The Virtual Flight Test Environment –

A Web-Based Framework for Realistic Testing of Flight Control Laws

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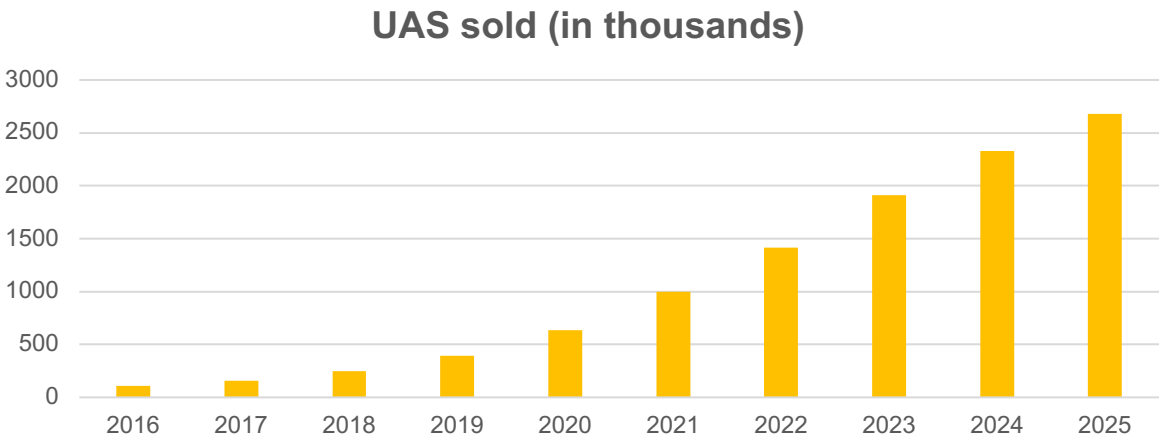
.:: Challenges in the Operation of UAS

Worldwide Market Growth for Commercial UAVs



Source: Tractia

A Growing Market needs Professionalisation

- Airspace Integration
- Intensive Testing
- Safe UAS-Systems
- Professional and practise-oriented teaching
- Safe and Reliable Flight Control Law Software
- Quick transfer from research to application

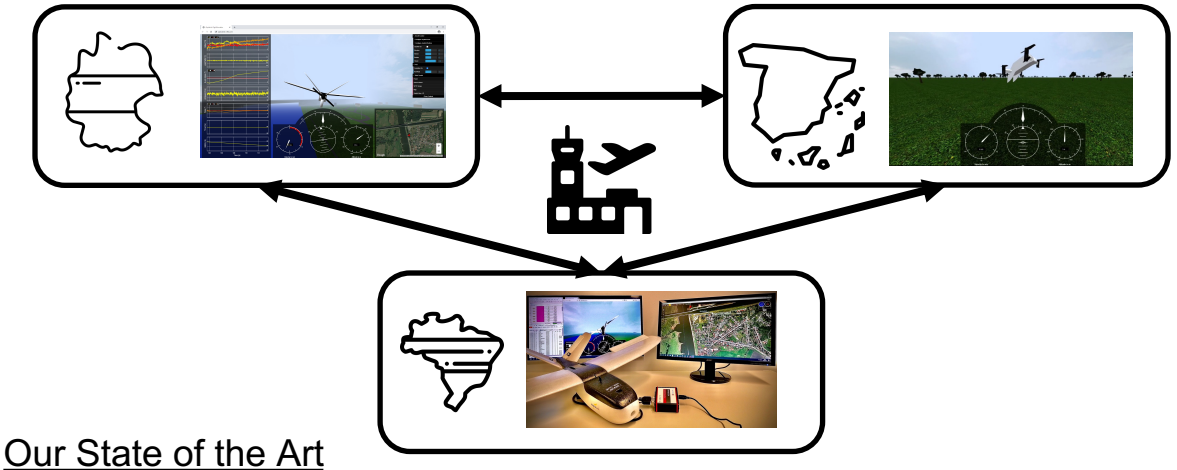
Test Center for Unmanned Aircraft Systems

Source: DLR

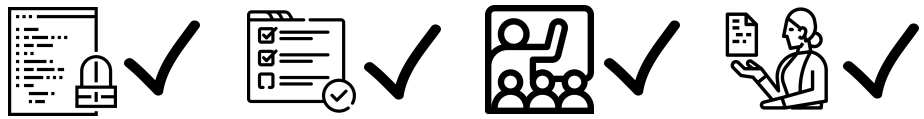
Source: DLR

Virtual Flight Test Environment

Our Vision

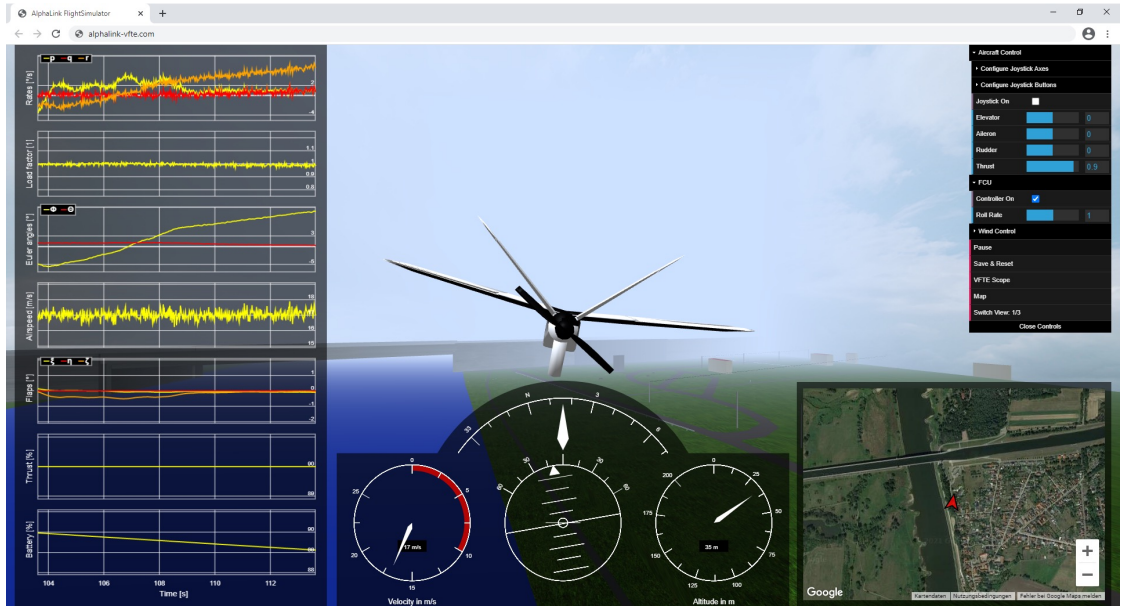


Our State of the Art



.:: Virtual Flight Test Environment as a Teaching and Research Platform

Performing of Flight Tests exclusively in the Web Browser



- Virtual flight test environment is a flight simulation that only requires a web browser
- No further software is necessary
- Control is possible with joystick or keyboard
- It can be flown without control law, with predefined control law structures or with own flight control laws

Concept of the Virtual Flight Test Environment

Webbrowser to interpret JavaScript and HTML

HTML + JavaScript
A "software" that takes over all tasks

Visualisation
Aircraft and Environment

Visualisierung
Display + Google Maps API

Simulation model
- Background: Simulink Model
- Transformation of the Simulink model into JavaScript

Aircraft Control
Rudder, thrust and flight control unit

.:: Usable UAS in the Virtual Flight Test Environment

Digital Twin of the Flying Lab

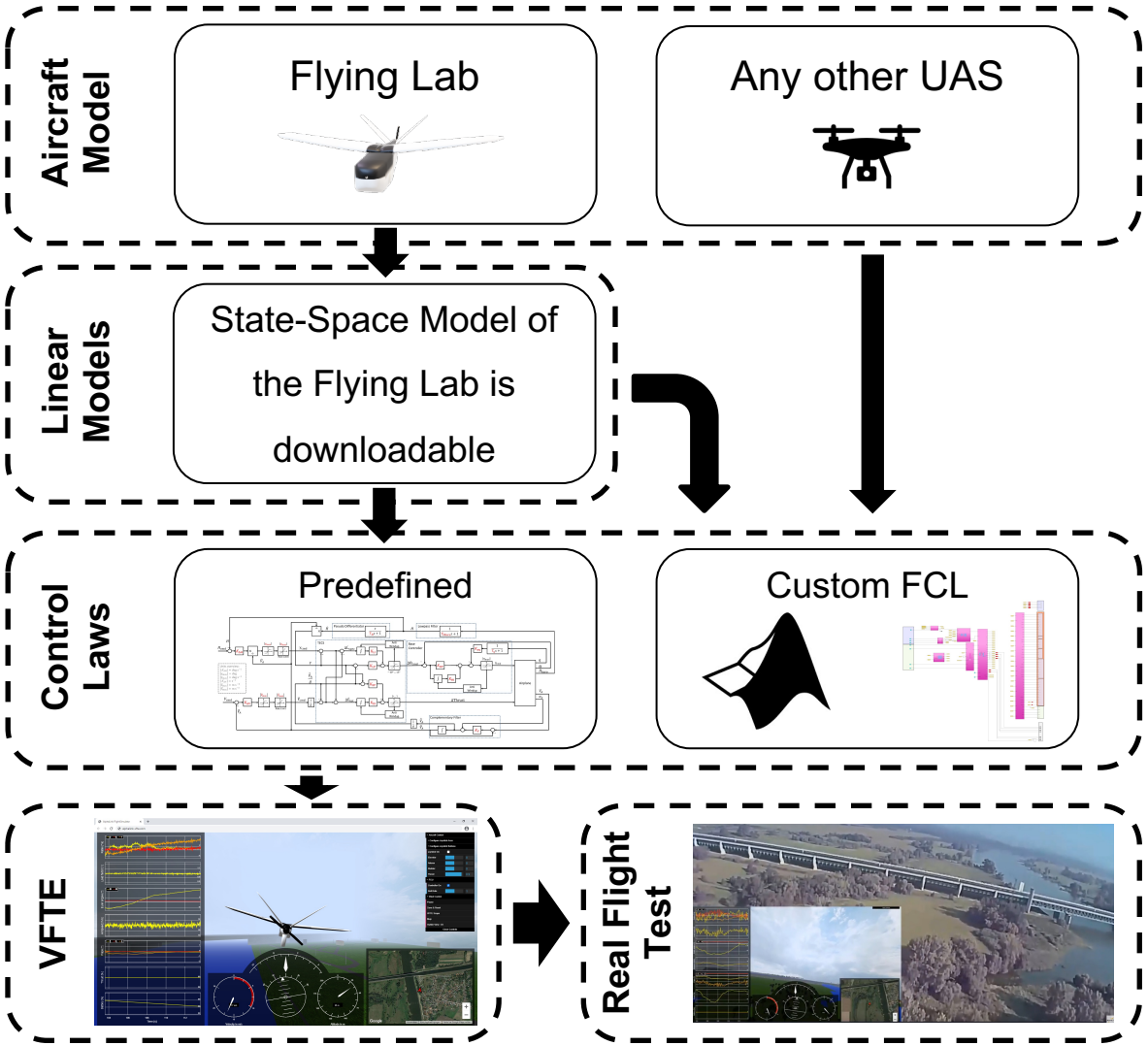
- Flying Lab is used by universities in teaching and research for experiments in flight dynamics and flight control
- Implementation of Simulink controllers on the real flight test vehicle without writing a line of code
- Controllers designed in the virtual flight test environment can be flown directly on the real aircraft with the same performance

Other implementable UAS & Environment

- In principle, any aircraft, e.g. copter, can be integrated into the virtual flight test environment
- In addition to a generic world (low performance required), the landscape of the waterbridge in Magdeburg is available as an environment.
- Further environments are planned

.:: Process Chain and Application Examples

Process Chain for Development and Testing of FCL-Software



Application Examples

1. Design of a controller for a predefined control-loop structure (Bank Angle Control Law)

2. Implementation of a custom control law in the Virtual Flight Test Environment

3. Download of the controller and validation with the Hardware-in-the-Loop Simulator and in real flight tests

.:: Example 1: Design of a Controller for a Predefined Control Law Structure

Virtual Flight Test Environment Logi ×

https://alphalink-vfte.com

AlphaLink Engineering

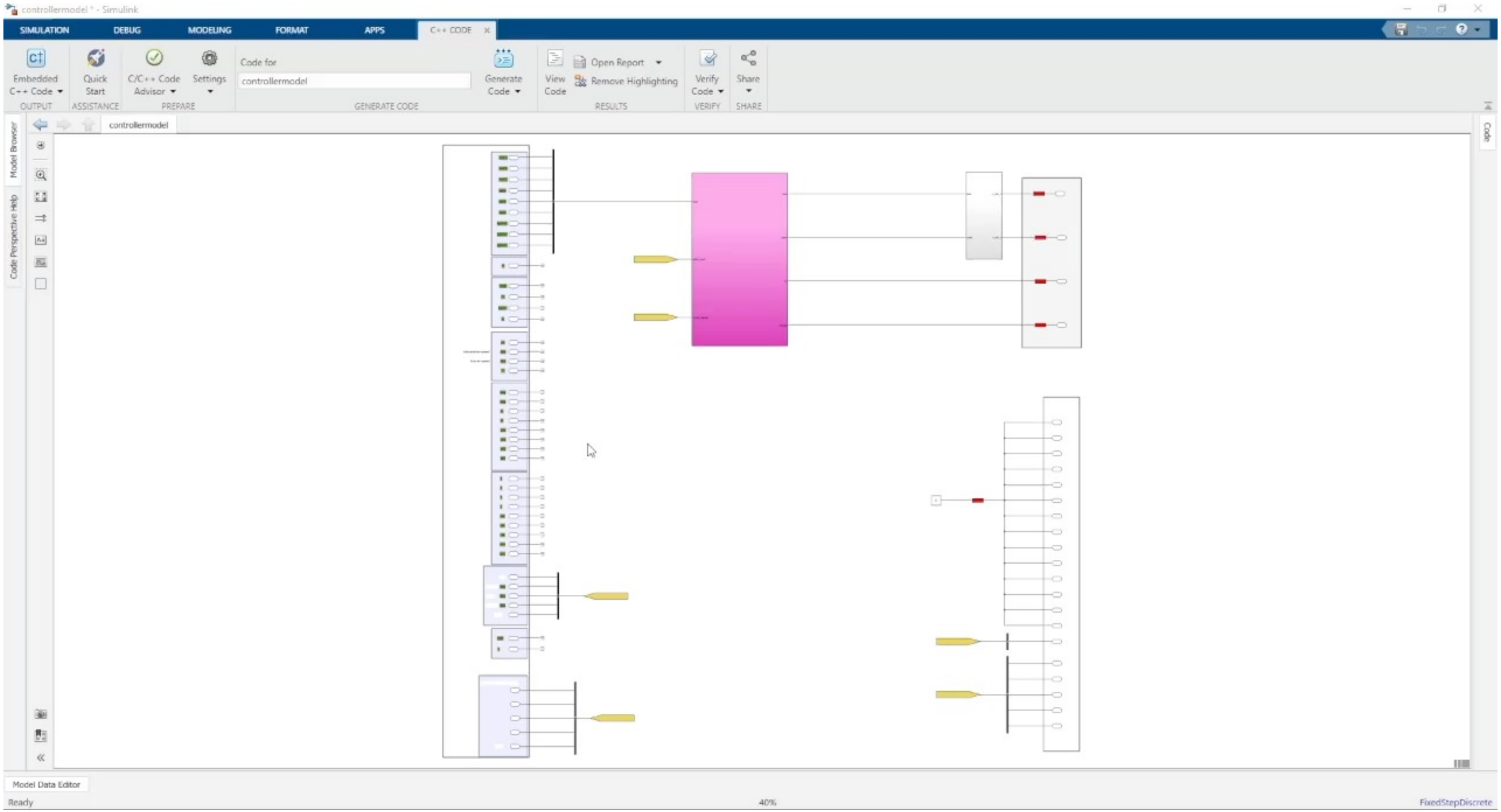
Upgrade Lessons FAQ Profile VFTE Community

Virtual Flight Test Environment

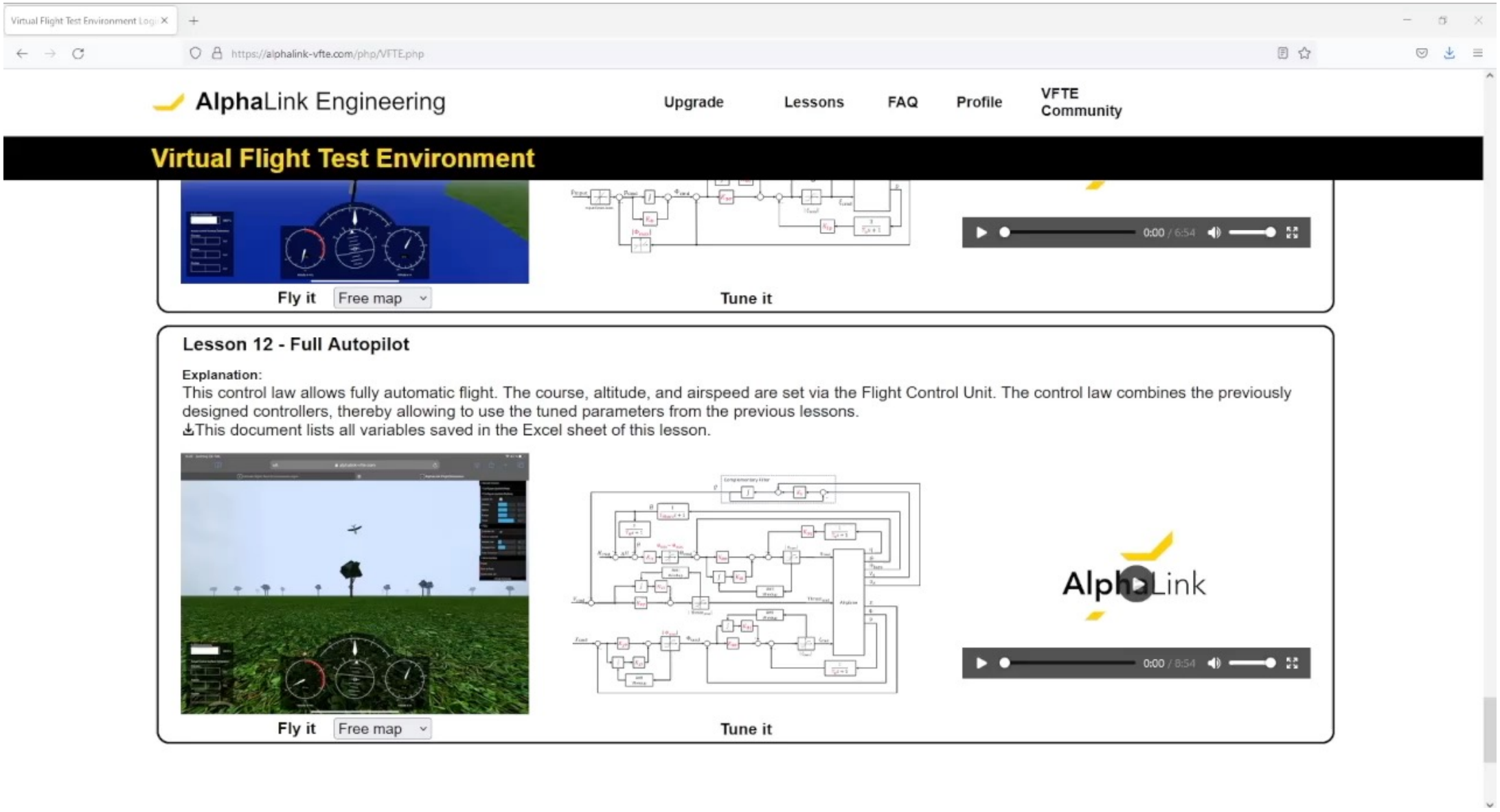
How to use the Virtual Flight Test Environment

This video explains the interaction with the virtual flight test environment. It shows how to set up your joystick and how to access the flight test data.

.:: Example 2: Implementation of a custom Control Law in the Virtual Flight Test Environment



.:: Example 3: Download of the Controller and Implementation on the UAS



.:: Current Users and Invitation to test the Web Environment

Current Users

Germany

- Technische Universität Berlin
- Technische Hochschule Wildau
- TU Hamburg
- TU Chemnitz
- Hochschule Karlsruhe
- Universität Rostock
- Deutsches Zentrum für Luft- und Raumfahrt
- Private users

International

- Brazil
- Bulgaria
- Chile
- Columbia
- Great Britain
- USA

Join the Network

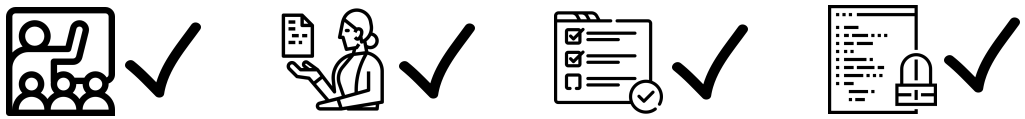
Register today: *www.alphalink-vfte.com*

Promotion Code: *eurognc_2021*

Test all functionalities of the VFTE one week (until 14.10.2021)

.:: Summary and Suggestions for Discussion

Summary



- The virtual flight test environment can be used for engineering education, where students are faced with real flight test problems (noise, bias)
- Scientists can implement their own new control concepts and test them before the flight test
- Due to the equivalence between model and real flight and system behavior, intensive testing is possible prior to the real-world flight test
- With the connection to the hardware-in-the-loop simulator, the flight control law software can be securely and intensively tested for error cases (e.g. sensor error) before the flight test

Questions for the audience

- As a user, what other functionalities would you like to see?
- Do you have any suggestions for the current state?
- What do you think about a networked version of the virtual flight test environment? Can you imagine testing your guidance, navigation and control solutions virtually with other users/researchers?

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