KITE//KRAFT

An Update on Kitekraft's Progress

By Florian Bauer, Christoph Drexler, André Frirdich, Maximilian Isensee, Lukas Willinger, Jorge Córdova, Filippo Campagnolo

26 April 2024

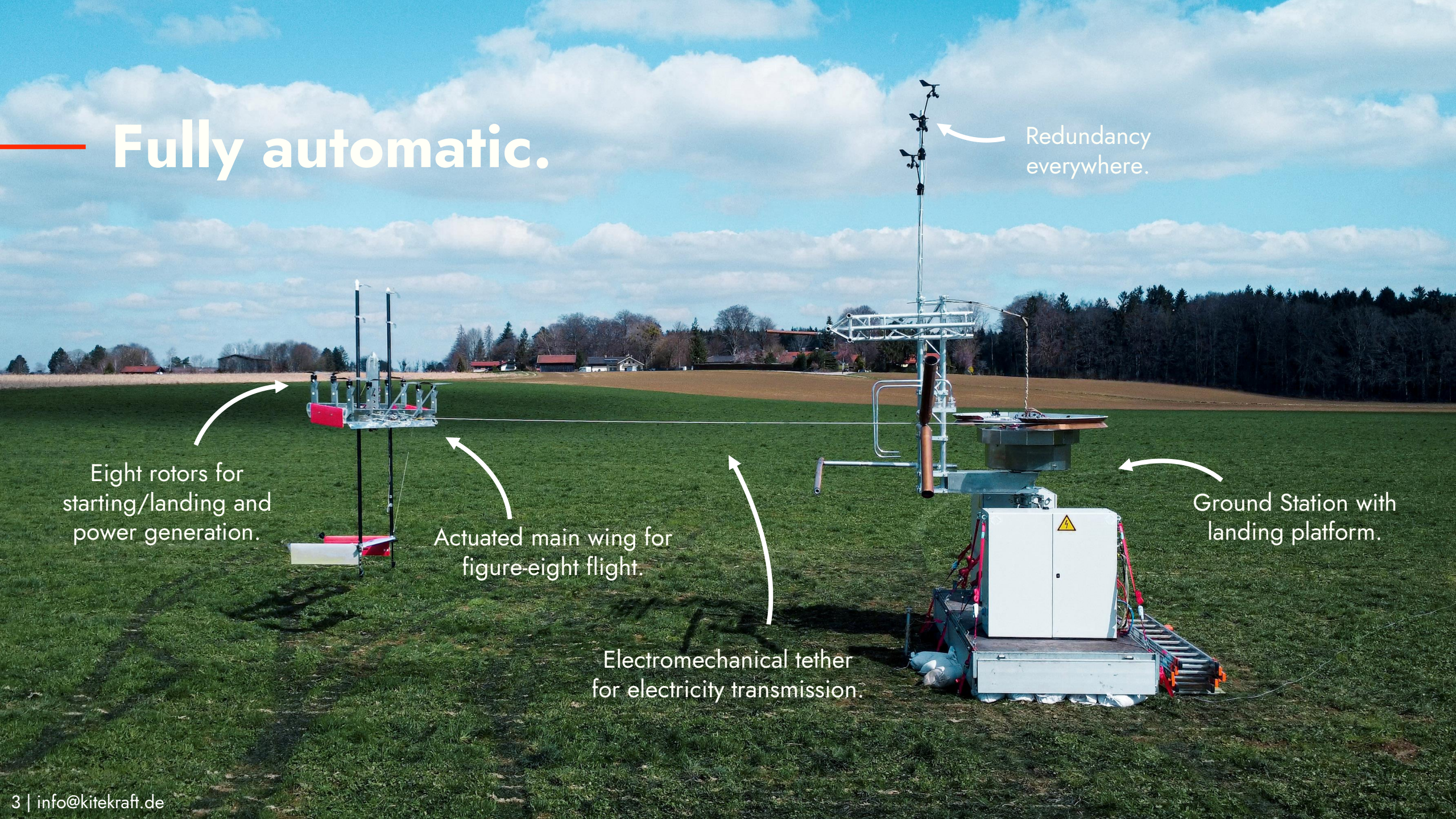
This project has received funding from the European Union's Horizon Europe program under Grant Agreement No. 101084216

MERIDIONAL

Technology Overview.

Full video: https://youtu.be/oVB5skG4I4s

Fully automatic.



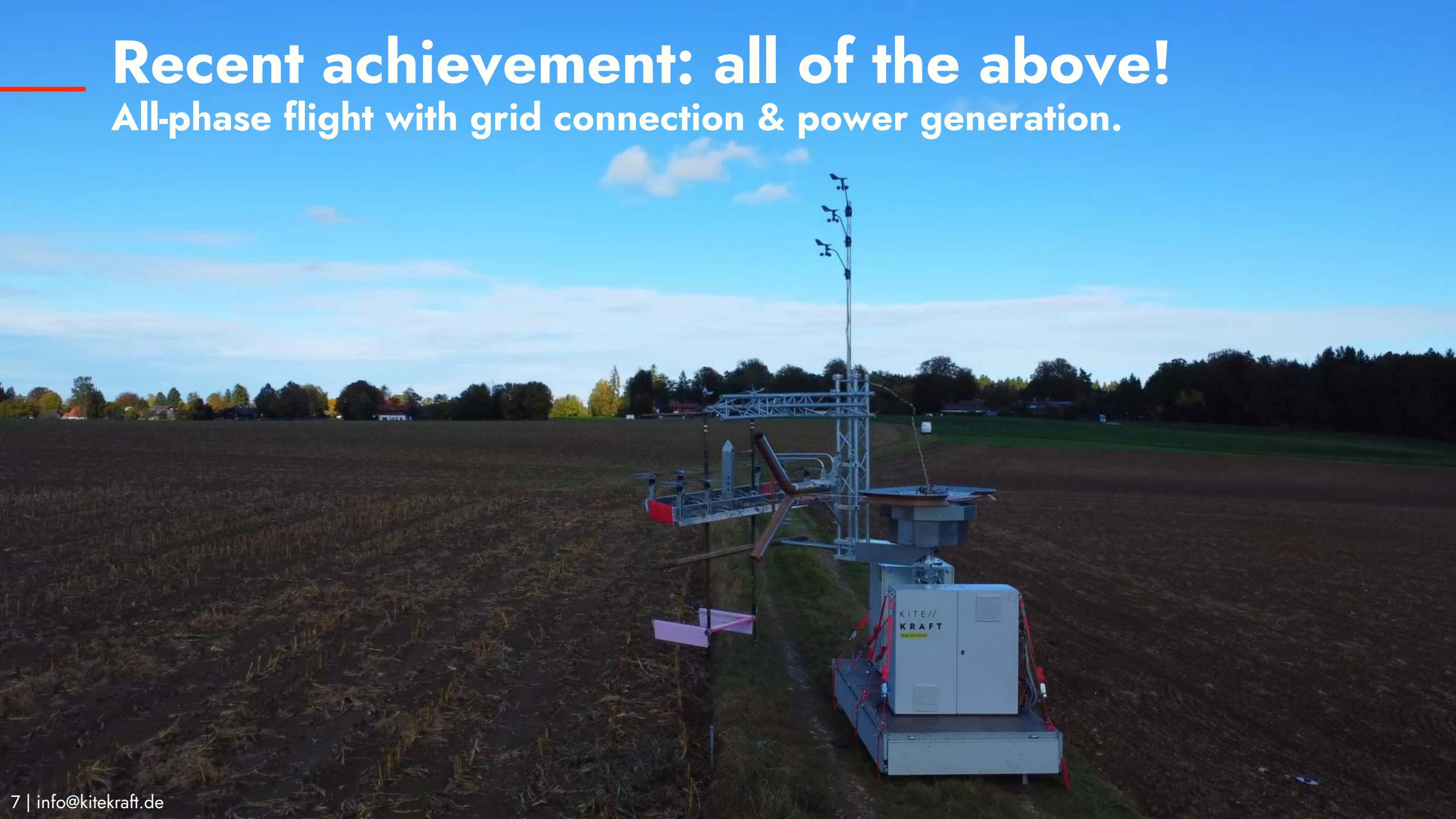
Recent achievement:
Wind tunnel control authority validation.

Recent achievement:
>100 undockings/dockings accumulated.

Recent achievement: grid connection.

Recent achievement: all of the above!

All-phase flight with grid connection & power generation.



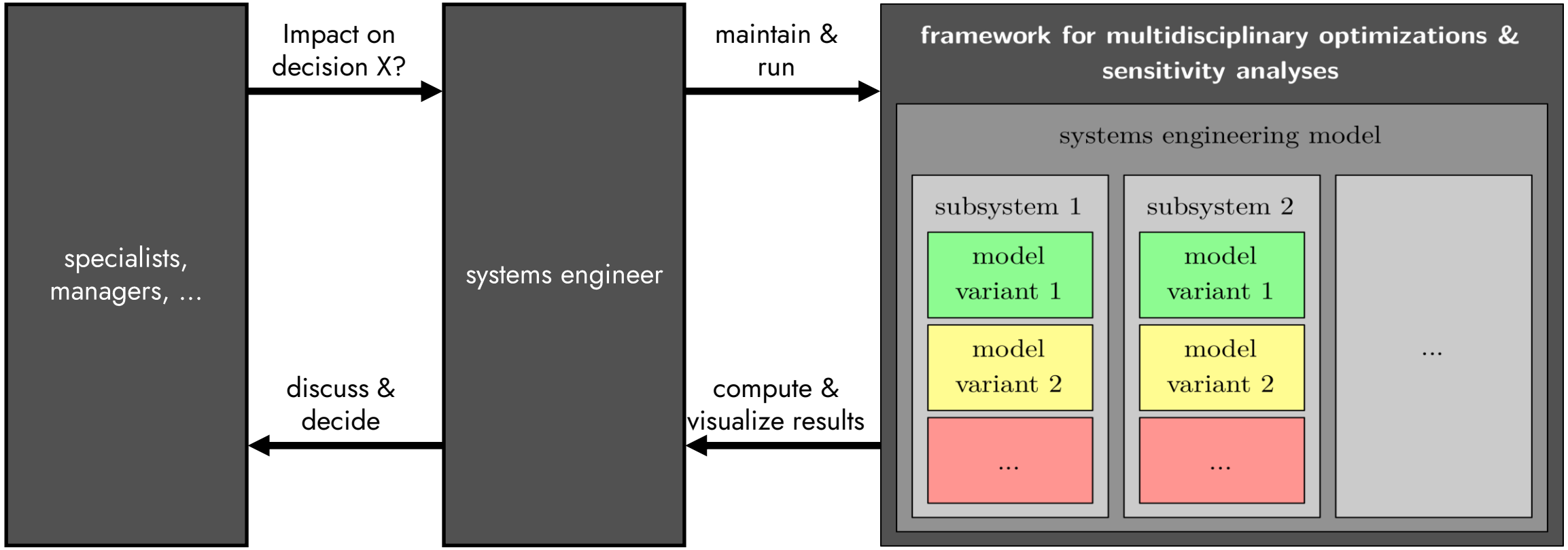
Our focus so far:

- Development of scalable, industrializable, fully automatic, airborne wind energy concept.
  (Business model only works if: 100kW to multi-MW, industrial grade, and fully automatic.)
- Onboard generation box-plane kite identified to fulfill all requirements.
- Focus on small-scale technology demonstrator, especially: fully automatic flight.
  (Never had a joystick to steer kite manually, minimal crew/pilot interaction with push buttons only.)
- Advantages: can fully validate concept, incl. sensor/actuator/communication/software setup.
- Achievements: no roadblock discovered, concept so far evaluated positively.
- Shortcomings: too small to fly efficient power curve (known from beginning), but efficiency comes with upscaling automatically.

Product Development Principles

- The best part is no part. The best process is no process.
  – *Can we make it simpler?*
- Assume ideas/designs are wrong to some extent.
  So, design & simulate, but build & test fast.
- Do all possible painful learnings fast at small-scale & low-cost.

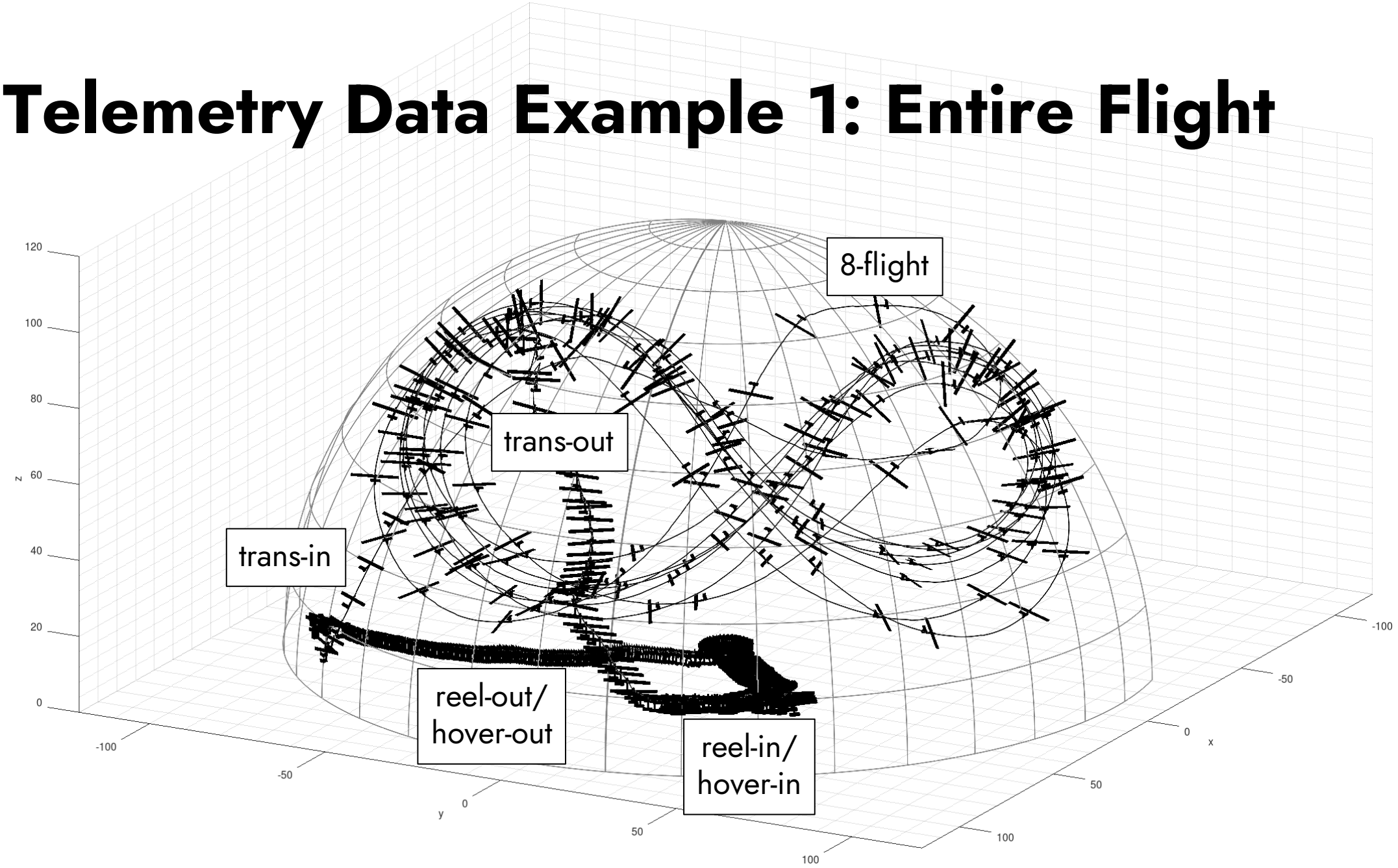
C++ Systems Engineering Framework Process: A Tool for Substantiated Decision Making



Using C++, PREEMPT-RT Linux, and Ethernet turned out to be one of our best design decisions

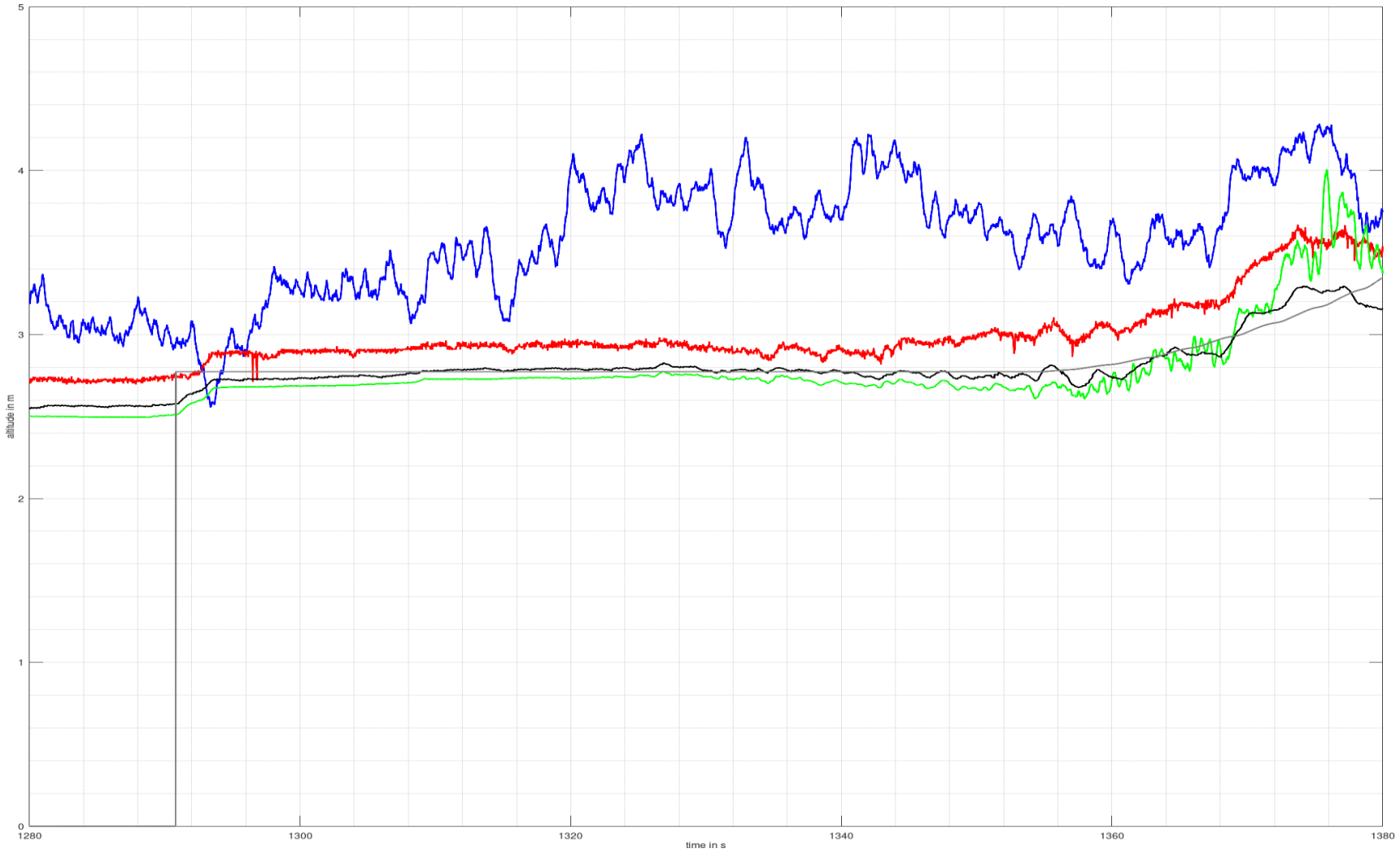
Source: Florian Bauer. "Multidisciplinary Optimization of Drag Power Kites". Dissertation. Technical University of Munich. 2021.

Telemetry Data Example 1: Entire Flight

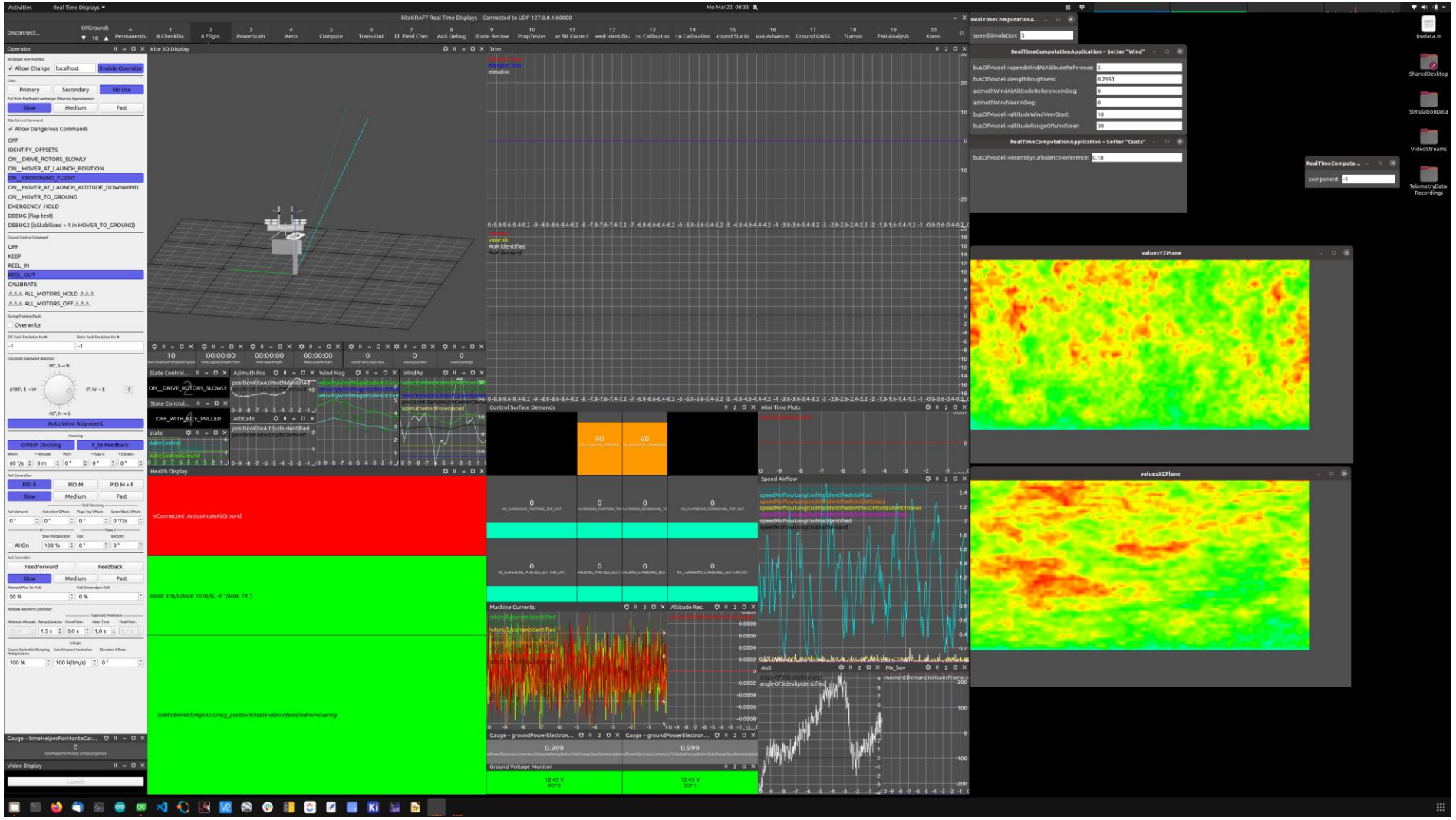


Telemetry Data Example 1: Undock

hover up *reel-out* *> 10m tether length*



Ongoing development focus: redundancies & realistic models.



Regulatory Efforts: UAS BVLOS Permit.

LBA

EASA
European Aviation Safety Agency

Conclusions.

Summary/Achievements:

- Kitekraft achieved all-phase automatic flight, with grid connection.
- Simulative and flight test results serve as concept validation, ready for upscaling.

Plans/Outlook:

- Upscaling design of 100kW market-entry product system started.
- Continued flight testing with small-scale system to further increase reliability in all specified environment conditions and all fault cases.
- UAS BVLOS permit flights with minimal/no crew on site.

Let’s create the wind turbine of the 21st century together!

Florian Bauer | Co-CEO & CTO

florian.bauer@kitekraft.de

www.kitekraft.de

This project has received funding from the European Union’s Horizon Europe program under Grant Agreement No. 101084216

MERIDIONAL