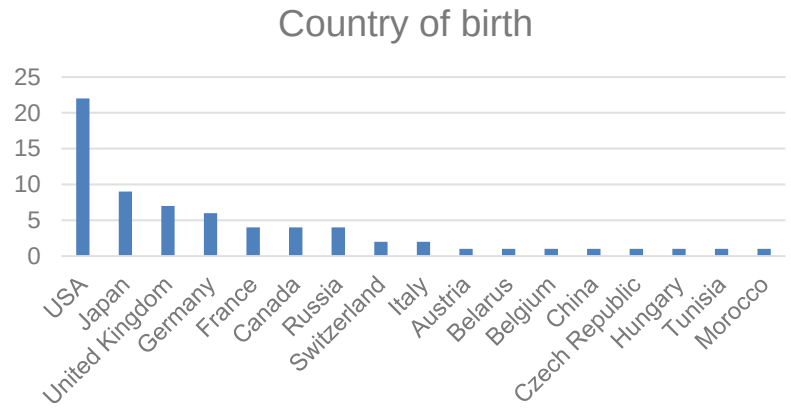
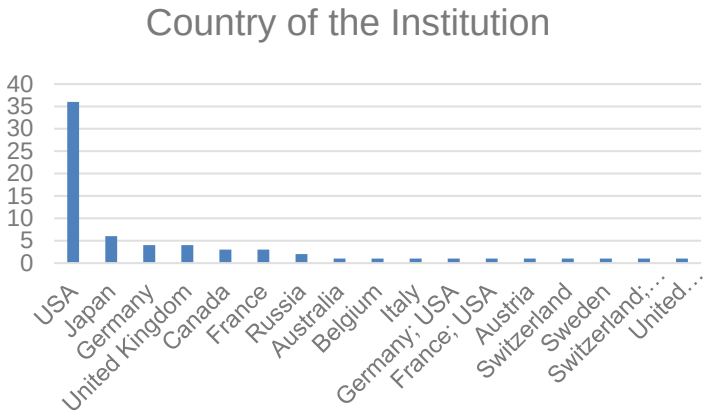
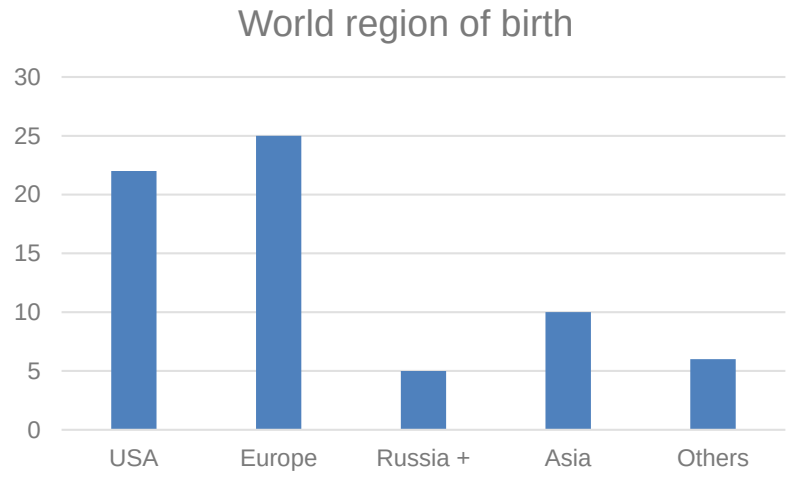
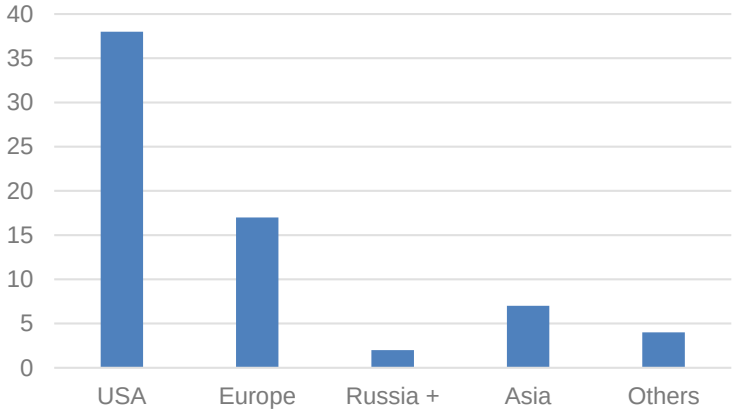
The European aerospace engineering education ecosystem

Winners of the Nobel Prize in Physics in the last 25 years



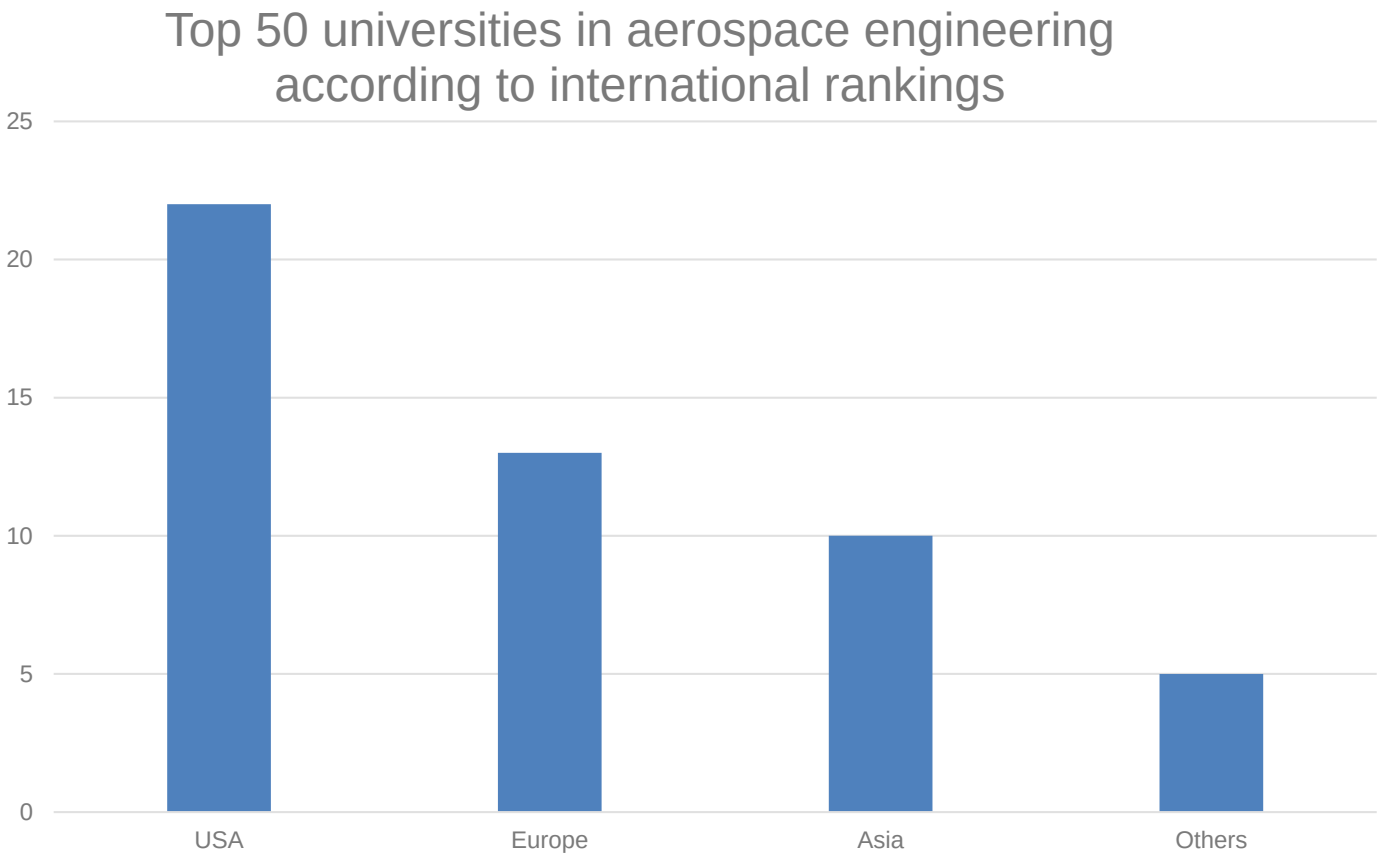






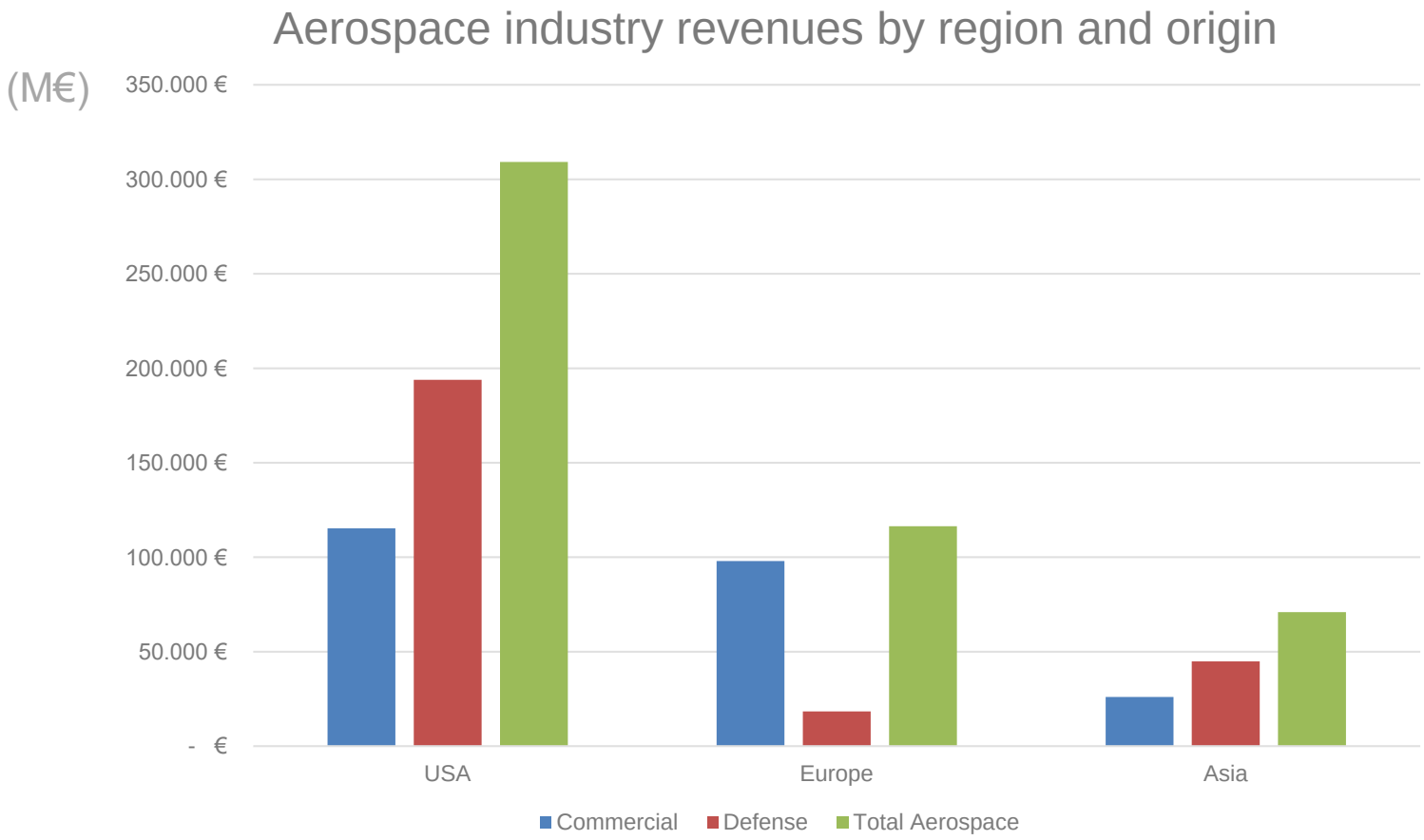
Source: Encyclopaedya Britannica

The European aerospace engineering education ecosystem



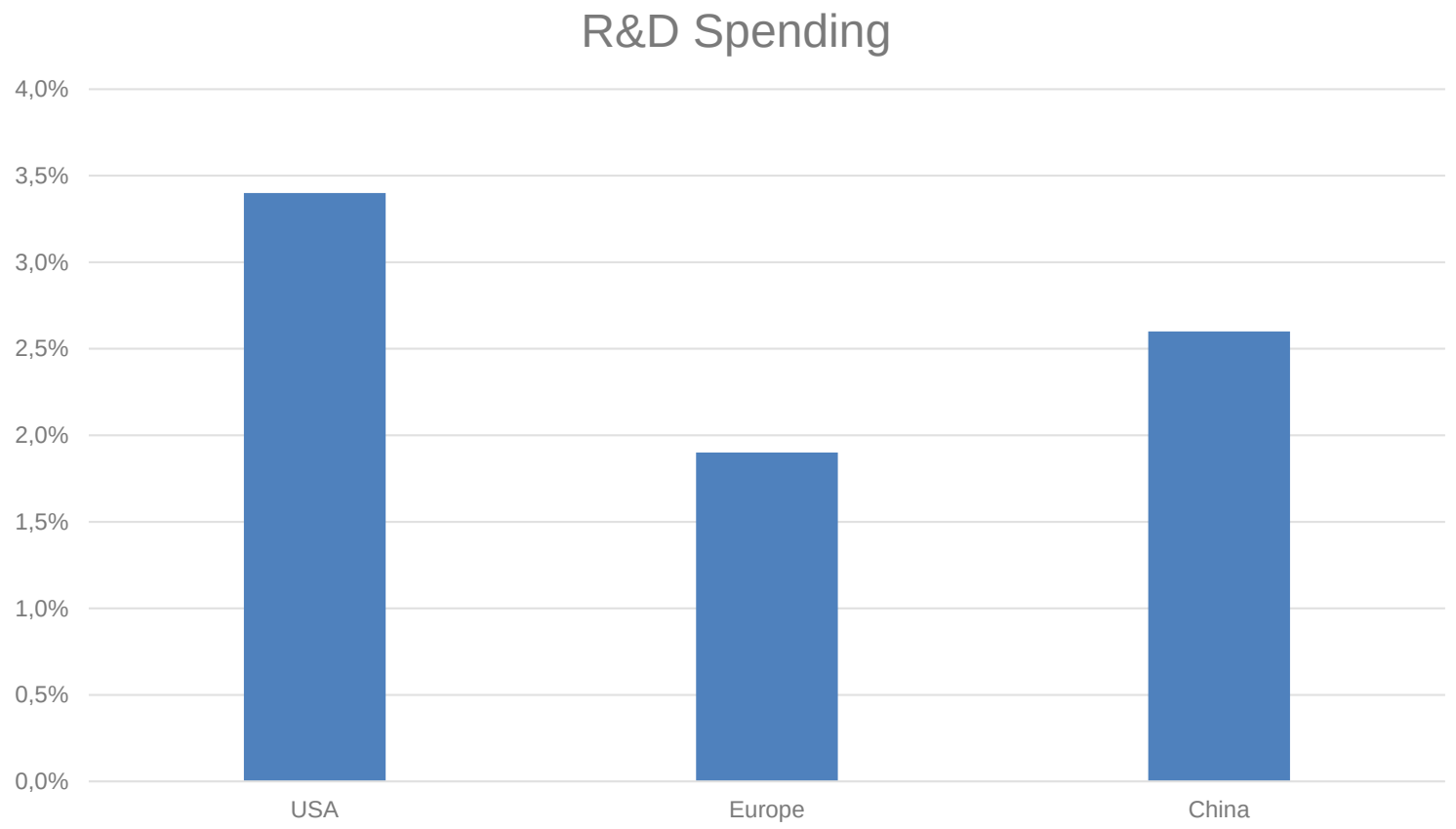
Source: QS / Shanghai

The European aerospace engineering education ecosystem



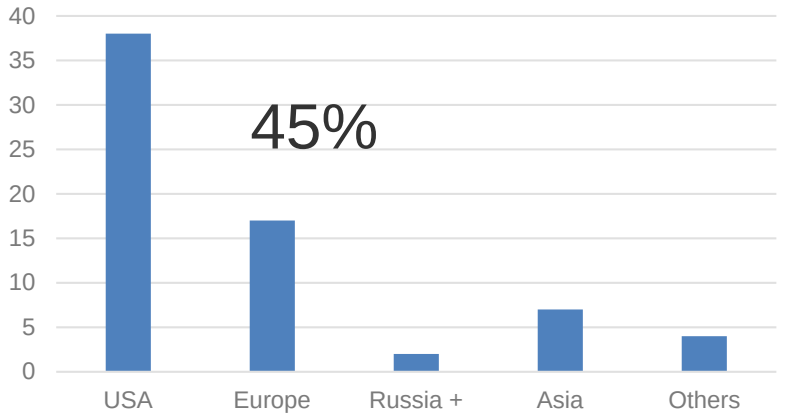
Source: FlightGlobal, 2023

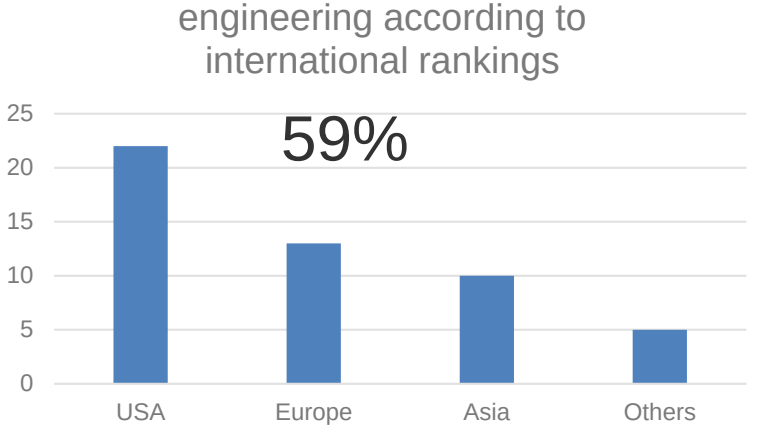
The European aerospace engineering education ecosystem

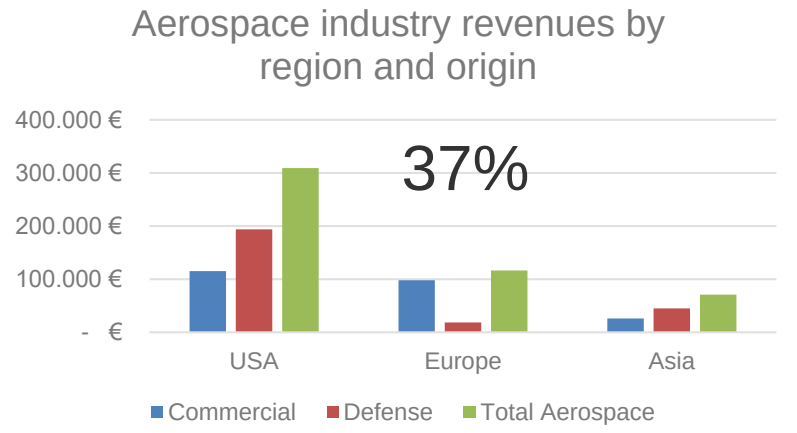


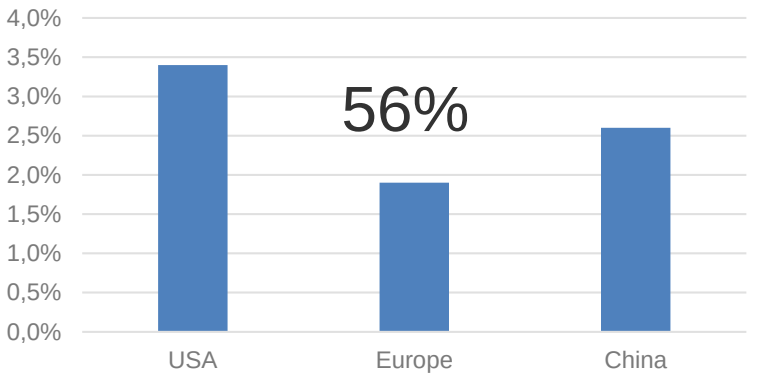
Source: OECD/UNESCO consolidated figures for 2023–2024

The European aerospace engineering education ecosystem

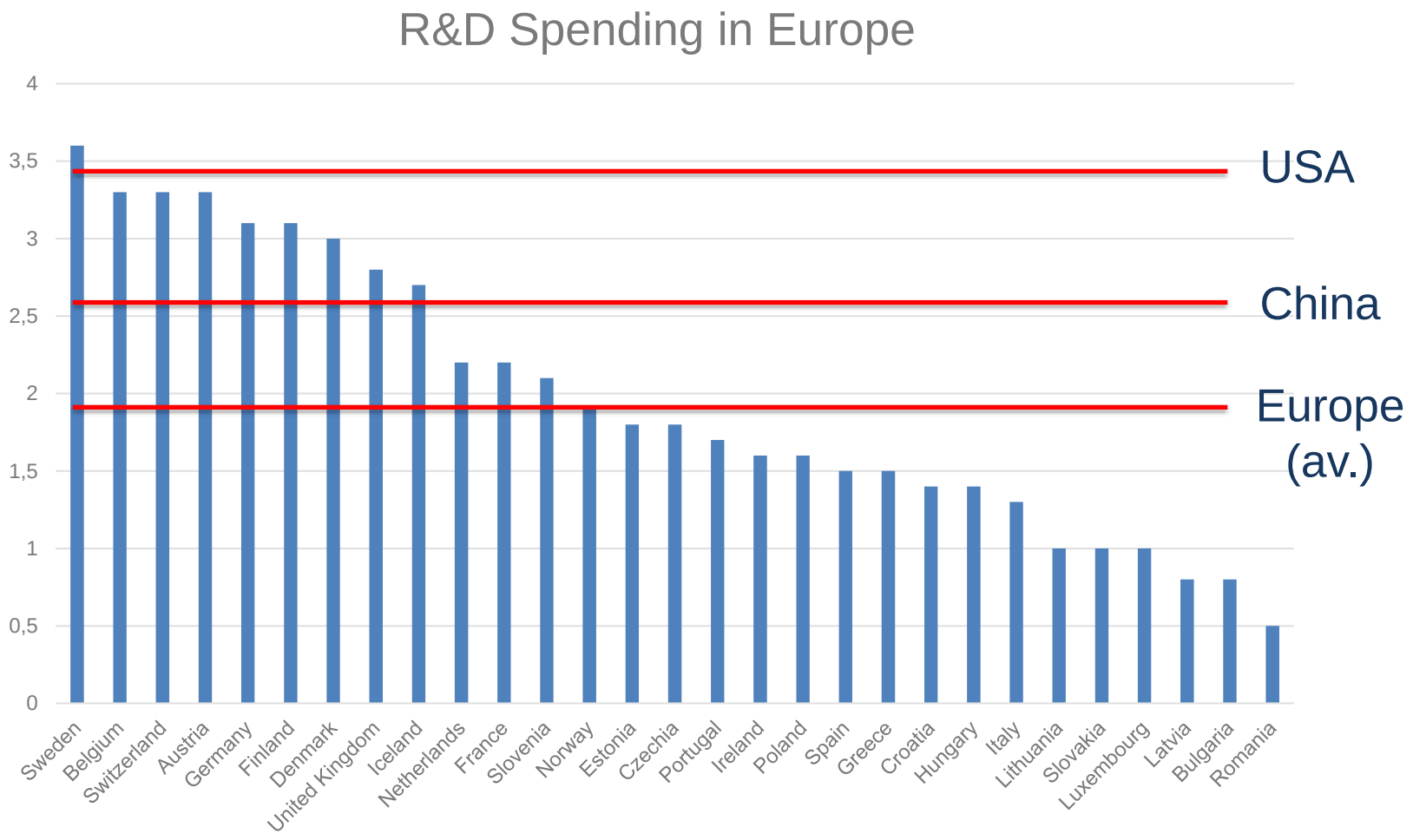








The European aerospace engineering education ecosystem



Source: OECD/UNESCO consolidated figures for 2023–2024

The European aerospace engineering education ecosystem

- The European aerospace engineering education ecosystem is a **multi-level network** of:
  - Universities
  - Research centers
  - Industry partners
  - Public institutions

- It is **diverse and decentralized**, reflecting Europe's multi-national character,

- but **interconnected** through European-level initiatives, R&D programs, and academic networks.

How many institutions provide aerospace-engineering education in Europe?

- Do you count only specialist aerospace departments? (→ about 40 — the PEGASUS core + some others)

- Do you include every university offering any named undergraduate or postgraduate course with “aerospace/aeronautical/astronautical” in the title? (→ 60–140 depending on country coverage and program duplicates)

What do we call “Aerospace engineering”?

- Bachelor / Master (Fachhochschulen / Universities)
- From 3+1 to 4+2 all possible combinations
- Mechanical, Telecom, IT, …
- Industry “academies”

The European aerospace engineering education ecosystem

European-level initiatives, R&D programs, and academic networks

- PEGASUS
- European Universities
- Erasmus mobility
- ECATA
- EASN
- CEAS
- Clean Aviation, SESAR, EASA
- EDF
- National R&I agencies

European-level initiatives, R&D programs, and academic networks

The European aerospace engineering education ecosystem

PEGASUS

- PEGASUS (Partnership of European Group of Aeronautics and Space UniversitieS) is the group of many of the main European Higher Education Institutions in Europe
- PEGASUS partners are public and/or non-profit institutions of higher education in aeronautical / aerospace engineering located in the EU
- Presently 31 member Institutions in 12 European countries represented

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The European aerospace engineering education ecosystem

Country	Institution
	Politecnico di Milano Politecnico di Torino Università di Napoli Università di Bologna Università di Pisa Università di Roma
	Ecole de l'air et de l'Espace ENAC Toulouse ESTACA ISAE-ENSMA ISAE-SUPAERO ISAE-SUPMECA
	TU Delft
	UPC / ESEIAAT Terrassa UPM / ETSIA Madrid UPV / ETSID Valencia US / ESI Sevilla
	IST Lisboa
	VGTU Vilnius

Country	Institution
	RWTH Aachen TU Berlin TU Braunschweig Universität Stuttgart TU Dresden
	Cranfield University University of Bristol University of Glasgow
	KTH Stockholm
	CVUT Prague
	Politechnika Warszawska
	University of Zilina

The European aerospace engineering education ecosystem

PEGASUS

Goals:

- Contribute to the development of a quality system for the European higher education in Aerospace Engineering
- Improve educational process and curricula to specifically serve the needs of the aerospace industry
- Show similarities and differences of European curricula to the aerospace world
- Cooperate with other groups and networks to fulfil the EU policy lines in higher education
- Increase cooperation between partners and industry as well as national and European research agencies
- Contribute to attract non-European students and engineers through competitive curricula and continuing educational services

The European aerospace engineering education ecosystem

PEGASUS

PEGASUS Industry Alliance:

- The aerospace industrial community and the PEGASUS network are equally represented to discuss all issues relevant to this subject
- The main objective of the PEGASUS-Industry Alliance is to contribute to reinforcement of the European academic and industrial relations for mutual benefits

PEGASUS Research Alliance:

- The main objective of the PEGASUS-Research Alliance is to improve the mutual relations between the PEGASUS Universities and the EU Research Establishments
- This will generate benefits for the graduates and will create synergies in the fundamental research in the aerospace sector

The European Universiy initiative

- **Origins:** launched by the European Commission in 2018

- **Goal:** build a network of universities offering:
  - **Joint curricula and degrees** across countries.
  - **Mobility for students and staff** at all study levels.
  - **Integrated strategies** linking education, research, innovation, and societal engagement.

- **Strategic ambition:** transform European higher education into a **structural, systemic, and sustainable cooperation model**, making Europe globally competitive and cohesive

The European Universiy initiative

- UNIVERSEH – Dedicated to space (European Space University, ISAE Supaero)
- EuroTeQ – Engineering alliance; includes TUM, CTU
- ENHANCE – Engineering/technology alliance; includes TU Delft Aerospace faculty and other aero strong members (POLIMI, RWTH Aachen, UP Valencia, PW)
- Unite! – Engineering alliance; members run aerospace degrees (KTH, POLITO, UPC)
- EELISA – Engineering alliance; student activities with ESA; relevant to space/aero projects (UPM)

The European aerospace engineering education ecosystem

- European Consortium for Advanced Training in Aerospace
- Yearly course on management of multinational aerospace projects for high qualified young engineers
- ECATA Academic Institutions:

- ECATA Companies:

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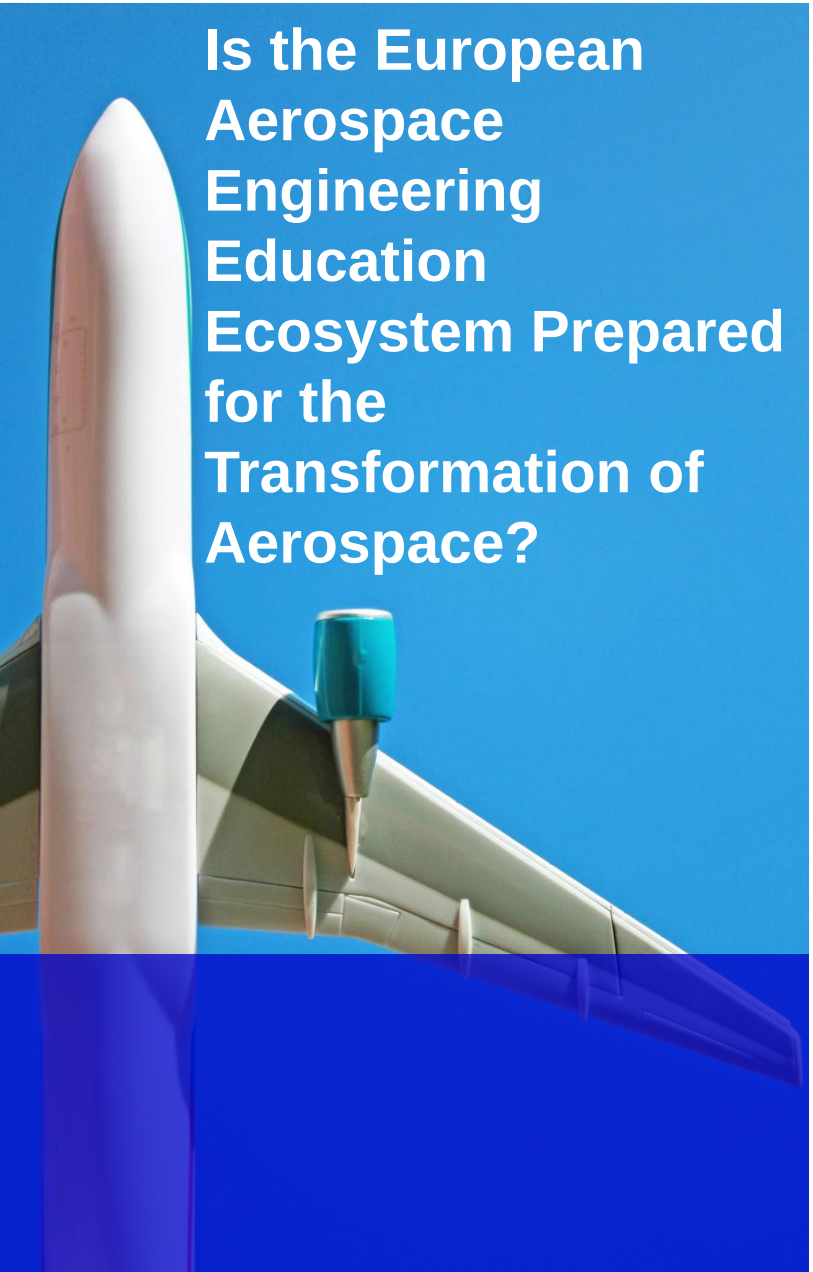

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Global comparison

- **Europe** – Fragmented funding, uneven digital/AI integration, strong sustainability alignment
- **USA** – Deep NASA/DoD ties, flexible funding, rapid curriculum change
- **China** – State-directed, rapid scaling, strong industry alignment

Readiness assessment

- Sustainability Policy Alignment – ☐ High
- Digital & AI Skills Integration – ☐ Medium
- Infrastructure (Labs/Testbeds) – ☐ Medium
- Curriculum Agility – ☐ Medium
- Lifelong Learning – 🔴 Low

Pathways to adaptation

- Curriculum modernization
- Shared infrastructure
- Industry–academia integration
- Lifelong learning culture
- EU-level micro-credentials

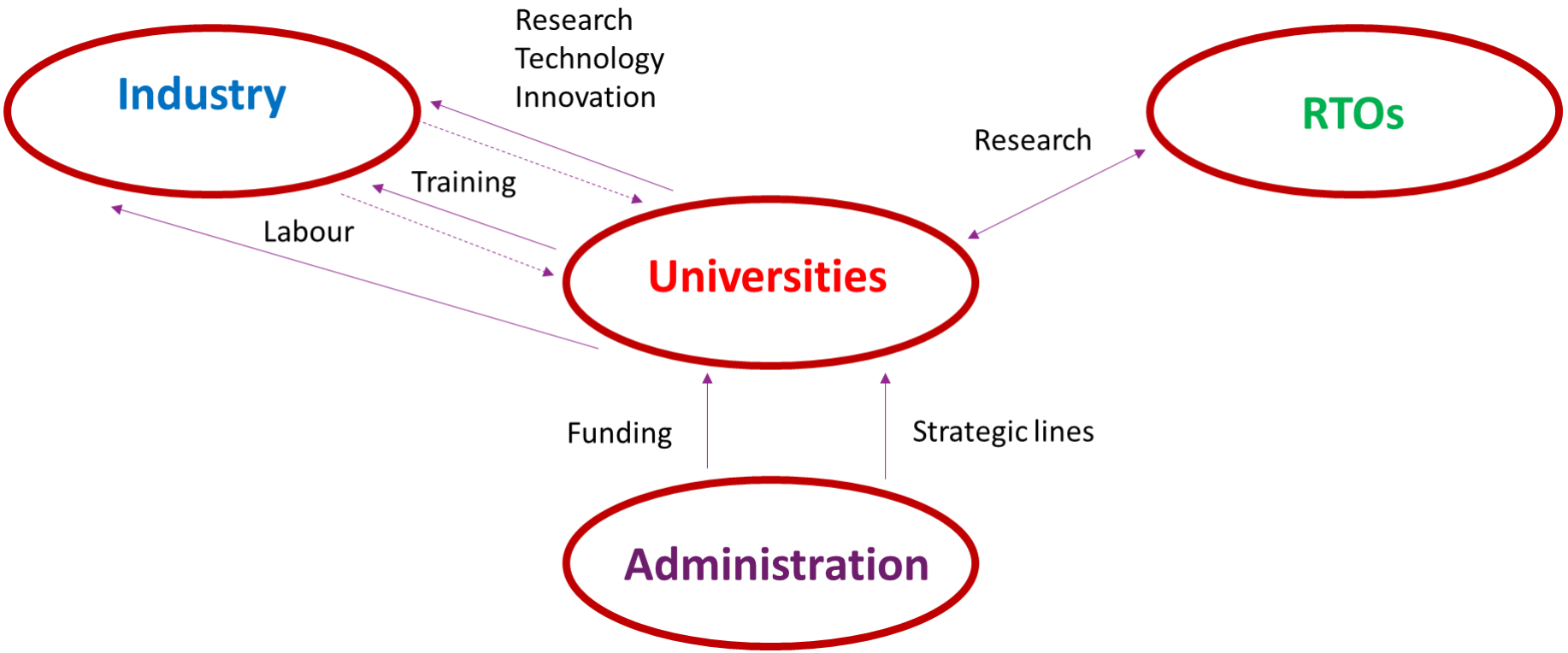
What is the role of the University?

- Historical models: Newman, Humboldt, medieval university: universitas magistrorum et scholarium
  - University as a space for critical inquiry, formation of intellect
  - Education + research
- Modern social, economic, technological pressures:
  - Employability, skills, measurable outcomes, responsiveness to external demands

What is the role of the University?

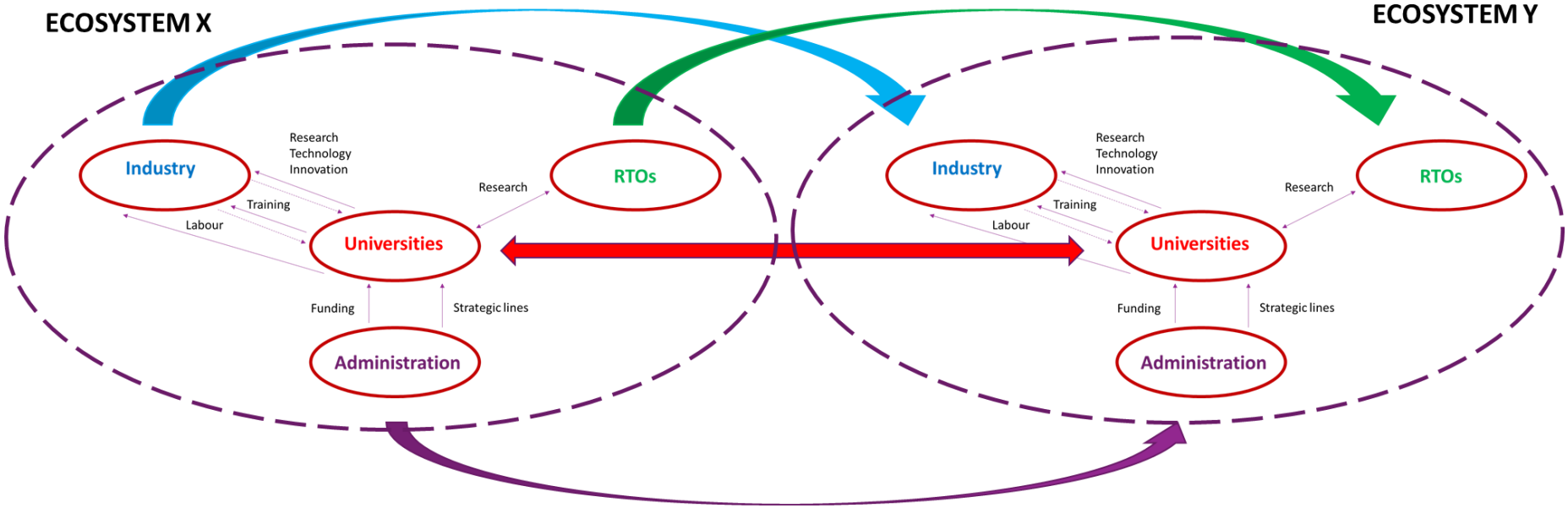
- The tension between **knowledge for its own sake** and **knowledge for utility** is longstanding and foundational to the mission of the university
- Neither extreme by itself seems sufficient: knowledge purely for itself risks becoming disconnected from society; utility alone risks eroding deeper intellectual, ethical, cultural purposes
- The ideal university may be one that preserves space for pure inquiry and liberal education, while also equipping students for the world, fostering skills, adaptability, and serving societal needs

The role of Universities in the Innovation ecosystem



Conclusion

The role of Universities in the Innovation ecosystem



Conclusion

"Freedom, Sancho, is one of the most precious gifts that heaven has bestowed upon men; no treasures that the earth holds buried or the sea conceals can compare with it; for freedom, as for honour, life may and should be ventured;

……

Happy he, to whom heaven has given a piece of bread for which he is not bound to give thanks to any but heaven itself!"

Don Quixote, Miguel de Cervantes (1615)

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