Thesis Labs
Leiden-Delft-Erasmus Universities

Sustainable Aviation: Wings of the Future

2025 - 2026

Universiteit Leiden

TU Delft

Erasmus University Rotterdam

Interested in joining this Lab?

Get in touch with or submit your application online

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Caseholders

LUCHTVAART in transitie

AIRBUS

nlr

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Main Challenge

This Thesis Lab will work on challenges provided by the 'Flying Vision Accelerator'. Flying Vision is a project within the Aviation in Transition program, a Dutch Growth Fund initiative worth over €370 million aiming to achieve climate-neutral aviation by 2050. The initiative aims to develop an open and innovative ecosystem and co-operates on:

Reducing energy demand of aircraft and flight;
Adopting novel energy carriers in aviation;
Who is the traveller in 2050?

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Assignment 1. Green Gold: Is Aviation's Carbon Revenue Enough to Power the Future?

Caseholder:
NLR – Department: Aerospace Operations, Sustainability & Environment (AOSE)

Research question(s):

- How are current EU Emissions Trading System (EU ETS) auction revenues (historical and projected) reinvested in the sector, such as in Sustainable Aviation Fuels (SAF) production or developing new technologies, such as electric aircrafts or hydrogen aircrafts?
- What are investments needed to meet climate goals? Develop a reinvestment model that illustrates how this financial yield can create a self-sustaining cycle of innovation and adoption.
- What are key financial and policy bottlenecks in the reinvestment loop?
- Why is private debt financing for new SAF plants hesitant?
- Are there any policy inconsistencies or regulatory hurdles between EU-level mandates and national implementation?

About the assignment:
To commit to achieving climate neutrality by 2050, the EU implemented regulations such as the EU Emissions Trading System (EU ETS), a "cap and trade" principle, generating significant revenue through the auctioning of emission allowances. The EU and individual Member States, such as the Netherlands, are exploring various mechanisms to reinvest the revenue from the EU ETS back into the sector to accelerate the sustainability transition, such as transitioning to Sustainable Aviation Fuels (SAF).

This thesis assignment focuses on determining whether the current investment and policy landscape is sufficient to meet the EU and Dutch sustainability goals for aviation. The analysis should identify and assess the primary bottlenecks hindering the effective reinvestment and scaling of sustainable solutions.

Assignment 2. Increase the production of Sustainable Aviation Fuels by analysing emerging synthetic blending component (SBC) production technologies

Caseholder:
NLR – Department: Aerospace Operations, Sustainability & Environment (AOSE)

Research question(s):

- Which SBC production technologies are emerging and seeking approval with ASTM?
- What is the basic concept of these technologies?
- What makes these technologies different from those that are certified?
- What is the potential for each technology to contribute to decarbonisation of aviation?

About the assignment:
This assignment explores emerging technologies to produce synthetic blending components (SBCs), which are eventually blended with conventional aviation fuel (CAF) to create SAF (Sustainable Aviation Fuel). Currently 8 SBCs have been approved for SAF production by ASTM. According to ICAO there are 10+ technologies seeking approval.

During this thesis assignment, the student will investigate which new SBC production technologies are seeking ASTM approval, what the basic concept of these technologies is, and how they differentiate themselves from currently approved technologies (cost of production, required investment, feedstock needs/availability, energy requirements, efficiency, yield, carbon intensity of final product, etc.).

Assignment 3. Breaking the Sustainable Aviation Fuel (SAF) Blend Wall

Caseholder:
NLR – Department: Aerospace Operations, Sustainability & Environment (AOSE)

Research question(s):
- What are the (current) barriers for SAF blending above 50% and do they apply to all SBCs?
- How could these barriers be removed?
- What can individual stakeholders do to help overcome the barriers?

About the assignment:
At the moment aviation fuel specifications, developed by ASTM, allow for a maximum of 50% blending of synthetic blending components (SBCs) in conventional aviation fuel (CAF) to produce SAF (Sustainable Aviation Fuel). Current SAF mandates in the European Union, namely ReFuelEU Aviation, go beyond 50% blending, with a mandate of 70% SAF in 2050. Additionally, recent studies have confirmed that using a high SAF blend on one flight leads to a higher climate impact reduction, than using a low SAF blend on multiple flights, while keeping the total SAF amount constant.

The student will investigate what is currently limiting blending above 50% and will explore solutions to overcome this on the short and longer term.

Assignment 4. Designing the Passenger-Centric Cabin of the Future

Caseholder:
NLR – Department: Aerospace Operations, Sustainability & Environment (AOSE)

Research question(s):

- How does the ultimate comfortable aircraft look like?
- What are next-generation sustainable aircraft concepts, such as the Airbus ZeroE hydrogen aircraft or the Flying-V blended-wing design.
- How their unique shapes and propulsion systems could influence cabin layout, window placement, and interior space.
- What are passengers' needs when taking a flight?
- Create a design that weighs passengers' comfort and needs against an optimal sustainable set up

About the assignment:
Traditional aircraft design has been constrained by the needs of fossil-fuel propulsion, leading to the familiar tube-and-wing configuration. Future designs, however, are not limited in this way, allowing for a creative exploration of what "ultimate comfort" truly means for a passenger.

The main objective of this assignment is to research, analyse, and propose an innovative cabin design for a future sustainable aircraft, based on passengers' needs. You will explore how next-generation, environmentally-friendly aircraft concepts can be leveraged to create a superior passenger comfort experience.

Assignment 5. Optimization of Hydrogen Storage for Future Aircraft: A Study on Liquid Hydrogen (LH2) Tank Design for Aviation Certified Tank

Caseholder:
NLR – Department: Aerospace Operations, Sustainability & Environment (AOSE)

Research question(s):
What is an adequate tank design that ensures safe, efficient, and reliable storage of 300 m3 of LH2 in an aviation certified tank, while meeting the performance, safety, and regulatory requirements for future hydrogen-powered aircraft?

About the assignment:
This research focuses on developing efficient and safe solutions for the storage of liquid hydrogen (LH2) in aircraft. Specifically, the student will investigate the optimal design for a 300 m3 aviation certified LH2 tank, considering factors such as:

- Tank geometry and material selection to minimize weight and ensure structural integrity
- Insulation and thermal management systems to maintain LH2 at cryogenic temperatures
- Safety features and emergency response systems to prevent and mitigate potential hazards
- Integration with existing aircraft systems and infrastructure

Assignment 6. From structural nerves to intelligent cabins: how biology can help to redefine flight by 2050

Caseholder:
Airbus – Central Research & Technology, Materials Domains, 1XRM

Research question(s):
How can existing biosensor technologies be effectively and durably embedded within advanced aerospace materials, such as composites or else, to create a self-monitoring structural network that enables real-time, predictive maintenance by 2050?

About the assignment:
This assignment explores a future where aircraft are not just machines, but intelligent, self-aware systems that adapt to their environment and their occupants, redefining the very nature of flight.

How can the integration of advanced biosensor networks into next-generation aircraft architecture create a living, responsive intelligent platform? This could help enhance safety, operational efficiency, and passenger well-being, addressing societal needs for sustainable, resilient, and human-centric flight by 2050

The aviation industry constantly strives to improve safety, reduce environmental impact, and enhance the passenger experience. Today's aircraft rely on scheduled maintenance and passive monitoring, which can be costly and reactive. By 2050, the demand for air travel will have surged, requiring a fundamental shift in how aircraft are designed, built, and maintained. Biosensing technologies can offer a paradigm-shifting solution.

From a societal perspective, a living aircraft that can self-diagnose and adapt in real-time addresses critical concerns.

- Safety and Security: A biosensor network can detect micro-damage in materials before it becomes a risk, preventing catastrophic failures and making air travel even safer.
- Sustainability: By enabling predictive, condition-based maintenance, we can extend the lifespan of components, reduce waste, and optimize flight paths based on real-time structural data, leading to greater fuel efficiency.
- Human-Centric Design: The ability to monitor the physiological state of passengers and crew creates a more comfortable and responsive environment.

Expected type of work:
This project aims to sketch a conceptual framework for integrating advanced biosensor networks into future aircraft structures to enable real-time structural health monitoring (SHM). The work will follow a structured, phased approach, combining theoretical research with practical design and analysis to culminate in a comprehensive report and a product concept. 3 workphases shall be envisaged

- **Phase 1:** Foundational Research & Stakeholder Analysis (Months 1-2): The initial phase will establish a strong theoretical and contextual foundation including a literature review and a stakeholder analysis.
- **Phase 2:** Product Design Proposal & Life Cycle Assessment (Months 3-4): This phase will translate the research findings into a tangible product concept including a conceptual Design and an initial sensor selection plus potential integration strategy. A Data Architecture shall also be proposed outlining the system for data collection, processing, and transmission, from the embedded sensors to a central cockpit display and a ground-based maintenance platform.
    - A general Life Cycle Assessment (LCA) shall be conducted to evaluate the potential environmental effects of the proposed system. This is crucial for demonstrating the sustainability of the solution.
- **Phase 3:** Process Chain Analysis & Reporting (Months 5-6): The final phase will focus on analyzing resource usage and process chains to understand potential integration pathways. Final Report & Product Pitch.

Assignment 7. Materials Digital Passports: A digital substances and formulation passport to promote safety and enable re-use and recycling (1)

Caseholder:
Airbus – Central Research & Technology, Materials Domains, 1XRM

Research question(s):
How can the development and implementation of a Materials Digital Passport (MDP), specifically a digital substances and formulation passport, effectively enhance safety and promote circularity in the aerospace industry simultaneously?

About the assignment:
This research will explore the technical requirements, data architecture, and governance framework for such a passport, addressing how it can provide a secure, transparent, and immutable record of material composition and structural relevance, including the presence of critical and hazardous substances. The research will also investigate the passport's potential to facilitate the identification of materials for reuse and recycling, quantify their environmental impact, and streamline regulatory compliance, ultimately creating a more sustainable and safer aerospace value chain.

The current state-of the art of tracking substances in different aerospace applications along the life-cycle, lacks a comprehensive systems for monitoring and analysis purposes - from initial production to final use in aircraft structures and also extending it to end-of-life, meaning recycling and circular use. This deficiency can lead to a safety risk, as it hinders the identification and management of hazardous substances during manufacturing, maintenance, and disposal. Furthermore, the absence of this verifiable data prevents the effective reuse and recycling of valuable materials, leading to an unsustainable, linear economic model.

A solution is therefore needed to establish a digital chain of custody for materials, enabling better safety management while simultaneously unlocking the potential for a circular economy in aerospace.

Assignment 7. Materials Digital Passports: A digital substances and formulation passport to promote safety and enable re-use and recycling (2)

Expected type of work:
The project will commence with a comprehensive state-of-the-art analysis to review current practices and existing digital solutions for material tracking within the aerospace and other relevant industries. This will be complemented by a series of structured stakeholder interviews with key players, including material suppliers, component manufacturers, airlines, and maintenance, repair, and overhaul (MRO) providers, to capture their perspectives and pain points regarding material data management.

The second chapter will detail a proposed work-flow and dependency chain for a Materials Digital Passport (MDP). This will involve a value-adding analysis, focusing on how the MDP can enhance safety protocols by providing transparent substance information and also contribute to economic efficiency by streamlining material identification for end-of-life management. This section will illustrate the interconnected processes and dependencies required for a successful implementation.

The third phase will involve the identification of applicable technologies, exploring solutions such as blockchain, distributed ledgers, and secure cloud-based platforms for data management. This chapter will also propose data structuring approaches, including the use of ontologies or standardized data models, to ensure interoperability and data integrity across the value chain.

Finally, the fourth chapter will synthesize the findings to develop implementation scenarios. These proposals will outline practical, phased approaches for integrating a digital substances and formulation passport into existing aerospace frameworks, complete with recommendations for governance, stakeholder collaboration, and regulatory alignment.

Available reports:
Malina Wiesner, Janine Mügge, Joanna Steiner, Jonas Klumski, Theresa Riedelsheimer, Dr.-Ing. Kai Lindow: Integrating Circular Economy Practices in Aviation: Requirements Analysis for the Exchange of Material and Product Information to improve Circularity in the Aviation Industry, Procedia CIRP, Volume 136, 2025, Pages 462-467, ISSN 2212-8271

Mabkhot, M. M., Kalawsky, R. S., & Liaqat, A. (2025). "Introducing the Manufacturing Digital Passport (MDP): A New Concept for Realising Digital Thread Data Sharing in Aerospace and Complex Manufacturing." Sensors, 13(8), 700.

Seddiqui, M. H. et al. (2024). "A Material Passport Ontology for a Circular Economy." Preprint, Cambridge Centre for Computational Chemical Engineering.

Assignment 8. Holistic approach to lower energy in production: impact of design and material selection on energy consumption

Caseholder:
Airbus – Central Research & Technology, Materials Domains, 1XRM

Research question(s):
- How can low-energy-production requirements be linked to the design and material selection process already in early development phases?
- What are today's technology blockers?
- What is the difficulty in mapping energy consumption already in the design phase?
- How can this be overcome?

About the assignment:
An important part of the life-cycle of materials is the conversion from a raw state material to the desired design of the end-product. In this section of the life-cycle, typically a lot of energy is consumed, depending on e.g. the number of processing steps or other process parameters like temperature profiles. The definition of the process chain and assembly route is defined by the design of the final product - typically already at very early stages of the product development. The optimization to be done is therefore complex, since different technical challenges have to be considered simultaneously.

Expected type of work:
The result of this study will be an assessment report of the status quo including an impact analysis, a visualization of impacts across the supply chain, etc.. Potentials for low energy process chain for high performance aerospace materials will be described. A guidance and methodology will be proposed to connect part design with material & process selection having in mind low energy production processes.

Available reports:
https://www.airbus.com/en/newsroom/stories/2021-04-this-new-class-of-materials-could-transform-aircraft-design

Assignment 9. Inline monitoring in additive manufacturing

Caseholder:
Airbus – Central Research & Technology, Materials Domains, 1XRM

Research question(s):
- What are the approaches and associated obstacles towards the use of inline monitoring in additive manufacturing?
- How do different manufacturers/developers/researchers intend to overcome the challenge of qualifying inline monitoring as replacement for post-printing inspection?

About the assignment:
Additive manufacturing is a key to sustainable future aerospace as it enables manufacturers to create parts perfectly designed for purpose, reducing unnecessary weight and thus energy consumption in use and manufacturing. So far each part that will "fly" must be inspected manually in a time-consuming qualified process after the printing. Inline monitoring of the additive manufacturing process utilising AI is a promising approach to remove post-printing inspection, reducing the overall time and cost, as well as energy consumption, material consumption and waste. This is done by monitoring printing parameters during the process, enabling the prediction of the expected outcome and allowing for corrective actions early in the manufacturing process.

Expected type of work:
Technical study (evaluation of the state-of-the-art on a case study) or qualitative study (based on interviews with manufacturers and developers).

Available reports:

R. McCann et al., In-situ sensing, process monitoring and machine control in Laser Powder Bed Fusion: A review, Additive Manufacturing, 2021 45, https://doi.org/10.1016/j.addma.2021.102058

J. Qin et al., Research and application of machine learning for additive manufacturing, Additive Manufacturing, 2022 52,, https://doi.org/10.1016/j.addma.2022.102691

Z. Snow et al., Toward in-situ flaw detection in laser powder bed fusion additive manufacturing through layerwise imagery and machine learning, Journal of Manufacturing Systems, 2021 59(12-26), https://doi.org/10.1016/j.jmsy.2021.01.008

S. Everton et al., Review of in-situ process monitoring and in-situ metrology for metal additive manufacturing, Materials & Design, 2016 95(431-445), https://doi.org/10.1016/j.matdes.2016.01.099

Assignment 10. Intelligent manufacturing process chains: how to create a green global industrial system?

Caseholder:
Airbus – Central Research & Technology, Materials Domains, 1XRM

Research question(s):
- What kind of concepts and meta data are missing to determine if an manufacturing location has less environmental impact than another?
- What metrics are necessary to determine if one means of transportation is more environmental friendly than another?
- What are efficient solver approaches to find promising industrial system network solutions that can be assumed to dominate large portions of the design space relative to relevant FoMs, including sustainability but also recurrent cost, lead time, and rate-adaptation capability, and that provides solutions that differ significantly from each other?

About the assignment:
Currently we are modelling the global Airbus industrial system as a knowledge base. This knowledge base can be used for further investigations. The knowledge base contains the available means of transportation as well as locations with their manufacturing capabilities.
The knowledge base could be extended to allow for investigations into an industrial system that has a less environmental impact than the one currently used. For that it might be necessary to complete the data in the knowledge base.
The knowledge base could be used to feed an optimisation algorithm that finds a "good" industrial system with regards to sustainability. To differentiate this from our current forays into optimization, a different solver should be used than the ones currently under investigation (Answer Set Programming, Evolutionary algorithm).

Expected type of work:
To optimize the industrial system, among others the following metrics could be applied:
- Ensure that the route uses as little resources as possible
- Find other alternative means of transportation (like using freight trains)
- Ensure that the transport means are loaded ideally
- That they are not empty on their return trip
- That they bring back resources that can be recycled reused at their destination

Possibly also:
Create an optimized way of transporting goods for the global Airbus industrial system. This includes:
- Define metrics to measure the current KPIs of transport means in the Airbus industrial system i.e. what are the used resources for transporting a certain part from A to B (CO_2 emissions, recurring costs etc.)
- Find optimal production facilities that can not only produce a given part but can also recycle the excess material, waste that is produced during the process, etc.
- Production facilities that produce less waste should be prioritized
- What is a good production facility? One with power produced by coal, gas, oil and good recycling capabilities or one that is powered by green energy but unable to recycle materials
- Are facilities in Europe better suited for a circular economy than the ones in Asia/America. If not, what is missing
- What would be the impact of Airbus developing its own transportation network of sustainable transport means (wind powered ships, electric trucks, etc.)
- How to model an industrial system that is not environment neutral today but maybe in 20 years (given the long lifetime of our products) and how to create a future proof and flexible way to adopt new technologies easily, swap around production places and capabilities as needed, et

Available reports:
Will be provided during the project.

Assignment 11. The use of quantum computing for simulation of bio-species (1)

Caseholder:
Airbus – Central Research & Technology, Materials Domains, 1XRM

Research question(s):
Today, the first quantum hardware is already available. However, the step from classical simulation approaches to the implementation via quantum computing is a new field with lots of open questions:

- What are the main challenges to realise the transition towards quantum computing approaches?
- What is necessary to implement these approaches for industrial use, and more specifically for the simulation and prediction of properties and capabilities of bio-species?

About the assignment:
Bio-species (e.g. enzymes, bacteria, fungi, algae) gain more and more importance for processing and manufacturing. A low environmental impact as well as a high selectivity for specific biochemical processes contribute to the increasing interest for bio-species-based products and technologies that enable recycling and circularity of resources.

While the technology for (large scale) production of bio-species is usually available, the identification of the right species is challenging. Many time-consuming test procedures are necessary to analyse the properties of the macromolecular structure and assess their catalytic capabilities, leading to long development cycles. Therefore, computational methods are an essential backbone of biological science, allowing the simulation and prediction of properties and capabilities of bio-species.

However, computational methods face increasing challenges when it comes to complexity and scale of simulated problems. Atomistic approaches (e.g. DFT, MD) quickly reach their limitations in number of atoms and molecules that are simultaneously simulated while continuum approaches (e.g. FEM) cannot adequately reflect the relevant atomistic processes. Quantum computing can contribute to overcome some limitations of classical methods by providing more computational power and new approaches to solve even the most complex problems. Therefore, quantum computing is highly interesting for the simulation of the complex macromolecular structure of biospecies and the resulting catalytic properties.

Assignment 11. The use of quantum computing for simulation of bio-species (2)

Expected type of work:

Quantum computing implementation:
What is needed to make use of quantum computing (hardware, algorithms, expertise)? What are the specific needs of industry regarding quantum computing (e.g. hardware specifications, software requirements) to benefit compared to classical supercomputers/ clusters?

Estimation of Quantum Advantages (using the example of bio-species):
What new approaches to perform complex simulations will be provided by quantum computing compared to classical methods? What are the computational benefits (in terms of computational limitations) of quantum computing (classical simulation approaches vs. quantum or quantum/hybrid approaches)?

Market Analysis:
How to access quantum computing hardware/software (e.g. suppliers of hardware/ software, rental/computing hours models)?

Available reports:
Prashant S. Emani et al., Nature Methods 2021, 18, 701-709; DOI 10.1038/s41592-020-01004-3

Martin J. Field, J. Comp. Chem. 2001, 23(1), #4 The Use of Quantum Computing for Simulation of Bio-Species 48-58; DOI 10.1002/jcc.1156

Johan Åqvist et al., Chem. Rev. 1993, 93(7),

Assignment 12. Next Gen Roadmapping: dynamic decision-making tools towards the decarbonisation of aviation

Caseholder:
Airbus – Tech Hub NL

Research question(s):
- How can (technology) roadmapping evolve to fit the challenge of informing the decision making towards the decarbonisation of the aviation sector?
- What characteristics of aviation technologies and R&D developments should be considered for decision making?
- How can these characteristics be implemented in dynamic (technology) roadmaps?
- How can the interdependencies between future policy decisions, business decisions, and technological progress in time be displayed informatively in a roadmap format?

About the assignment:
Aviation is facing the decarbonisation challenge. New roadmapping tools are needed to inform policy and decision making.

Aviation is a complex system of systems and is facing the challenge of decarbonising. Many different technology avenues are being explored, and all kinds of new products and services are being developed while legacy technologies are being phased out. The sector finds itself at a crossroads where many complex decisions are taken on all levels: policy, technology, product/service development, resource allocation, etc.

To tackle such complex decision-making processes, organisations often use (technology) roadmaps to guide them. These roadmaps include different levels with interlinkages showing dependencies based on time and progress. It is the development of such roadmaps specifically for the decarbonisation of aviation that is of interest to this thesis assignment.

Expected type of work:
The expected type of work is:
- Literature study (on roadmapping literature and existing aviation roadmaps)
- Interviews (with industry roadmap owners, policy makers, and technology developers)
- Stakeholder analysis (of the roadmap users)
- Design, prototyping and testing of dynamic roadmapping formats/frameworks

Available reports:

- Phaal, R., Farrukh, C. J., & Probert, D. R. (2004). Technology roadmapping—a planning framework for evolution and revolution. Technological forecasting and social change, 71(1-2), 5-26.
- Simonse, L. (2024). Design roadmapping: Guidebook for future foresight techniques. TU Delft OPEN Publishing.
- Royal NLR & SEO Amsterdam Economics (2025). Destination 2050-roadmap. https://www.destination2050.eu
- Luchtvaartnota 2020 - 2050. https://www.rijksoverheid.nl/documenten/rapporten/2020/11/20/bijlage-1-luchtvaartnota-2020-2050
- Royal NLR & TU Delft (2021). Towards a sustainable air transport system. https://filelist.tudelft.nl/News/2021/02_Februari/LR/Whitepaper_NLR_TUDelft.pdf

Student expertise:
This assignment is a combination of aerospace engineering, technology policy & analysis and industrial design engineering challenges. Students with backgrounds and/or interests in these fields could fit the assignment well.

Assignment 13. Mechanical Assembly of Cryogenic Components in Aircraft Environment

Caseholder:
Airbus – UpNext

Research question(s):
- What are the primary design and material considerations for mechanical joints connecting cryogenic (20 to 100K) and room-temperature structures in an aerospace environment?
- How do vibration, differential contraction and thermal cycling affect the structural integrity and thermal performance of composite-based assemblies?
- Can a methodology be developed to test and validate the fatigue life of these mechanical joints at cryogenic temperatures, considering the effects of differential contraction?

About the assignment:
Cryogenic propulsion systems, a key enabler for flight based on Liquid hydrogen, require robust mechanical assemblies to join ultra-cold components (e.g., superconducting magnets or cryocoolers) to a room-temperature support structure. In ground-based applications, this is typically achieved using composite structures for their low thermal conductivity, which minimizes heat ingress and thermal losses.

However, an aircraft environment introduces unique challenges, including high vibrations and frequent thermal cycling (from -40°C to 200°C), that can lead to material fatigue and joint failure over the aircraft's lifecycle. These differential temperatures induce differential dilatation, a phenomenon that must be understood and accounted for in the mechanical joint to ensure its longevity. The success of this technology is critical for the broader societal goal of decarbonizing the aviation sector and reducing its environmental impact. A deep dive is needed to evaluate and propose assembly solutions that can withstand these specifi c aerospace constraints and enable a sustainable future for air travel.

Expected type of work:
- Comprehensive literature review on mechanical joints in cryogenic and aerospace applications (e.g., from NASA, CERN, and other relevant research institutions).
- Interviews with experts in both the cryogenics and aerospace industries to gather insights on existing challenges and best practices.
- Design of test coupon or sub-assembly to evaluate different joint confi gurations.
- Material (composite/metal) analysis and selection for the joint solution, considering both thermal and mechanical properties.
- FEM analysis of the designed junction with thermal and mechanical loads
- Development of a preliminary test plan to evaluate

Available reports:
- Scientific articles and reports on cryogenic component assembly, structural fatigue, and thermal cycling in aerospace applications.
- NASA or CERN publications on cryogenic structural design and testing.
- Technical papers on composite materials for low-temperature applications.
- Access to Dutch industrial and academic test results (planned for 2026)

Student expertise:
This subject is well-suited for a student with a background in Mechanical Engineering or Materials Science. Expertise in structural mechanics, fatigue analysis, and a basic understanding of cryogenics would be beneficial.

Assignment 14. Investigating and mitigating two-phase flow instabilities in hydrogen-powered aircraft systems

Caseholder:
Airbus

Research question(s):
What are the parameters affecting the hydrogen phase change pressure instabilities?

About the assignment:
Developing tools together with hydrogen and aircraft experts to support the development of storage and distribution systems aboard hydrogen powered aircraft, specifically for two-phase flow instabilities in hydrogen piping networks.

Hydrogen is an energy carrier with the potential to contribute to the decarbonisation of the aviation industry. This assignment relates to the design of propulsion systems aboard hydrogen powered aircraft.

Several kinds of two-phase flow instabilities in hydrogen piping networks have been reported in the literature that can affect the operability of a phase change system. These phenomena must be considered during the design of hydrogen storage and distribution systems for uses in aircraft.

Expected type of work:
The work proposed is to develop in collaboration with Airbus a tool/series of tools to evaluate the parameters (architecture confi gurations, thermofl uidic states etc.) affecting the intensity and phase of these pressure oscillations.

Available reports:
To be provided upon request.

Student expertise:
Backgrounds in physics, mechanical engineering, aerospace engineering.

Assignment 15. Development of tank bulk-boiling models for optimizing depressurization of hydrogen tanks

Caseholder:
Airbus

Research question(s):
What are the main drivers affecting the depressurization phase performance of tanks aboard hydrogen powered aircraft?

About the assignment:
Improving the refueling time of hydrogen powered aircraft by investigating phenomena around the depressurization of tanks aboard hydrogen powered aircraft.

Hydrogen is an energy carrier with the potential to contribute to the decarbonisation of the aviation industry. This assignment relates to the design of propulsion systems aboard hydrogen powered aircraft.

During the refueling phase, it is predicted that a depressurization of the aircraft tanks is necessary. As this operation is contributing to the overall refueling time and it is required to obtain a certain level of temperature homogeneity across the tank after it, it is necessary to evaluate the main drivers affecting the depressurization phase performance.

Expected type of work:
The work proposed here is to contribute to the development of tank bulk-boiling models to support the refueling evaluation studies.

Available reports:
To be provided upon request.

Student expertise:
Backgrounds in physics, mechanical engineering, aerospace engineering.

Assignment 16. A critical assessment of the State aid framework in funding (local) SAF production in the regions, noting that airlines will need to 'uptake' not only at the major hubs but also the smaller regional airports.

More information will follow.

Caseholder:
Flying Vision Accelerator

Expected expertise:
Law students

Assignment 17. An investigation on the legal and regulatory barriers to electric, hydrogen, or hybrid aviation, with a particular focus on the cross-border dimension

More information will follow.

Caseholder:
Flying Vision Accelerator

Expected expertise:
Law students

Assignments 18. Explore the concept of ‘eco branding’ and regulatory inventions such as the EU Flight Emissions Label in aviation competition as a market differentiator

More information will follow.

Caseholder:
Flying Vision Accelerator

Expected expertise:
Law students

Assignment 19. Consider the extent to which the Green Deal is overtaken by the objective of European competitiveness, and the role that aviation plays as test case.

More information will follow.

Caseholder:
Flying Vision Accelerator

Expected expertise:
Law students

Thesis Labs
Leiden-Delft-Erasmus Universities

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Contact us or Apply online

Universiteit Leiden

TU Delft

Erasmus University Rotterdam