AVIOX AEROSPACE

Engineering

UAV & Drone Development

Aerodynamics

Project portfolio – adapted version for webpage

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Content

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About us

We design and develop custom UAVs tailored to the unique needs of each project. Our focus lies on aerodynamic efficiency, lightweight structures, and reliable flight performance. Every aircraft is engineered from the ground up to achieve the perfect balance between innovation and practicality.

Our expertise covers the full development process — from conceptual design and aerodynamic simulation to prototype manufacturing and flight testing. Using advanced tools such as XFLR5 and in-depth aerodynamic analysis, we ensure that every design reaches optimal performance in real-world conditions.

Beyond development, we provide consulting services in aerodynamics and UAV optimization. Whether for experimental platforms, research applications, or specialized flight missions, we help clients achieve their performance goals through precise engineering and creative design.

Our mission is to push the boundaries of small-scale aviation by combining technical excellence with a deep understanding of aerodynamic principles. Each project reflects our commitment to efficiency, innovation, and reliability in every detail.

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Founder

Nikolas Schalhaas is an engineer in the field of unmanned and ultralight aircraft. With experience from over 50 projects for private and industrial clients, he has contributed to aerodynamic design, structural development, and concept creation.

As a passionate model aircraft pilot and licensed glider pilot, he combines practical flying experience with his academic background. In 2024, he founded his own company after working as a successful freelancer.

Today, most of his work focuses on large-scale custom UAV projects, with clients across Europe. His approach remains dynamic, precise, and tailored to each project's unique requirements.

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Core Competences

Aerodynamics, Simulation and Aircraft design

XFLR5, Flow5, CFD, Stability analysis, Calculation using specialized tools in Microsoft Excel

CAD Softwares

Inventor, Fusion, AutoCAD, 3D-Experience, CATIA, SolidWorks

Design Methods

Reverse Engineering, Free Form Design, Surface Design, Repair of damaged CAD files

Types of projects

UAVs, General Aviation

Responsibilities

Independent design of UAVs and light aircraft;
Consulting in the fields of CAD, aircraft design, and aerodynamics;
Sole responsibility for the overall design process

Additional Competences

3D printing; 3D print design; Optimization of components for additive manufacturing

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Previous Work and Responsibilities

Key Achievements

- **1 UAV approaching serial production**
- Collaborations with startups from Austria, Australia and the US

Responsibilities

- Design and Development of Model aircraft, Drones and UAVs, primarily optimized for 3D printing and composite manufacturing
    - Concept development
    - Flight Stability (Lift and stability simulations)
    - Range and performance analysis
    - Aerodynamic optimization
    - Simulations in XFLR5, Flow5 and Autodesk CFD
    - Freeform design in CAD
    - Selection and Calculation of propulsion systems and electronic components
    - Preparation for manufacturing
- Desing and optimization of components for 3D printing
- **CAD-Troubleshooring**
- **Prototyping** and **small-batch production** using FDM-3D-printing
- Development, Production and sales of proprietary products
- Creation of complex Microsoft Excel-based tools for a variety of applications
    - Intrgration with CAD software
    - Aircraft performance calculation
    - Product and Project management
    - Macro programming in Excel

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Major Projects

Development of a UAV for Wildlife Observation

Duration: April 2024 until August 2024

Type of Project: UAV-Development

Customer: Several private individuals aiming to found a startup and produce and market the UAV.

Responsibilities: Design, Aircraft geometry, aerodynamics, Flight Stability, Simulations

Work:

- UAV Development
- Continuous communication with team members
- Consideration of numerous client requirements

Description:

A UAV was to be developed for wildlife observation in Africa. Requirements:

- Usage: Observation of Wildlife in Africa
- Flight Characteristics: low flight speed, high endurance
- The camera system had already been developed by South African students, which imposed strict requirements on the shape and size of the fuselage.
- Cost effective production
- Simple handling for assembly and operations

The UAV was developed according to these requirements. Flight stability was simulated using Flow5.

Shortly before the first prototype was completed, a key investor withdrew, causing the project to be discontinued commercially. Instead, the clients completed the prototype with private funds. Due to financial constraints, the project initiators decided not to pursue further development; an attempt to sell the fragmented company structures and licenses for the UAV failed.

Wingspan: 4 m

Construction method: CFRP

Range: >300 km

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Figures:

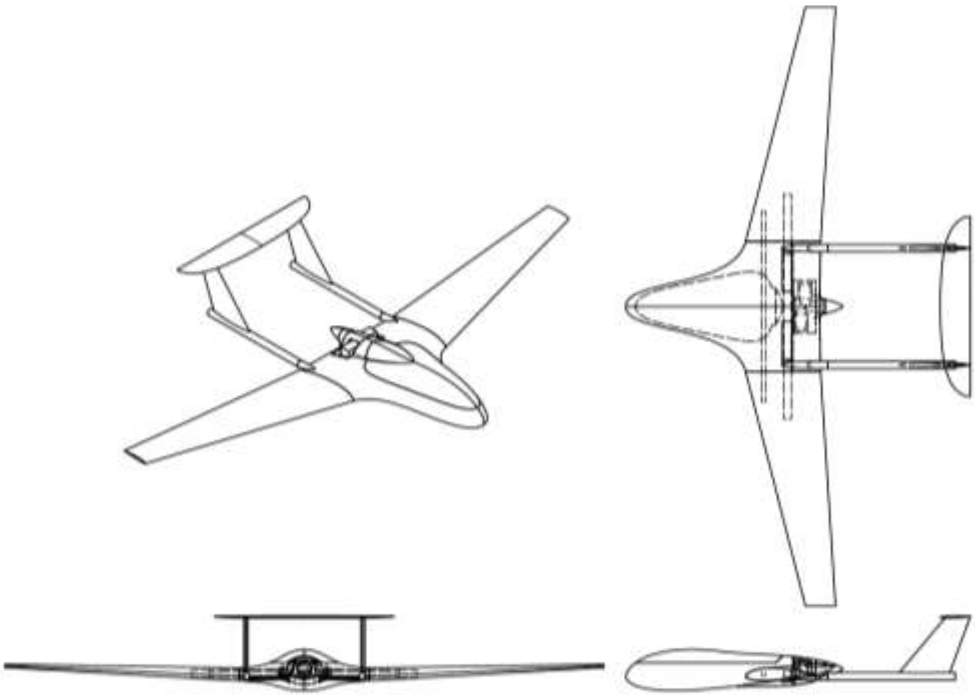

Figure 1: Wildlife Observation UAV — 3-View Drawing

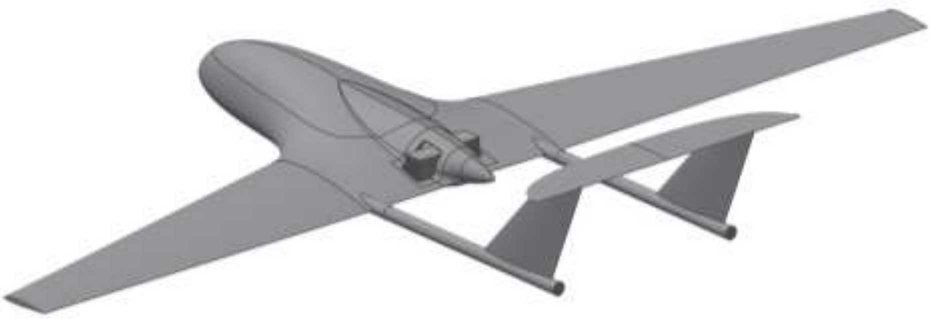

Figure 2: Wildlife Observation UAV

Figure 3: Wildlife Observation UAV

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Development of a stratospheric glider (Diploma thesis)

Description:

Following the concept development of a stratospheric glider for weather data collection by another team the previous year, my team was tasked with continuing this research.
The goal was to design and build a compact prototype capable of conducting flight tests.

Thanks to my extensive experience in UAV development and model aircraft, I was given the opportunity to lead the team throughout the project and contribute significantly to the path toward success from the very beginning.

The concept involved replacing the conventional foam box used to house weather balloon instruments with a glider. Typically, these sensitive electronics are lost in the environment and cannot be reused. To avoid this, the glider was designed to glide back to the launch site. A drawback of our system is that the significantly higher mass of the glider requires substantially larger balloons.

Since balloons of the necessary size are expensive and single-use, the vertical ascent was initially simulated using a multicopter. For this purpose, a hexacopter and a commercially available model motor glider were modified accordingly to conduct the tests. After several successful trials, development of the dedicated glider—named “StratoFly”—began.

To operate effectively, StratoFly must maintain stable flight at altitudes up to 30 km. Due to the much lower air density at such heights, designing an aircraft that remains both statically and dynamically stable with a consistent center of gravity—both near the ground and at 30 km altitude—without entering dangerous spins is highly complex. Stability simulations were conducted using Flow5 and XFLR5 to address these challenges.

The glider’s voluminous yet aerodynamically efficient fuselage was designed to accommodate multiple professional measurement instruments, significantly enhancing data quality.

Prior to wing construction, a major issue was identified: neither CATIA nor 3D-Experience provide reliable functions to import airfoil profiles as point clouds. To resolve this, an Excel tool was developed that uses macros to import airfoil profiles into 3D-Experience. This tool was continuously expanded with new features and is now very powerful:

- Conversion of various airfoil file formats (Selig, Lednicer)
- Optional closing of trailing edges
- Automated replacement of decimal points and commas for proper import
- Flexible scaling of profiles
- Arbitrary translation and rotation of profiles along all spatial axes using a 3D rotation matrix

Compatibility issues arising from different Excel versions were completely overcome.

To make “AirfoilImport” fully available to third parties while preventing unauthorized use, an intuitive user interface was created, all background processes were hidden and password-protected, and editing was restricted to selected cells only. In this form, “AirfoilImport” was provided to HTL Eisenstadt for educational purposes.

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Thanks to this tool, wing modeling was completed quickly and designed for easy adjustment at any time.

After successful design and development, a prototype was 3D-printed, and positive molds were produced for manufacturing laminate molds.

Due to the withdrawal of a team member, the build could not be fully completed. Therefore, the prototype was fitted with the very similar wings of the commercially available model glider “Mika” for the mounting fixtures.

Specifications:
Wingspan: 2 m
Mass: 2 kg
Purpose: Weather research
Construction methods: 3D printing and CFRP

Figures:

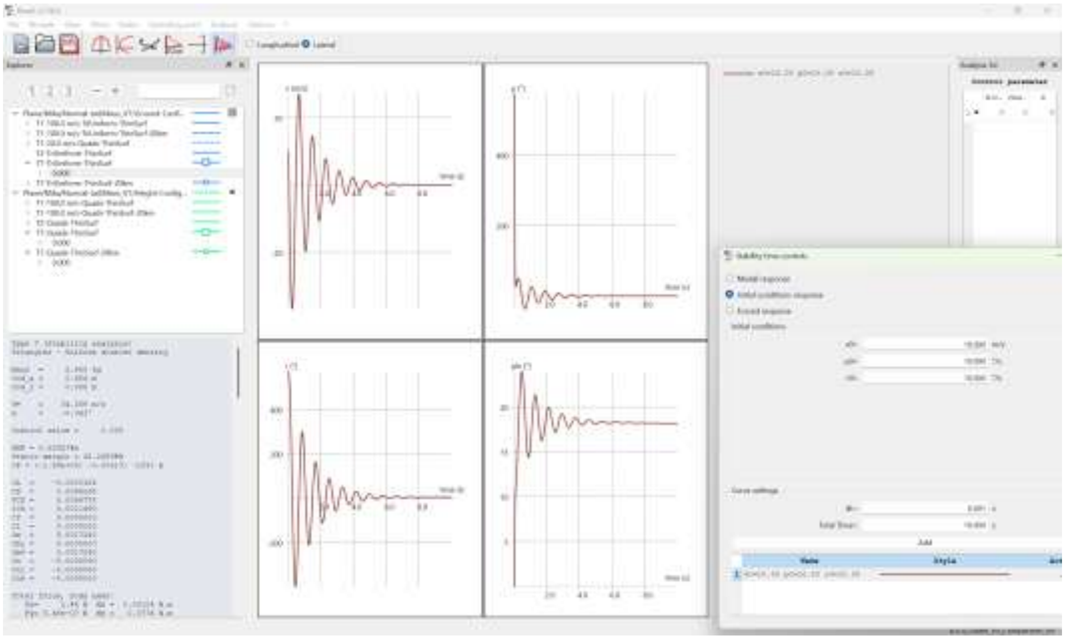

Figure 4: Stratospheric Glider. Lateral Dynamic Stability in Flow5

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Figure 5: User Interface of the Excel-Tool "AirfoilImport"

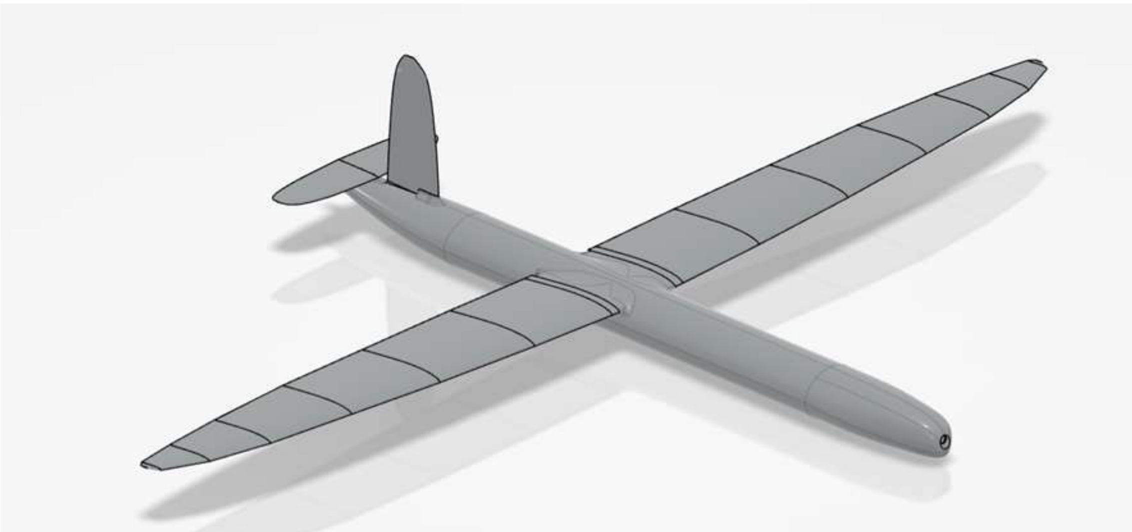

Figure 6: Stratospheric Glider in 3D-Experience

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Figure 7: Stratospheric Glider

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Design of a 145-seat short-range commercial jet (Design lectures final project)

Duration: September 2025 until June 2025

Description:

As part of the structural design course in the 5th year, a passenger aircraft was fully designed and modeled.

Requirements:

- Required runway length
- Cruise speed in Mach
- Range
- Passenger capacity

The aircraft was calculated and dimensioned using over 2,000 lines in Excel. Established formulas, tables, and charts from reputable technical references were applied.

Calculated parameters included:

- Lift-to-drag ratios under various flight conditions
- Aircraft constraint diagram for evaluating thrust-to-weight ratio
- Aircraft mass
- Fuel consumption
- Cabin dimensions
- Dimensions of fuselage, wings, and control surfaces
- Requirements for airfoil profiles (followed by profile selection)
- Center of gravity position and stability margin
- High-lift devices
- Polar curves
- Flight performance (time-velocity and power-velocity diagrams)

Subsequently, the aircraft was parametrically modeled in 3D-Experience Generative Shape Design based on the calculations.

Using the Excel tool "AirfoilImport," developed during my diploma thesis for importing airfoil profiles into 3D-Experience and CATIA, the wings were parametrically modeled with minimal effort.

To validate the center of gravity calculations and optimize flight stability, simulations were conducted in Flow5.

CFD analyses were performed to optimize the fuselage shaping.

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The entire project, including all calculations, simulations, and 3D models, was meticulously documented.

Figures:

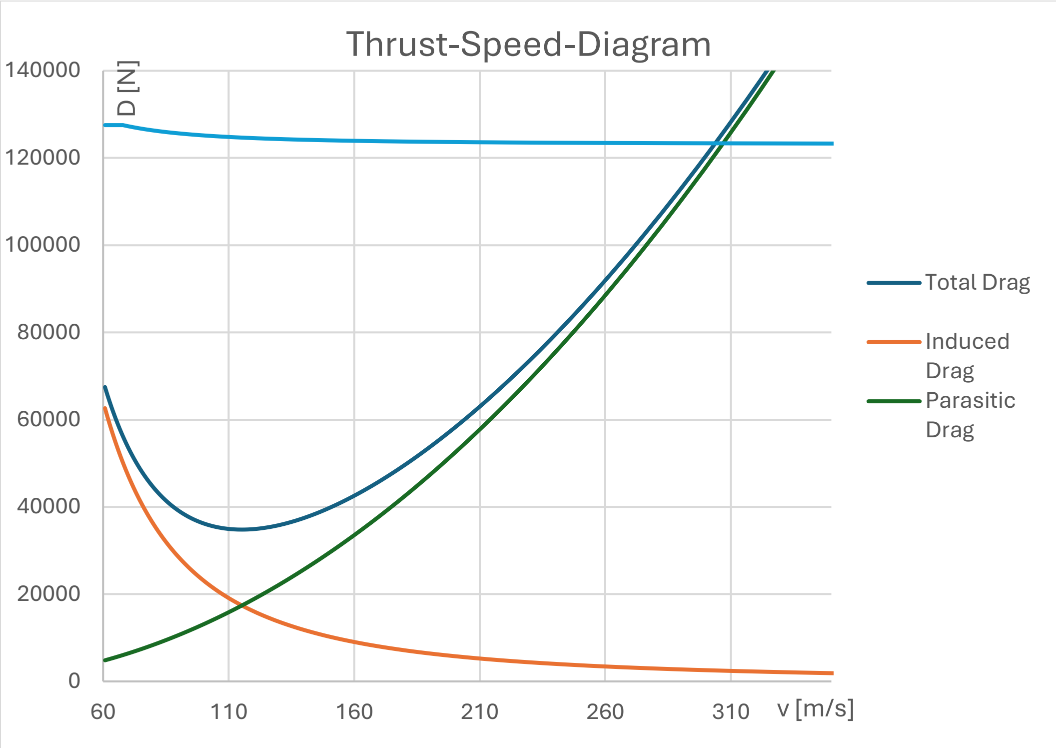

Figure 8: short-range jet. Thrust-Speed-Diagram

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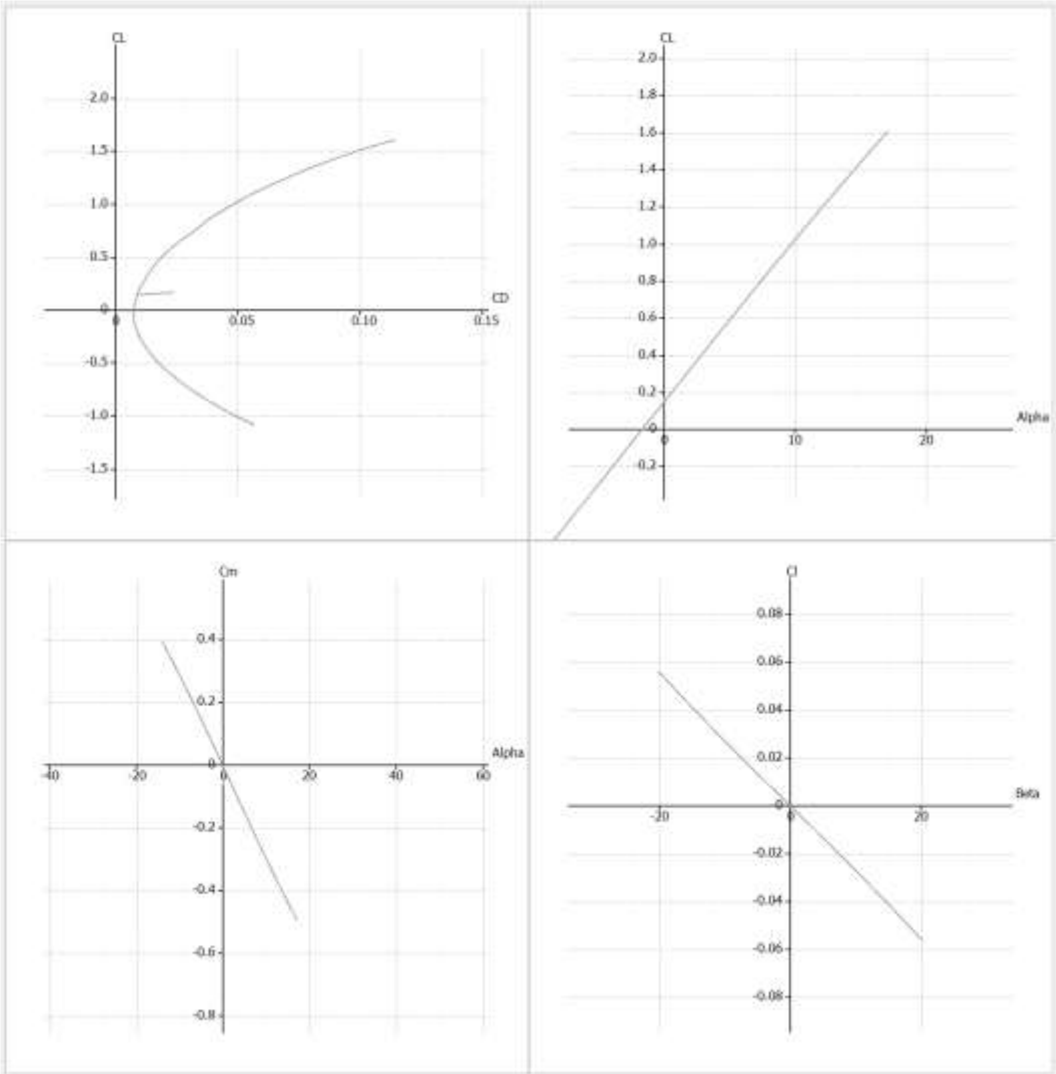

Figure 9: short-range jet. Static longitudinal flight stability

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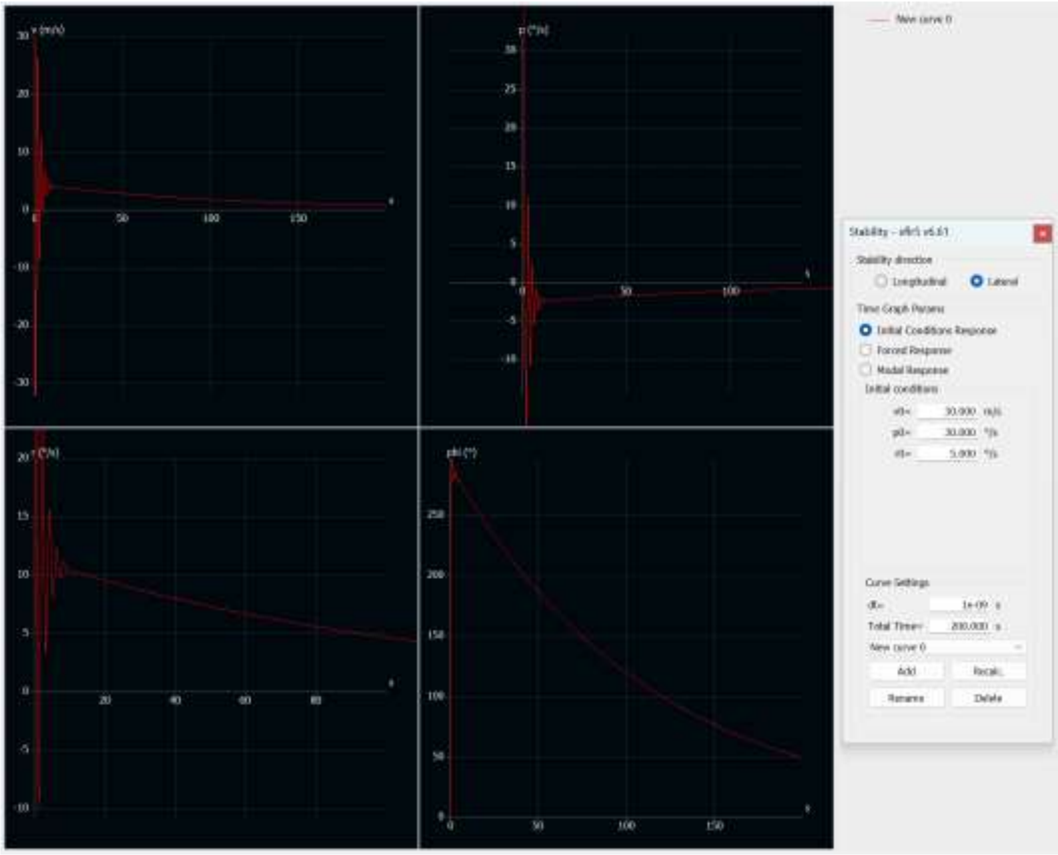

Figure 10: short-range jet. Dynamic Lateral flight stability

Figure 11: short-range jet.

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Figure 12: short-range jet. Rendering with livery

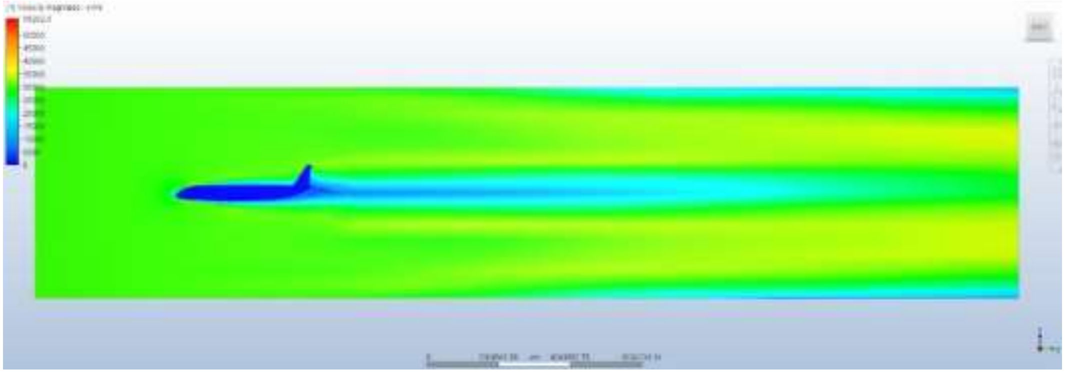

Figure 13: short-range jet. CFD-Simulation

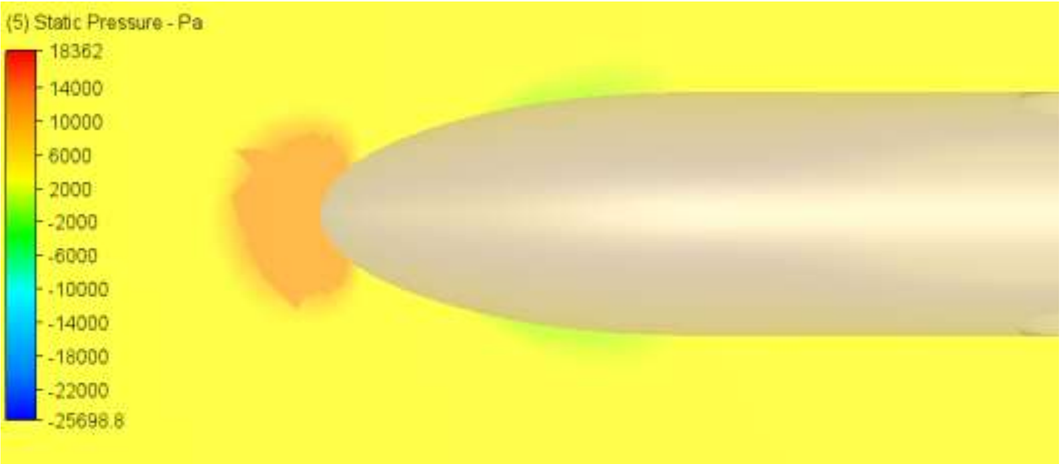

Figure 14: short-range jet. CFD-Simulation of the Fuselage Nose Section

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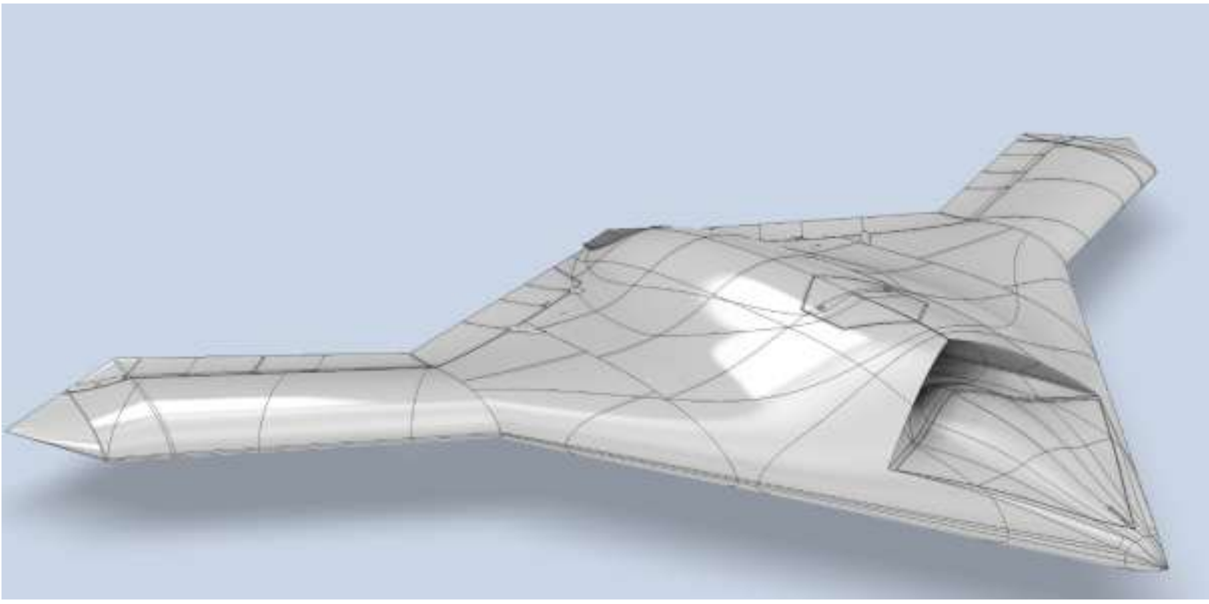
Additional Projects

In addition to my larger development projects, I have completed over 50 smaller assignments for various private and commercial clients. These ranged from model aircraft designs to reverse engineering of individual components. The following examples provide an overview of the thematic diversity of these projects:

- Development of multiple RC aircraft for 3D printing
  - Swift S1 (January 2023)
  - ASK-21 (Janurary 2023)
  - Swift S1 (March 2023)
  - X-47B (extremely functional) (September 2024)
- Co-Development of multiple RC aircraft for 3D printing
  - Blanik L-13 (March 2023)
  - Pilatus B4 (March 2023)
  - Grob 120TP (March 2024)
  - F-35 (March 2024)
  - Boeing 747 (March 2024)
- Reverse-Engineering (>15 Projects)
- CAD-Troubleshooting

Figures:

Non-aviation-related projects are also listed to account for a wider spectrum of work.



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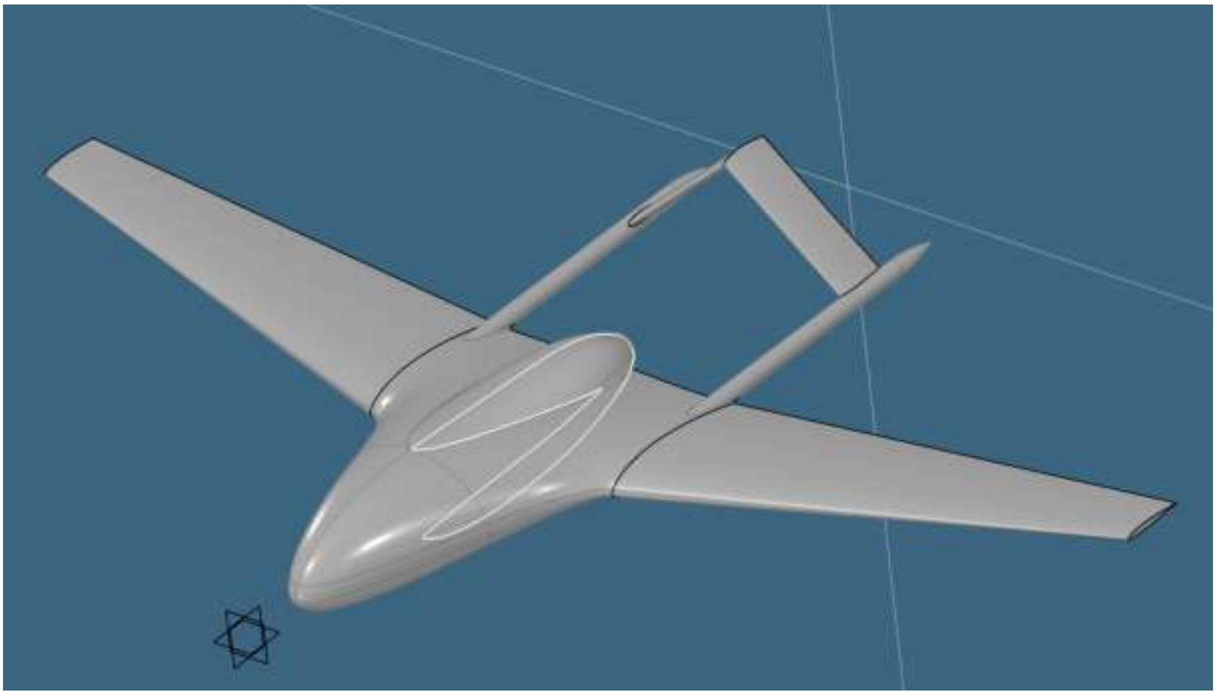

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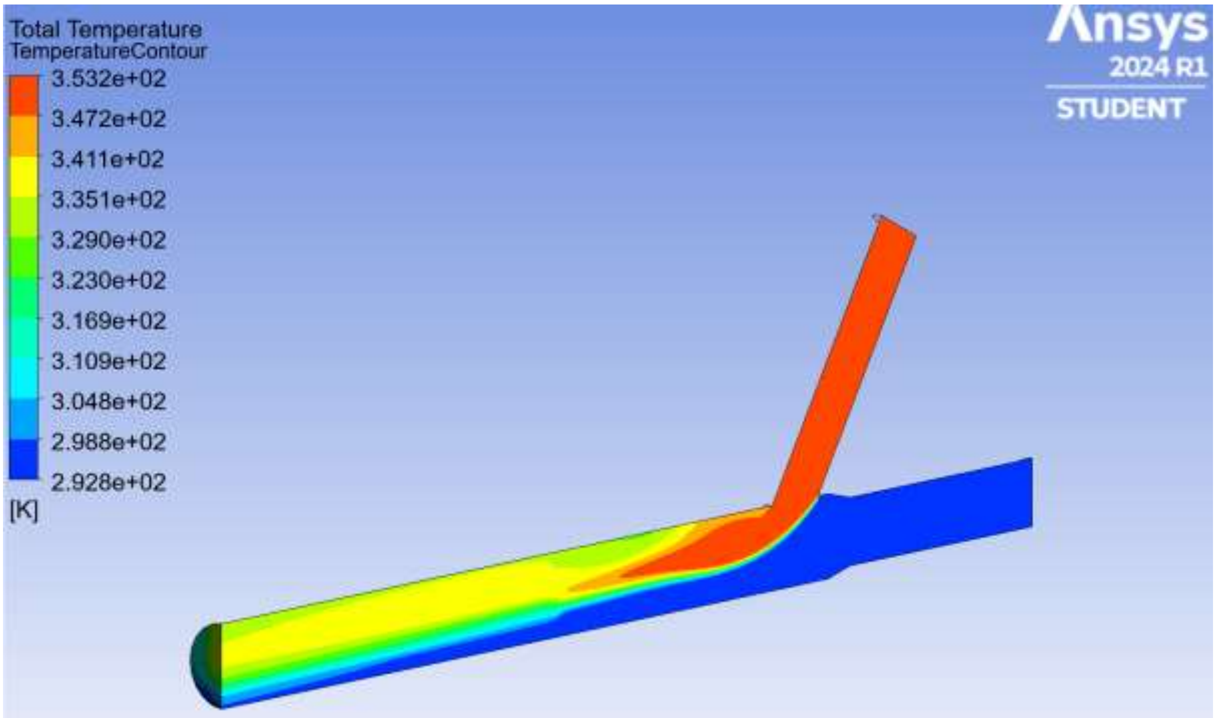

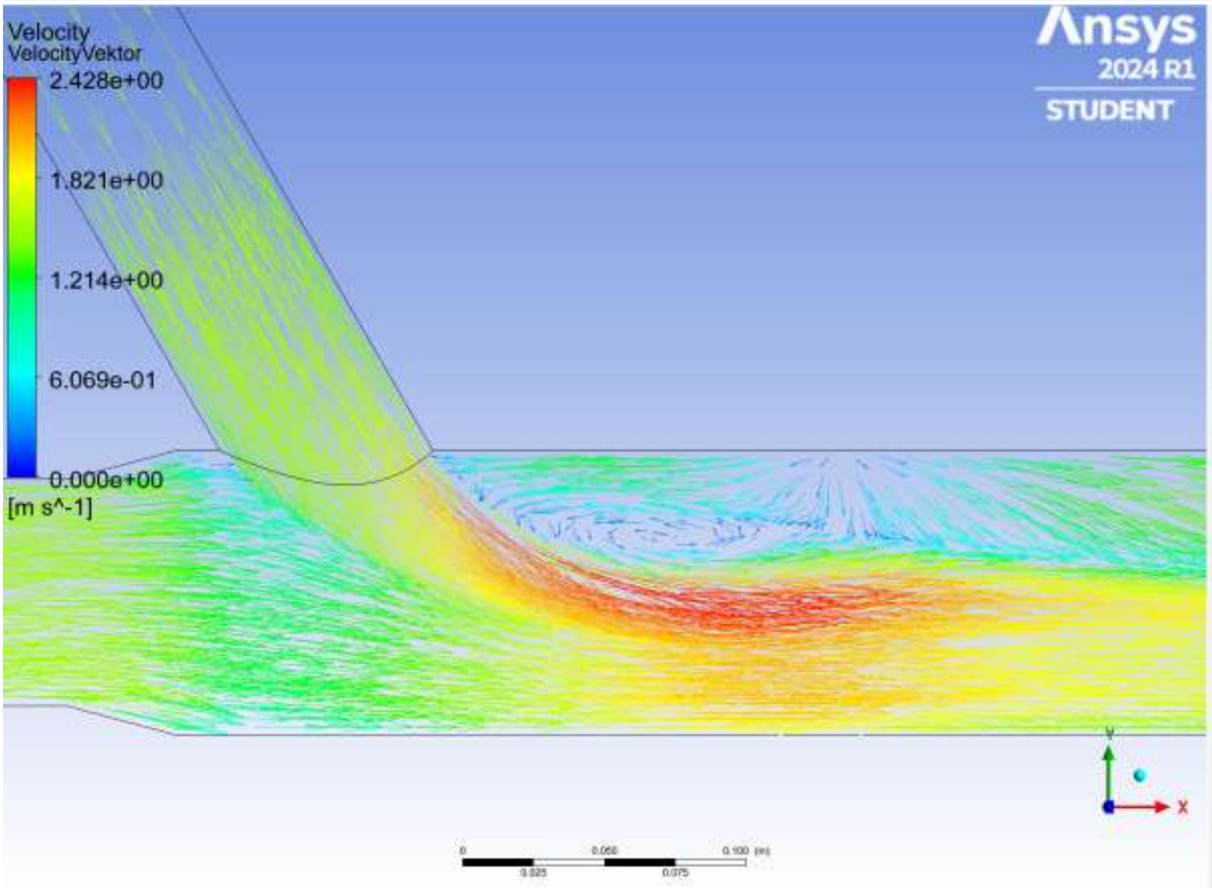

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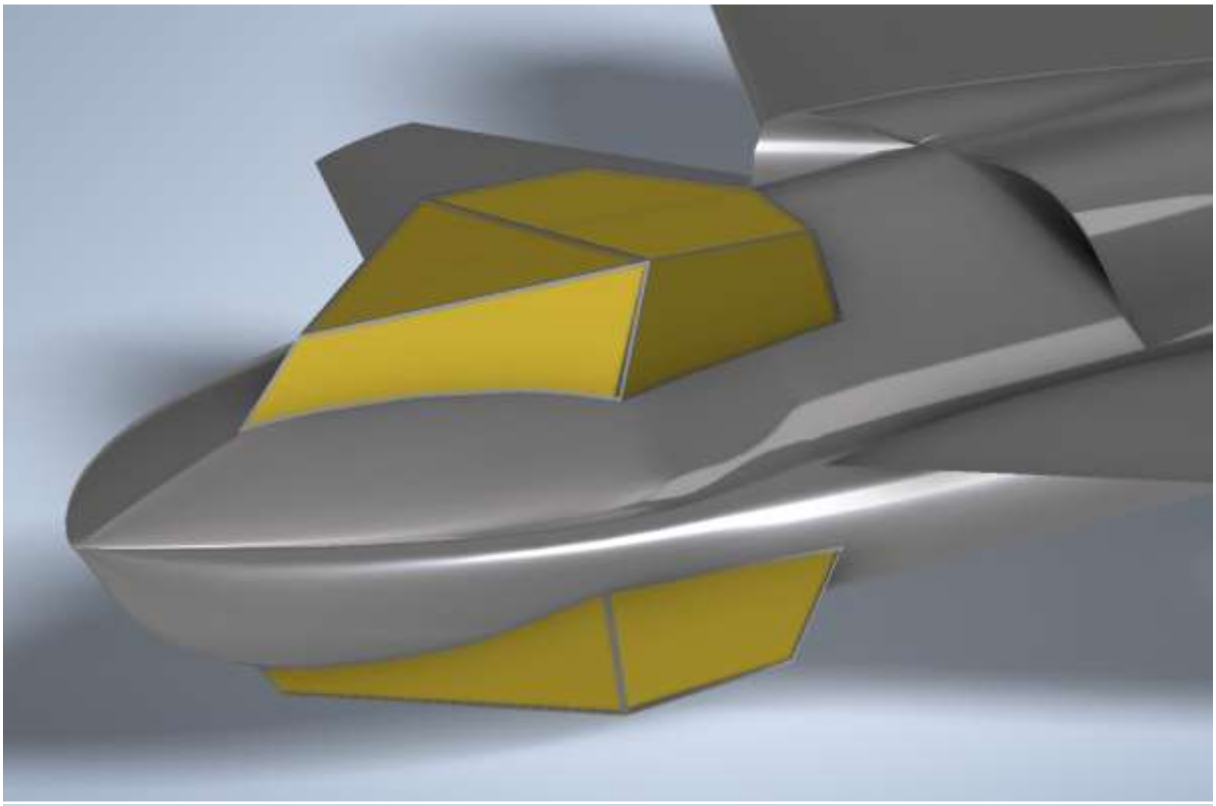

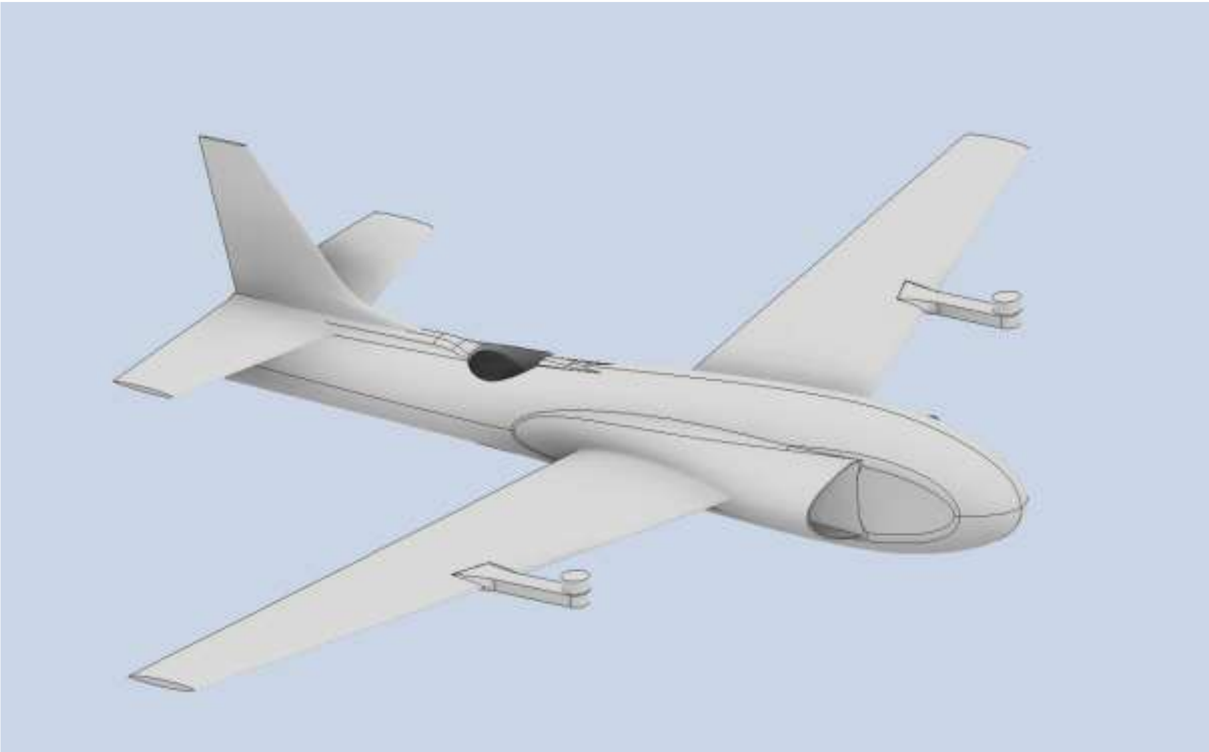

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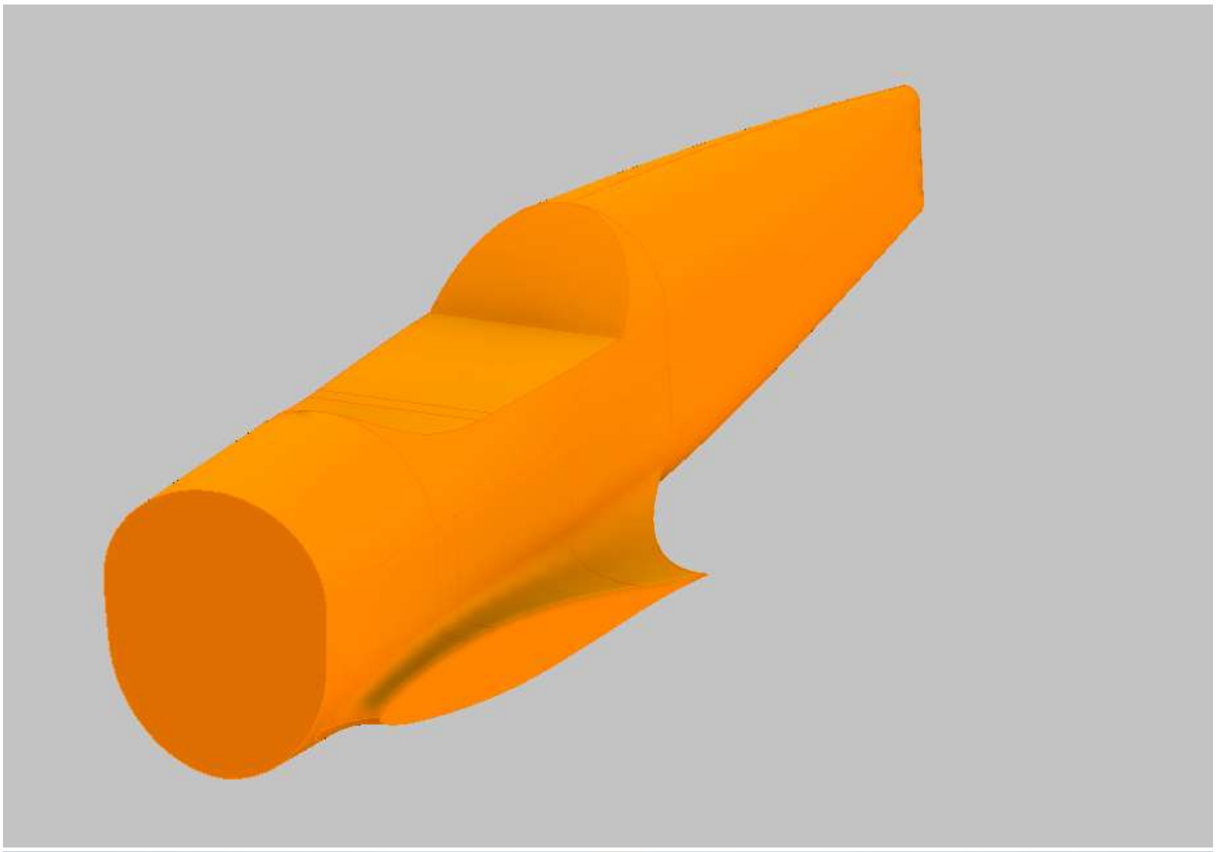

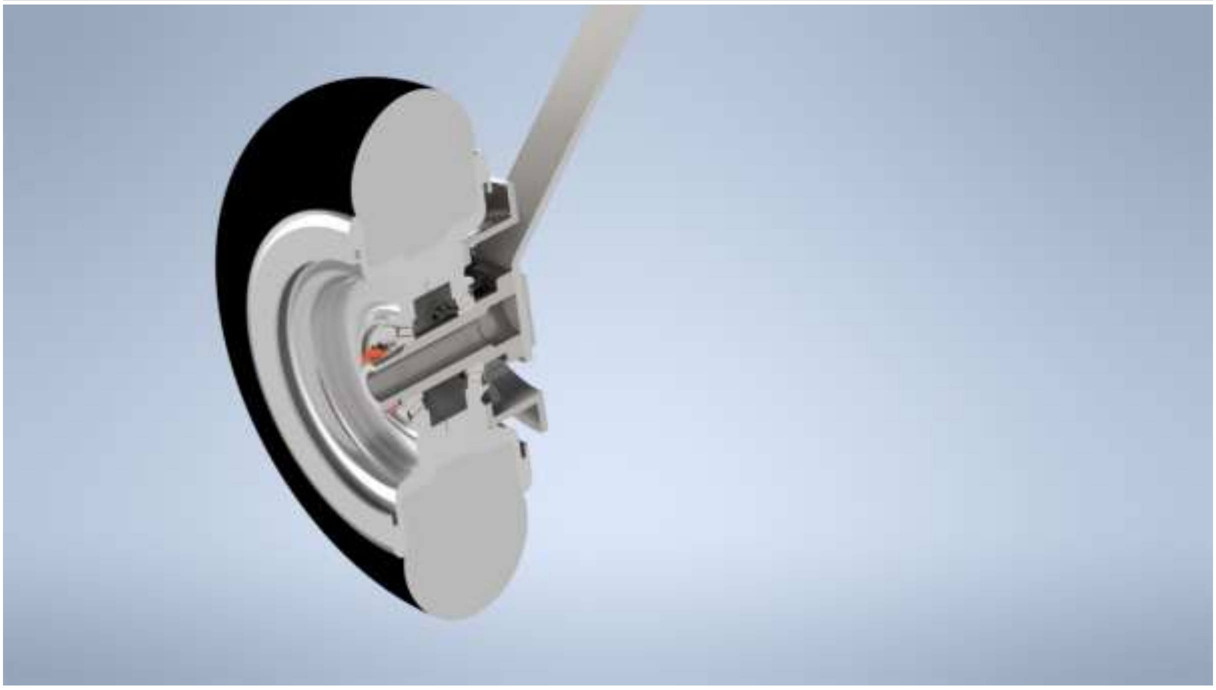

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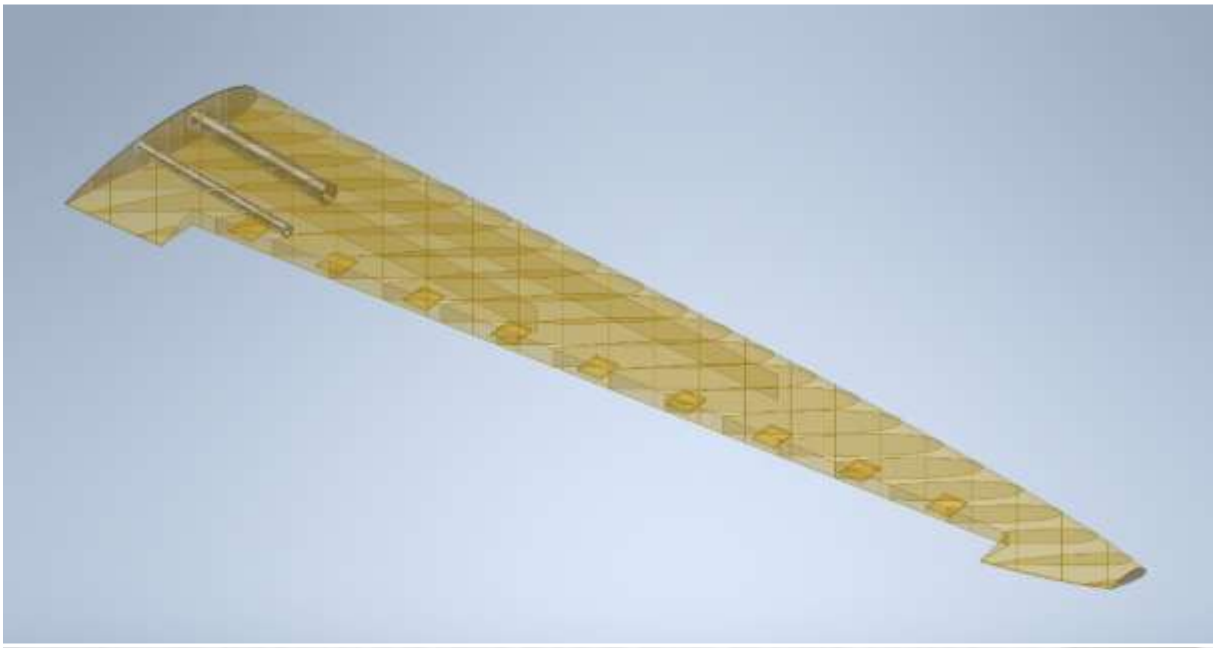

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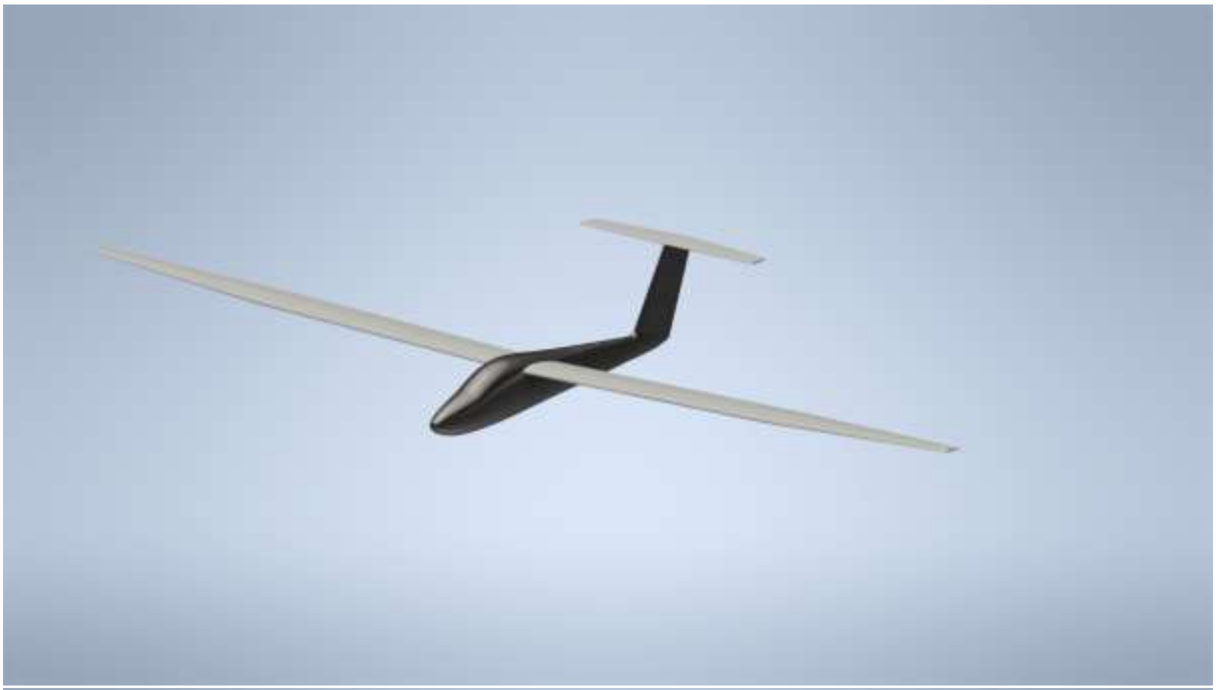

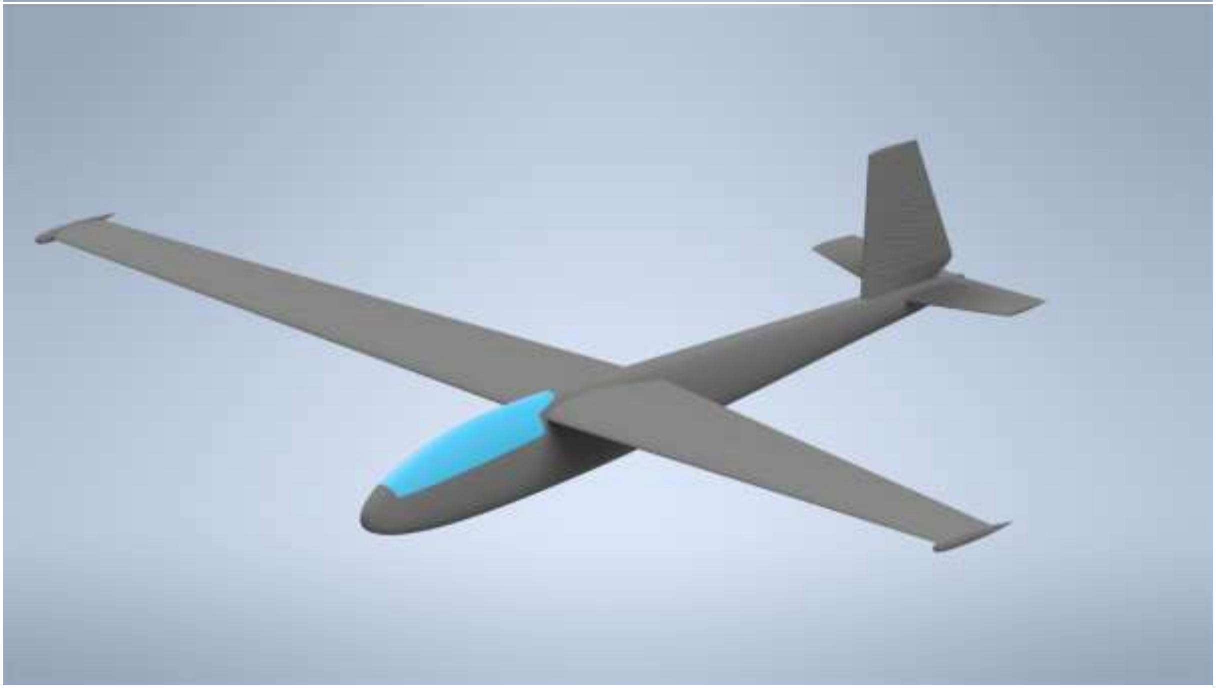

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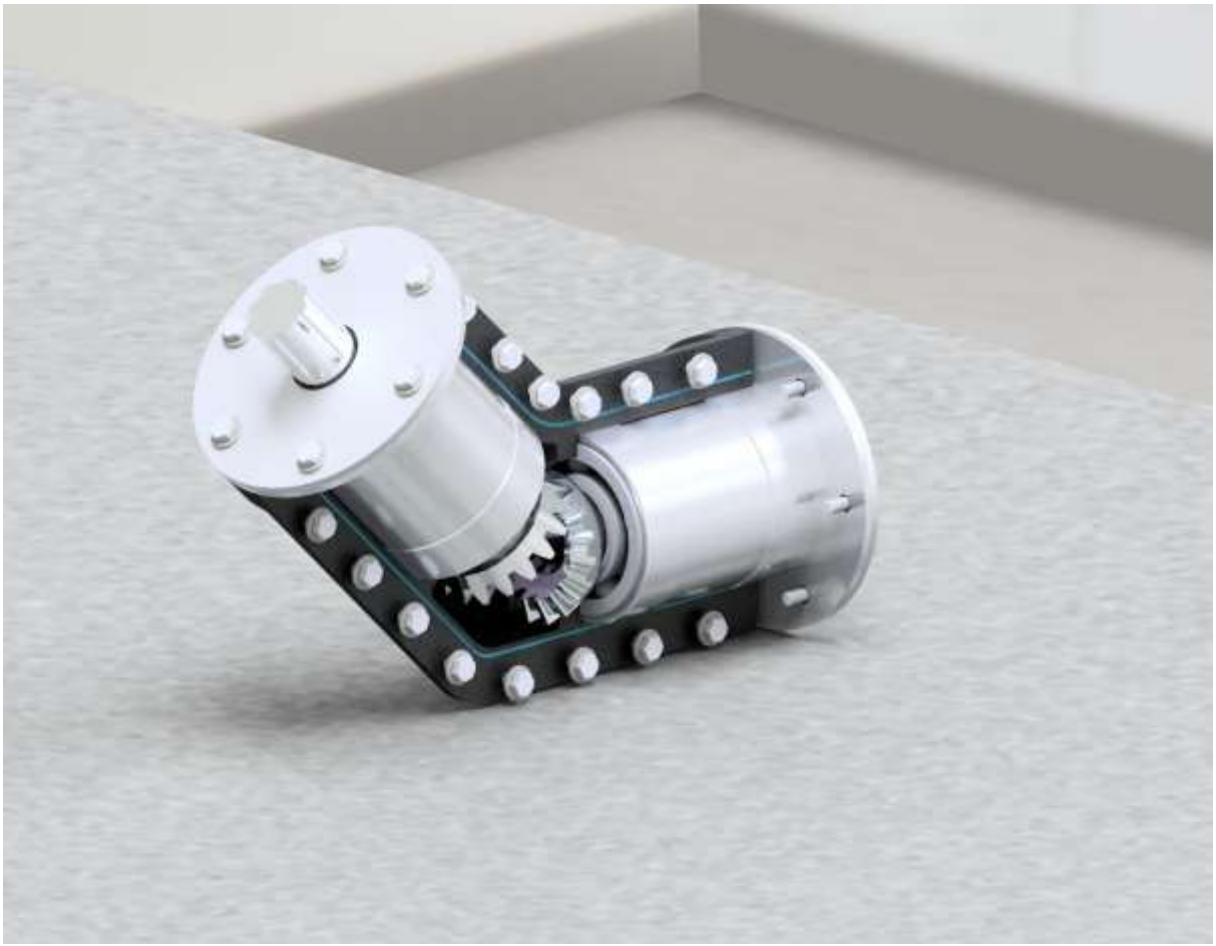

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