Centre for Sustainability
Leiden-Delft-Erasmus Universities

TEAM 2022
INTERDISCIPLINARY THESIS LAB

CIRCULAR AVIATION

"What can the circular economy mean for sustainable aviation?"

Academic Coordinator
Circular Aviation Lab

TU Delft

IRENE FERNANDEZ VILLEGAS

> Preparing the professionals of tomorrow to efficiently work and thrive in such multidisciplinary environments is hence vital to tackle the increasingly complex issues our society will face.

Circular Aviation as a potential contributor to Sustainable Aviation is a complex problem that involves **a wide range of disciplines** and, presumably, **different industries**. Preparing the professionals of tomorrow to efficiently work and thrive in such multidisciplinary environments is hence vital to tackle the increasingly complex issues our society will face. The interdisciplinary Thesis Lab "Circular Aviation" offers a **collaborative framework** in which a group of master students from **different backgrounds** come together with the goal of providing answers to an overarching research question common to all their master thesis projects. I feel honoured to be able to accompany them in this journey and excited to see the result of their collaboration.

LIGEIA PALETTI

Case Holder
Circular Aviation Lab

From the moment I started researching the implications that implementing circular economy in the aviation industry 3 years ago, it was clear that to achieve a “Circular Aviation” was not only a matter of new technological solutions. A Circular Aviation is a new aviation system and, as such, to exist it needs **a multidisciplinary approach within aviation, including all aviation stakeholders, and beyond aviation**. The Circular Aviation Lab reflects this concept, by including students from different disciplines of aerospace engineering and other engineering faculties, but also including a focus on aspects which are not at all technological, such as education, business models and policies. Besides the knowledge that the students are developing in their own individual assignments, the students are exposed to each other’s expertise and they have visibility of the challenges which other future experts are facing towards the same goal: **a climate neutral aviation by 2050.** The awareness of this **essential interconnectivity across disciplines and the ability to communicate across different ”technical languages”** are going to be essential skills for the future of aviation and of society.

> “To achieve a “Circular Aviation” is not only a matter of new technological solutions.”

I am grateful that this amazing group of students chose to support the aviation goal and NLR’s goal of a climate neutral aviation and my own personal goal of a circular flight in 2050. Being part of this journey is inspiring me that a full sustainable aviation is possible thanks to the future generations and, as member on an older generation, it is my responsibility to enable them to succeed.

STUDENTS 2022

INTERDISCIPLINARY THESIS LAB

CIRCULAR AVIATION

ROOSA JOENSUU

MS Aerospace Engineering

Topic: Critical raw materials in electric aviation

TU Delft

My name is Roosa. I'm from Finland but I've lived here in the Netherlands for about 5 years now. I came here to do a Bachelor's in Aerospace Engineering at TU Delft. After my Bachelor's, I started the Master's in the same faculty. My track is **Aerospace Structures and Materials**; I focus on the materials-side. During my studies I've realized that I want to work in sustainability: **I want to enable sustainable technologies and choices for a better future.** That's also how I got into the Circular Aviation Lab, where my thesis is on **critical raw materials in electric aviation**. As a materials engineering student, I'm concerned about how the planet's resources are used and especially how these are wasted.

> "As a materials engineering student, I'm concerned about how the planet's resources are used and especially how these are wasted."

Too many products are only designed for the operational part of their lifetime, without considering the end-of-life stage. Unfortunately, many solutions required for energy transition and electrification use materials that can be defined as critical: they are economically important and have high supply risks. I think **it's time to close the materials loop and design for a sustainable future through circular strategies – simultaneously reducing the overall supply risks.** This is exactly what I aim to do in my thesis.

ANTONY JOSEPH VALIAVEETIL

MSc Management of Technology

> I am conducting an action research which will possibly help these students (who are the future of aviation) to train their actions and design choices for meeting aviation's climate goals which we are all responsible for by 2050.

Topic: the barriers which Aerospace Engineering education currently possesses which prevents the implementation of sustainable or circular practices in the aviation industry

I'm an Indian, who was raised in Bangalore and moved to the Netherlands to pursue my Master's degree. I have a background in Aerospace Engineering from Karunya University, Coimbatore and I am currently doing my **MSc in Management of Technology** at the TU Delft. My research is based on **the barriers which Aerospace Engineering education currently possesses which prevents the implementation of sustainable or circular practices in the aviation industry**. In order to unearth these obstacles, I am working with a group of 400 aerospace engineers (bachelor level students) to understand their mindset and how they perceive incorporation of sustainability into their design. In essence, I am conducting an **action research** which will possibly help **these students (who are the future of aviation)** to train their actions and design choices for meeting aviation's climate goals which we are all responsible for by 2050.

TU Delft

VICTOR HUPE

MS Strategic Product Design

> I'm looking at the most sustainable way of flying, not flying at all.

My name is Victor, I have completed the bachelor Industrial Design Engineering at the Delft University of Technology. I'm currently following the master **Strategic Product Design**. For my thesis, I'm looking at the most sustainable way of flying, not flying at all. I'm looking into t**he reasons why people travel for business, while there are already alternatives (online meetings).** My goal is to reduce the impact of these passengers on the environment.

Topic: The reasons why people travel for business, while there are already alternatives.

TU Delft

ALEXIS FREYTAG VON LORINGHOVEN

MS Global Business & Sustainability

Topic: the potential of the circular economy for net-zero emission aviation.

Already from a young age onwards, I became fascinated in the aerospace industry. Dreaming of becoming an astronaut once I grow up, I spend my childhood days reading about planes, rockets, planets and the solar system. When I saw that the LDE Center for Sustainability offers an interdisciplinary Thesis lab about Circular Aviation, I immediately became intrigued. Studying **Global Business & Sustainability** at RSM in Rotterdam, I am currently conducting research about **the potential of the circular economy for net-zero emission aviation.** Precisely, I am conducting a **qualitative exploratory study** about how the circular economy can be implemented in the aviation industry and what challenges the sector faces in doing so on a large scale.

> "Dreaming of becoming an astronaut once I grow up, I spend my childhood days reading about planes, rockets, planets and the solar system."

Next to my interest in circular aviation, I enjoy going running, hiking and sailing and am always up for a cup of coffee. Also, I am a keen traveller. While I am an enthusiast of experiencing new cultures and languages, I am also very aware of the negative environmental consequences of flying. Next to offsetting my flights, I am **curious to explore new ways how the sector can shift to a greener future**, so that we can continue to stay connected with each other without harming the environment at such a large scale.

THOMAS ARBLASTER

MS Aerospace Engineering
MS Industrial Ecology (joined degree)

> "The topic I'm tackling builds on my knowledge of the design and manufacturing of aerospace structures."

I am a master student in both **Aerospace Engineering** (TU Delft) and **Industrial Ecology** (Leiden University and TU Delft). I like working on technical challenges, but **it's abundantly clear that the drastic shift towards environmental and social sustainability needed right now needs more than just a technical perspective.** This is what has drawn me first to Industrial Ecology, and later to this LDE Thesis Lab, to place myself in a more interdisciplinary environment. It's great to see the different perspectives held on the future of aviation and how various challenges are linked. **The topic I'm tackling builds on my knowledge of the design and manufacturing of aerospace structures**. **Lightweighting** is a primary strategy used from the structural side of aircraft to decrease their environmental impact: when there's less mass to move, less fuel is consumed. However, closing the loop is always challenging, and high-performance engineering materials are making this challenge more complicated. That's why I'm **quantifying the trade-off between mass-induced fuel use and the emissions that could be saved in other lifecycle stages.** This way, we'll know if a bit of extra weight can be afforded to make a component that's more sustainable to (re)manufacture and recycle.

Topic: quantifying the trade-off between mass-induced fuel use and the emissions that could be saved in other lifecycle stages.

MARIA PAPAVASILEIOU

MS Industrial Ecology

Topic: the environmental impact of inflight services offered to passengers

TU Delft

Universiteit Leiden

My name is Maria Papavasileiou and I am a second-year **Industrial Ecology** master's student at Leiden University and TU Delft. My background is in **Environmental Sciences**, focusing on nanomaterials' toxicity assessment and wastewater treatment. **I have also worked as a flight attendant for one of the largest airlines in the world.** Currently, I am working on my thesis looking to assess **the environmental impact of inflight services offered to passengers via the Life Cycle Assessment method which offers a holistic approach to the problem.** I would also like to identify **impact hotspots of services** that could be improved and make the transition to circular aviation smoother.

> "I have worked as a flight attendant for one of the largest airlines in the world."

I am very happy to participate in the Circular Aviation Lab because it offers an interdisciplinary approach to applying circular economy principles in the aviation industry since the participants have various backgrounds. Furthermore, **the collaboration and opinion exchange with students focusing on similar thesis topics, and academics and professionals already working towards circular aviation, are beneficial.** Overall, the Lab offers a valuable support system and interesting workshops, lectures, and activities.

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ELENA PETERS
PIETER-JELLE NIJDAM
ELISA VERGARI