

Shrink Your Travel Footprint

Whether on an airplane or a visionary high-speed Hyperloop system, one key question remains: Will future transport allow us to travel without burdening the environment? An interview with Agnes Jocher, Professor of Sustainable Future Mobility at TUM.

Domestic flights within Germany produce five times as much greenhouse gas as trains traveling the same route, according to Germany's Federal Environment Agency. Can I actually travel by airplane with a clean conscience anymore?

That is, of course, a question that each individual can only answer for themselves. However, the following question could help your decision: Can I avoid traveling, reduce my travel, or compensate for it by contributing to climate-protection projects? There are various actors carrying out such projects – and I'd like to mention the 'Gold Standard' program for climate interventions.

The most effective means of reducing the CO₂ emissions of aircraft is switching to alternative fuels. What exactly are you researching on this topic?

We're researching two alternative fuels. The first type is drop-in fuels. These fuels have been given this name because they're similar to conventional kerosene and can be used without the need for significant changes to airplane turbines. They avoid CO₂ emissions throughout their life cycle but still produce soot particles that have an effect on the temperature of the earth's atmosphere. We still don't understand precisely how these soot particles come about or what their effects are. So, we're using numerical simulations and experiments to investigate the physical and chemical processes of soot formation in combustion processes. We hope this will enable us to predict the type and volume of soot particles and develop reduction strategies. ▶

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Reisen mit Bedacht

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Können wir in Zukunft reisen, ohne die Umwelt zu belasten? Prof. Agnes Jocher forscht an alternativen Kraftstoffen für Flugzeuge und am visionären Hochgeschwindigkeitszug Hyperloop. □

Link

www.asg.ed.tum.de/en/sfm

Prof. Agnes Jocher

studied at TUM and gained her doctorate from the Faculty of Mechanical Engineering at RWTH Aachen and Sorbonne University, Paris. She then worked as a post-doc fellow at the Massachusetts Institute of Technology (MIT) in Boston. In a subsequent post at the German Environment Agency (UBA), she was responsible for sustainable aviation fuels. She became Professor of Sustainable Future Mobility at TUM in July 2020.

“Within the TUM Hyperloop program, my sub-group is investigating which technical designs might actually be possible.”

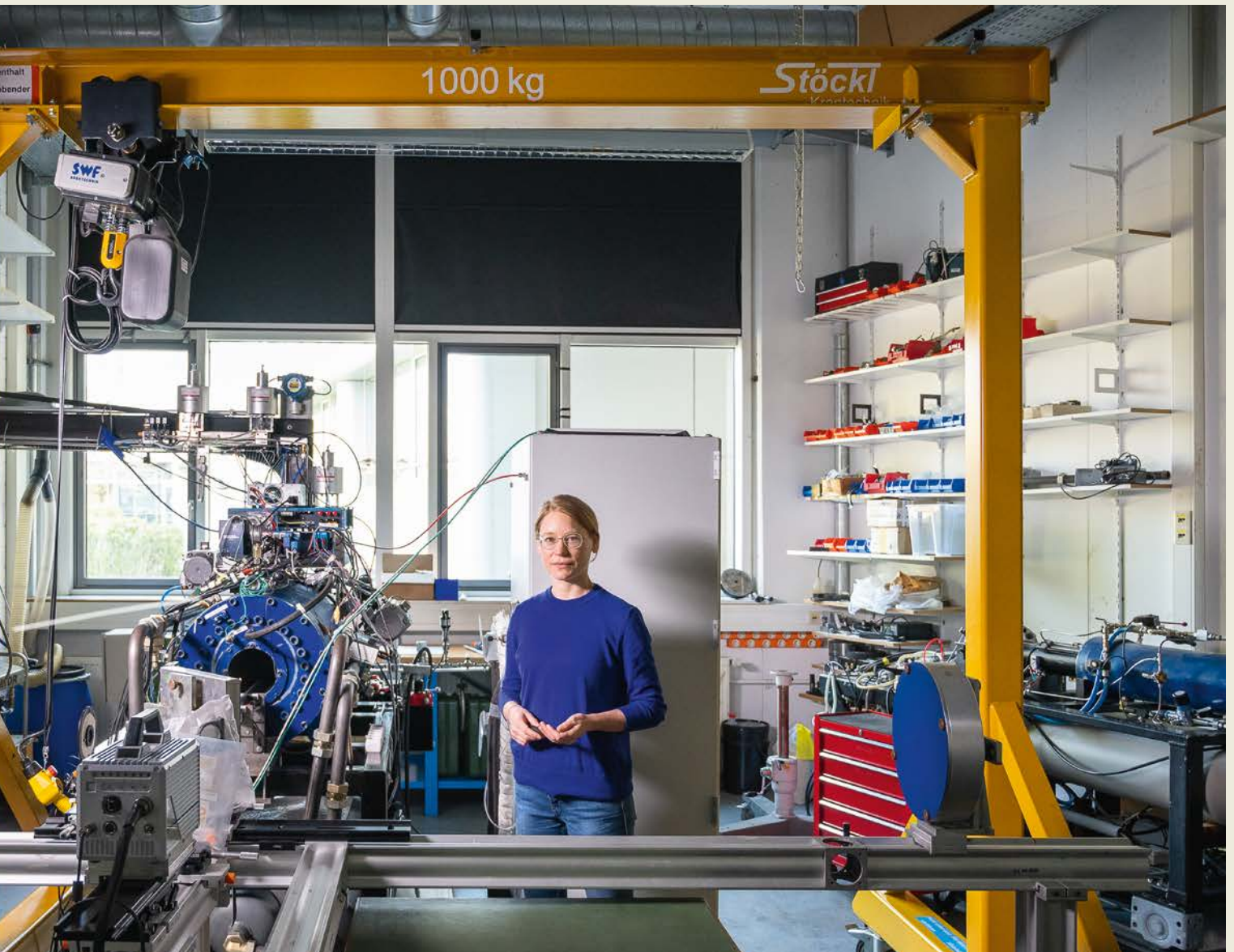
Agnes Jocher



The second alternative fuel we're researching is hydrogen, which does not result in tailpipe CO₂ or soot particle emissions. However, in contrast to drop-in fuels, the use of hydrogen requires significant interventions in airport infrastructure and airplane engines. We're looking at the question of how combustion chambers can be converted from using kerosene to hydrogen. First of all, we want to research the thermo-acoustic impacts like noise and vibrations on a modular test bench, which we're currently converting from kerosene to hydrogen. The first prototype aircraft with a hydrogen combustion chamber should take off in the next few years.

A tube with transport capsules capable of traveling at up to 1,200 kilometers per hour: Hyperloop is the vision of Tesla founder Elon Musk. Your professorship is linked to the interdisciplinary TUM Hyperloop program. What is your role in the program?

The TUM Hyperloop program, which comprises eight doctoral candidates and over 60 students, is dedicated to analyzing the technical and systematic feasibility of the Hyperloop. My sub-group is investigating which technical designs might actually be possible. When it comes to the extremely complex levitation and drive systems, this is a crucial, fundamental decision.



Agnes Jocher and her team are researching alternative fuels for transportation that reduce CO₂ and other emissions.

Hand on heart, is the Hyperloop a realistic prospect?

In our view, it is technologically feasible. The economic, ecological and social practicalities are another matter and are also being examined as part of the TUM Hyperloop program.

The Hyperloop’s main drive system is planned to be electric. How sustainable would the Hyperloop be compared to rail travel?

We’re still not able to make any valid forecasts as we’re only in an early phase of development. Plus, sustainability calculations also need to consider the construction of infrastructure and the Hyperloop’s service life.

Can you predict how we will travel in 50 years’ time?

I would rather provide a target: I believe that, in the future, we should be able to complete our entire daily routine on foot. Instead of hopping on the Hyperloop to race to work in a neighboring city, our workplaces should be only 15 minutes away. That would be good for the environment – and for our wellbeing. Longer journeys should be the exception and that’s obviously when we’ll need trains, the Hyperloop and airplanes. This will require coordination with urban developers. Where should we build Hyperloop terminals? How will we connect our cities? We need to consider our answers to these questions very carefully.

■ *Gitta Rohling*

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