AVIOX AEROSPACE

Engineering

UAV & Drone Development

Aerodynamics

Project portfolio – adapted version for webpage

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Content

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1 Executive Summary

Aviox Aerospace is a one-man engineering company, specializing in aerodynamics and the development of unmanned aerial vehicles (UAVs), drones and Model aircraft. Customers can expect tailored engineering services for UAVs of all applications.

Aviox Aerospace takes advantage of modern simulation tools: Flow5, CFD, multiple purpose-built excel-sheets to calculate flight performance and generate important data for flight testing.

Founded by Nikolas Schalhaas, Aviox Aerospace has contributed to numerous projects across recreational, commercial, and research-driven applications. Aviox Aerospace ´s work is rooted in a deep understanding of flight physics, years of experience in flying, building and flying model aircraft, and a commitment to delivering precise, reliable designs tailored to each client's mission requirements.

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.

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2 Founder

Nikolas Schalhaas is an aeronautical engineer specializing in the field of UAV and drone development. Over the course of his career, he has successfully contributed to more than 50 individual projects for private clients, businesses, and research-oriented partners.

His fascination with aviation began in early childhood. In 2016 he entered the world of aeromodelling, initially by flying RC aircraft and soon after by designing and building his own airframes. Since 2023 he has also been actively flying manned glider aircraft.

His long-standing enthusiasm for flight, combined with formal training at *HTL Eisenstadt – Flugtechnik*, an Austrian technical college focused on aeronautical engineering, led to multiple freelance engineering engagements starting in 2022 and ultimately to the establishment of his own company Aviox Aerospace in July 2024.

Since its foundation, the business has evolved from a CAD and 3D-printing service into a specialized consultancy for UAV aerodynamics, prototyping, and design.

Alongside his professional activities, Nikolas remains actively involved in several RC and glider flying clubs, enjoys travelling, and maintains a strong interest in sports, especially skiing, hiking and weightlifting.

Figure 1: Nikolas Schalhaas

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3 Core Competencies

- **Aerodynamics, Simulation and Aircraft design**

  XFLR5, Flow5, Autodesk CFD, OpenVSP, Stability analysis, further calculations in specialized tools in Microsoft Excel

- **CAD Softwares**

  Expertise in multiple CAD Softwares: Inventor, Fusion, AutoCAD, 3D-Experience, CATIA, SolidWorks (Currently only Fusion available for commercial projects)

- **Design Methods**

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

- **Types of projects**

  UAVs, General Aviation, Mechanical components

- **Responsibilities**

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

- **Additional Competences**

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

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4 Software Expertise

- CAD
  - AutodeskFusion (currently available)
  - Autodesk Inventor
  - Solidworks
  - 3D-Experience
    - Part Design
    - Generative Shape Design
    - Assembly Design
  - OpenVSP
- Simulation
  - XFLR5
  - Flow5
  - OpenVSP
  - Autodesk CFD
  - Ansys Fluid/Mechanical
  - Flying wings
    - Nurfluegel
    - Nur12d

5 Key Achievements

- **Multiple UAVs approaching serial production**
- **Collaborations with startups and companies from Austria, Germany, USA and Italy**

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6 Responsibilities

- Design and Development of Model aircraft, Drones and UAVs, primarily optimized for 3D printing and composite manufacturing
    - Concept development
    - Airfoil selection
    - 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
- Programming of tools and websites in Python, HTML and Excel

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7 Major Projects and Developments

So far, Aviox Aerospace has played crucial roles in multiple unmanned and manned aircraft developments, out of which 4 are presented:

7.1 Flying Wing UAV (Project under NDA)

Note: Due to a non-disclosure agreement, only low-level information about this project and no photos can be shared.

Project Duration: From September 2023

Project Type: UAV Development

Client: Private company based in the United States, with partners across several European countries

Responsibilities: Structural design, aircraft geometry, aerodynamics, flight stability, simulation

Contributions:

- Sole development of the UAV
- Consideration of the specific characteristics of tailless aircraft
- Continuous coordination with international team members
- Implementation of the structural design

Project Overview

Since September 2023, Nikolas Schalhaas and later Aviox Aerospace has been part of an international team working on the design and realization of a tailless fixed-wing UAV. Initially tasked solely with creating the CAD model in accordance with the project requirements, the scope of responsibility expanded significantly over time. Full responsibility for aircraft geometry, aerodynamics, flight stability, and simulation was ultimately assigned.

As of December 2025, multiple variants of the UAV—built in different sizes and structural configurations—have been manufactured and successfully flight-tested. Several units have already been delivered to international customers.

Ongoing activities include negotiations with additional clients, further flight demonstrations using existing prototypes, and the optimization of multiple variants for their respective mission profiles in preparation for serial production.

The primary mission of the UAV is reconnaissance. Accordingly, the design is optimized for maximum efficiency, extended range, and low flight speeds.

Due to strictly planned production timelines and fixed schedules for flight tests and demonstrations, significant parts of the project had to be done under time pressure to achieve the best possible results within the available timeframe.

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Despite the geographical distance between contributors, international collaboration has proved highly effective. Regular communication and thorough progress reporting have been key factors in the project's success.

Technical Specifications

- **Wingspan:** 2,5m to 4,5m
- **Mass:** 10–30 kg
- **Intended Use:** reconnaissance
- **Range:** >300 km

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7.2 Canard-Wing Light Sports Aircraft

Note: Due to a non-disclosure agreement, only low-level information about this project and no photos can be shared.

Project Duration: April 2025 until September 2025

Project Type: Canard Light Aircraft Reverse Engineering and Development

Client: Private individual with connections to the local aviation industry

Responsibilities: Structural design, consulting for remotely controlled prototypes and prototype manufacturing, consulting on composite material construction

Contributions:

- Reverse engineering based on photographic material
- Problem-solving across design and manufacturing aspects
- Preparation for composite manufacturing
- Technical consulting
- Aircraft design and design of composite layup molds

Project Overview

Based on an existing canard-configuration light aircraft, a new aircraft with a modified fuselage and a full carbon fibre structure was to be developed. The customer provided Aviox Aerospace with technical documents of the initial aircraft to keep the new aircraft in compliance to it.

The initial phase involved recreating the existing aircraft in CAD. This digital model will form the basis for discussions with national aviation authorities in order to define permissible modifications and subsequently manufacture the aircraft as a one-off experimental build.

Despite the higher development and material costs, the goal is to significantly reduce manual labor during manufacturing, improve production quality, and integrate customer-specific features directly into the aircraft.

This project is still under work, however, due to a lack of funds its continuation was delayed.

Technical Data:

- **Wingspan:** approx. 14 m
- **Intended Use:** Multi-seat experimental homebuilt aircraft
- **Construction Method:** CFRP (Carbon Fiber Reinforced Polymer)

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7.3 UAV for Wildlife Observation

Duration: April 2024 until August 2024

Type of Project: UAV-Development

Customer: Group of engineers 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. Many requirements were set by the customer, e.g.:

- 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.

Technical Data

- Wingspan: 4 m
- Construction method: CFRP
- Range: >300 km

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Images:

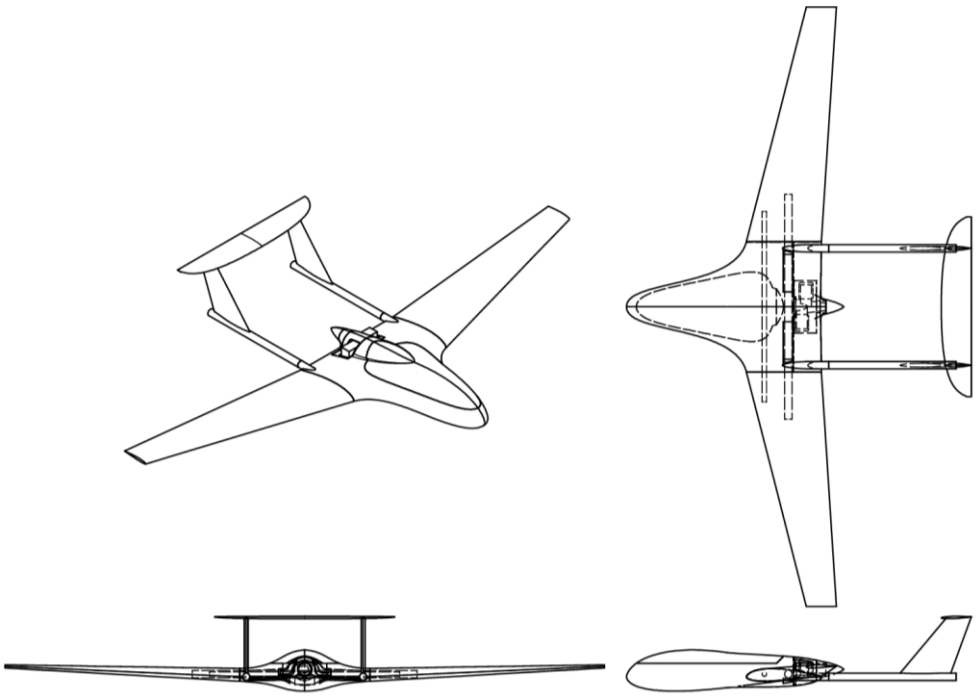

Figure 2: Wildlife Observation UAV

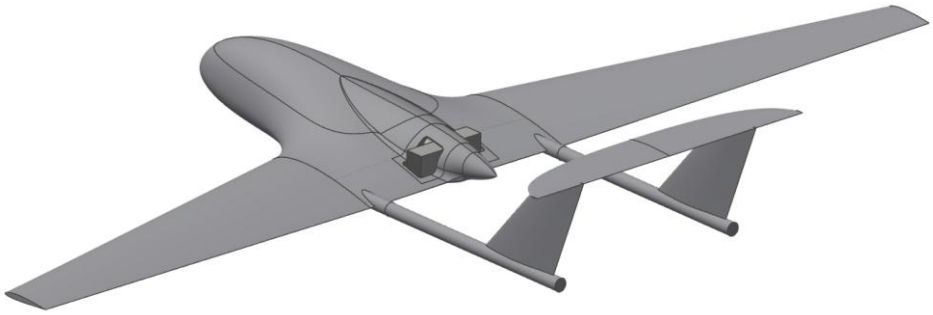

Figure 3: Wildlife Observation UAV

Figure 4: Wildlife Observation UAV

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7.4 X-47B flying wing 3D-printable Model aircraft

Duration: from September 2024

Type of Project: Model-Aircraft-Development

Client: private individual from the US

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

Work:

- Initial concept design
- Consideration of the characteristics of flying wings with no vertical surfaces (Horten-principle)
- Flight stability and performance simulations
- Realistic CAD Design of the X-47B ´s airframe considering its aerodynamic characteristics
- Many functional scale details: Landing Gear, Bomb Doors, Control surfaces, Engine inlet and nozzle
- Preparation for 3D printing – reduction of support structures in printing
- Support in the process of 3D printing large aircraft
- Support in assembling the first prototype
- Execution of the first flight

Description:

Starting in September 2024, a realistic RC model aircraft of the X-47B was under work. The client wished a high grade of detail and several working functions, such as retractable landing gear with gear doors, Bomb Doors and a realistic Engine Inlet and Nozzle. The wingspan was set at 2,4m, the mass at 10kg. This likely makes the X-47B one of world ´s largest and heaviest fully 3d printed true flying wings (following the Horten-principle). To ensure stable flight, the Horten-principle was applied to the wing and lift distribution. This turned out as the best decision, as in later flying tests, the X-47B ´s flying characteristic could not have been beaten by commercially available Flying wings.

The development of the X-47B was finished in February 2025. printing of the more than 200 parts and assembly was finished in July just before the first flight.

Based on the initial version, which was used for the first flight tests, a new version was developed to overcome some of the issues that came up with the stiffness of the landing gear. A third version is less focused on realism, but rather on performance, payload and grass operations. This Version features a larger EDF, modified landing gear and aerodynamically improved engine nozzle and is still under construction. The first flight is expected in spring.

Technical Data

- Wingspan: 2,4 m
- Construction method: Fully 3D printed out of LW-ASA
- Mass: 10kg
- Propulsion: 105mm EDF / 120mm EDF

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Images:

Figure 5: X-47B

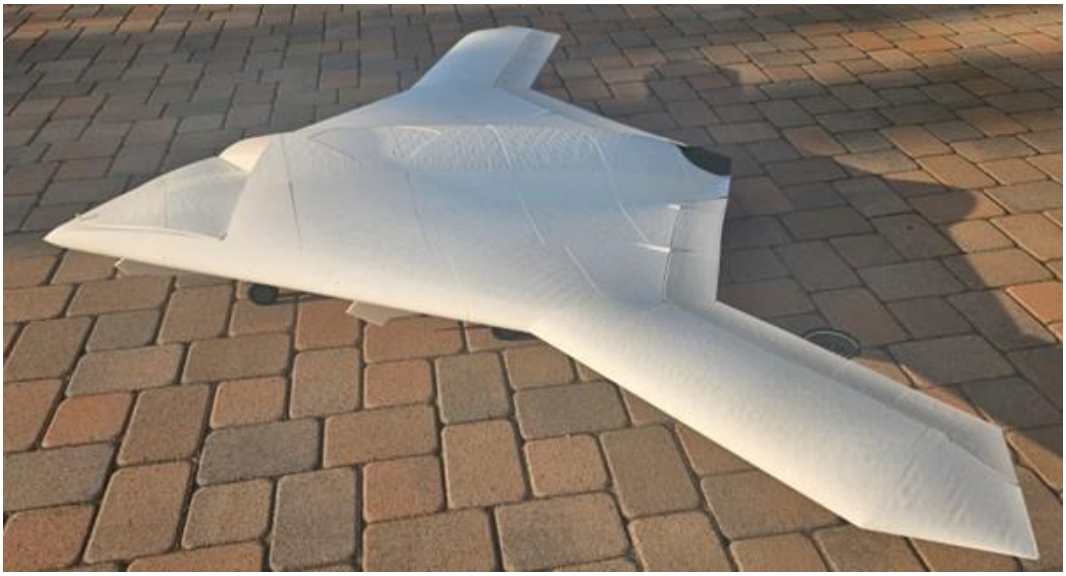

Figure 6: X-47B

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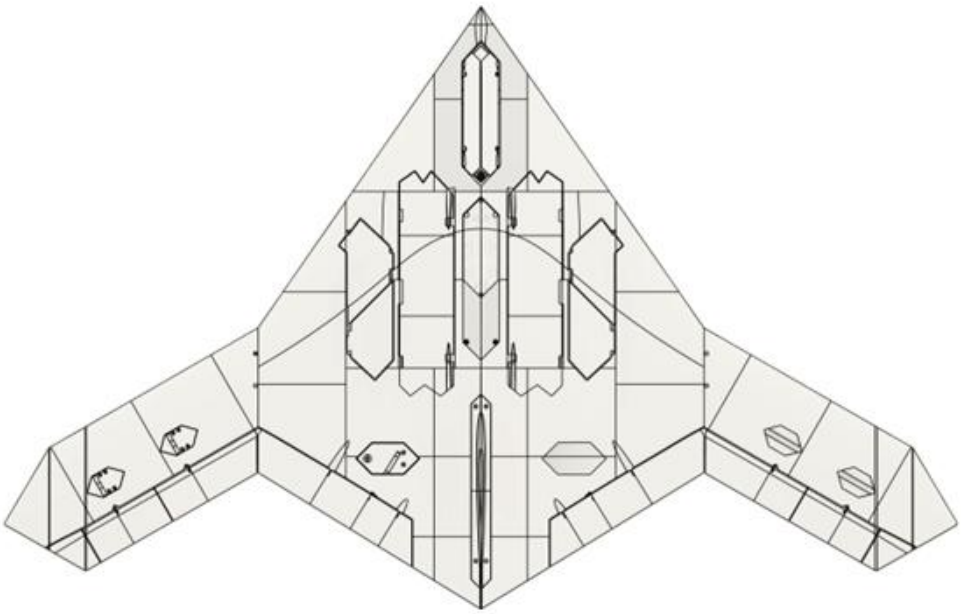

Figure 7: X-47B

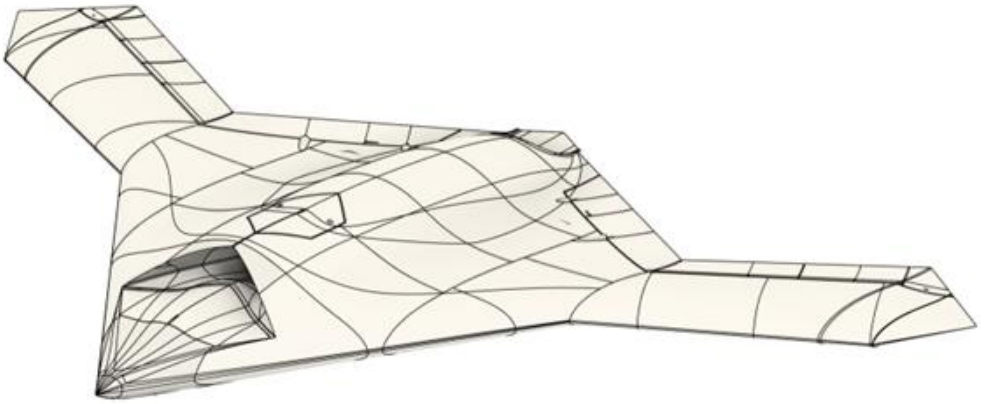

Figure 8: X-47B

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8 Founder´s personal projects

In Addition to his commercially used projects, the Founder Nikolas Schalhaas has also completed multiple personal and educational projects, out of which 2 are to be presented:

8.1 Development of a stratospheric glider (Diploma thesis Nikolas Schalhaas)

Duration: April 2024 until June 2025

Type of Project: Diploma thesis

Responsibilities: Design, Aircraft geometry, aerodynamics, Flight Stability, Simulations, prototyping, project management

Description:

Nikolas Schalhaas was the leader of a team of 4, working on the development of a stratospheric glider (named “StratoFly”).

The diploma project focused on the design and development of “StratoFly,” a stratospheric glider for high-altitude weather data collection. Originally launched in cooperation with the Austrian weather service and an investor, the project was restructured after the partners withdrew. Nikolas briefly considered integrating the whole project into his company Aviox Aerospace but was unable to pursue this due to time constraints and his school´s requirements.

Nikolas led the project from concept to prototype, applying his expertise in UAV and model aircraft development. Key challenges included maintaining static and dynamic stability up to 30 km altitude, ensuring a consistent centre of gravity, and achieving spin-free flight. Stability simulations were performed using Flow5.

The fuselage was designed to be both voluminous and aerodynamically efficient, accommodating multiple professional measurement instruments.

Before designing the wings, a major issue was identified: by default, neither CATIA nor 3D-Experience provides a reliable way to import airfoil profiles as point clouds. To solve this, an Excel-based tool with macros was developed to import airfoils into 3D-Experience. Over time, the tool was expanded and is now highly capable:

- Conversion of various airfoil file formats (Selig, Lednicer)
- Optional trailing-edge closure
- Automated correction of decimal separators for proper import
- Arbitrary scaling of the airfoil
- Free translation and rotation around all axes using a 3D rotation matrix
- Compatibility issues between different Excel versions were fully eliminated.

To make “AirfoilImport” safely available to third parties and prevent unauthorized access, a proper user interface was created, all background operations were hidden and password-

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protected, and only necessary cells were editable. In this form, “AirfoilImport” was provided to HTL Eisenstadt for teaching purposes.

This allowed the wings to be modeled very quickly and kept easily adjustable at any time.

A prototype was built and tested on the ground, flight tests were cancelled due tot he absence of a team member.

Specifications:

- Wingspan: 2 m
- Mass: 2 kg
- Construction methods: 3D printing and CFRP

Figures:

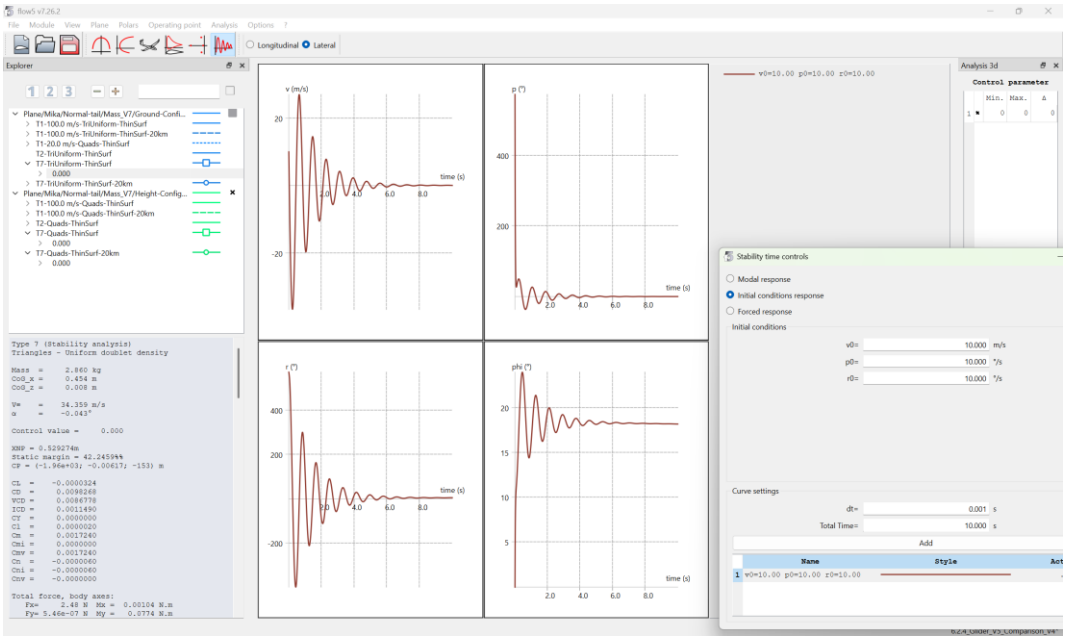

Figure 9: Stratospheric Glider: lateral dynamic stability in Flow5

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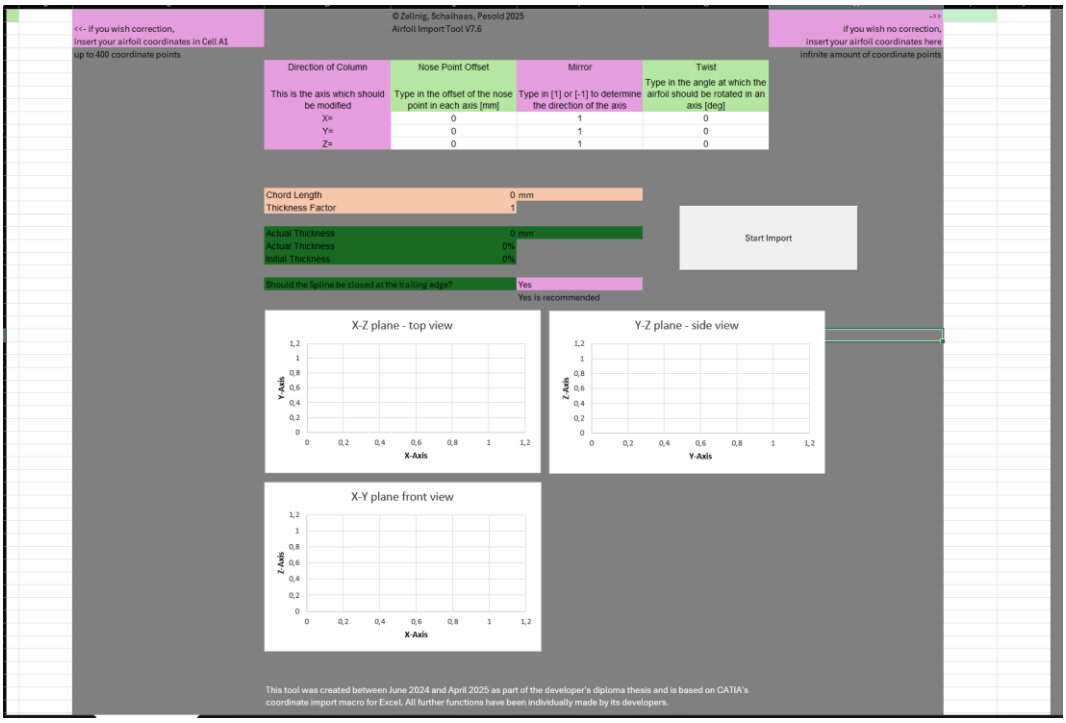

Figure 10: Stratospheric Glider: User Interface of the Excel-tool "AirfoilImport"

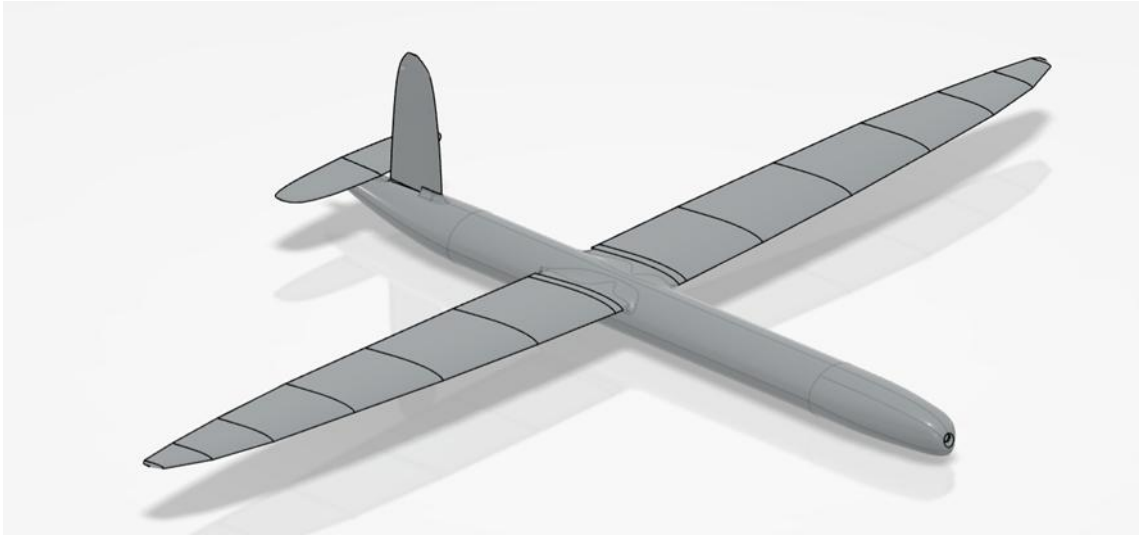

Figure 11: Stratospheric Glider: 3D model in 3D-Experience Generative Shape Design

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Figure 12: Stratospheric Glider: Team with "StratoFly"

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8.2 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 at HTL Eisenstadt, a passenger aircraft was fully designed, modelled in CAD and simulated.

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 airfoils (followed by airfoil selection)
- Centre of gravity position and static margin
- High-lift devices (flaps)
- 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 Nikolas Schalhaas´ 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 shape.

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

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Figures:

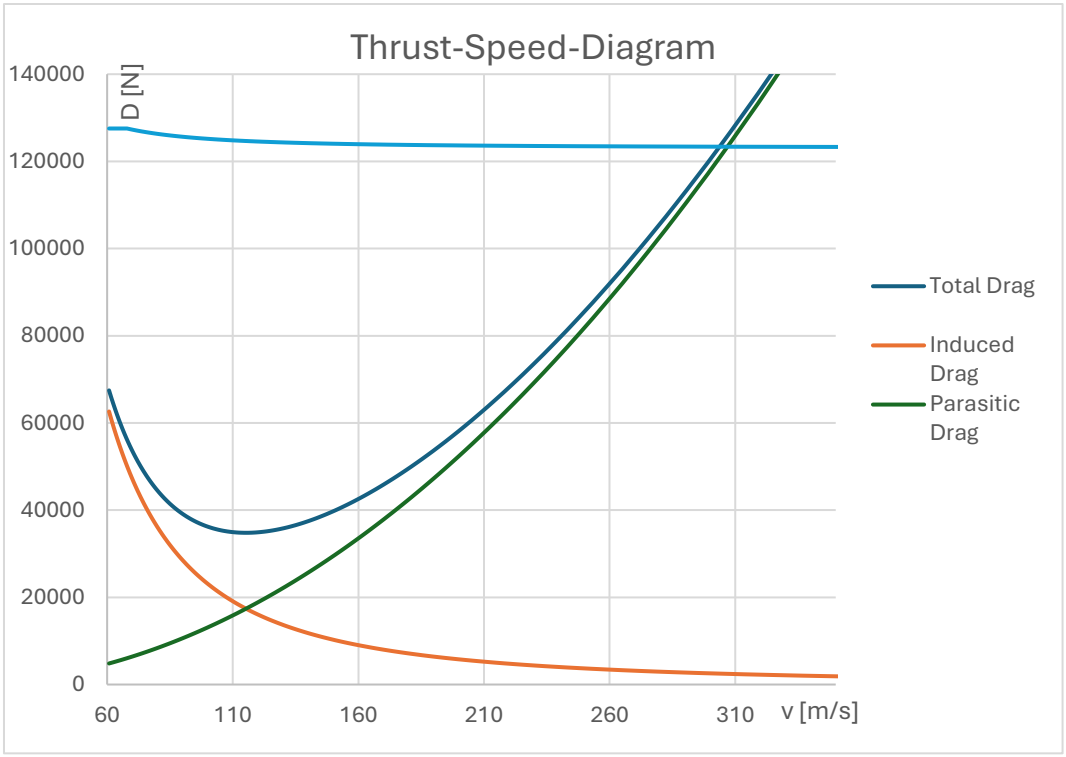

Figure 13: Short-Range-Jet: Thrust-Speed-Diagram

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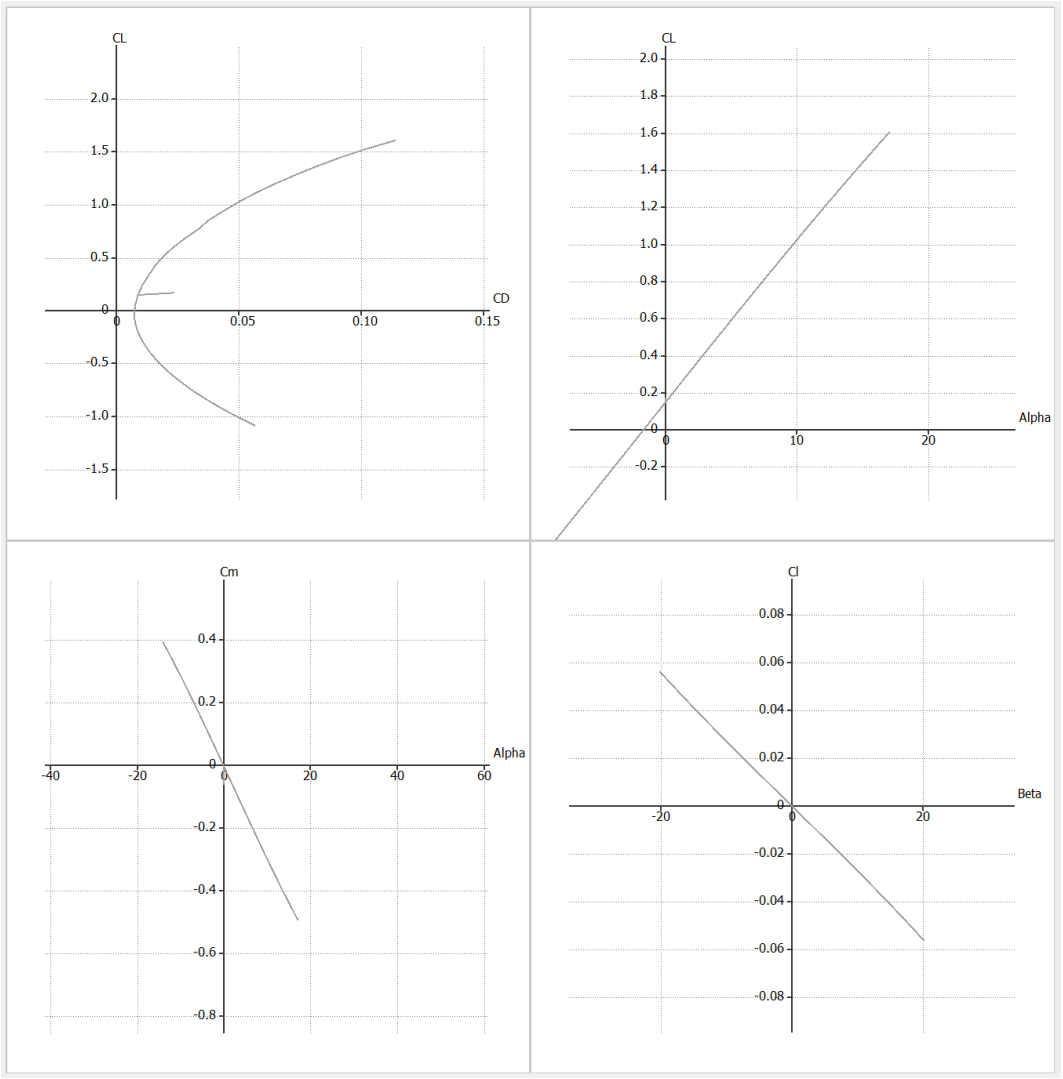

Figure 14: Short-Range-Jet: Static longitudinal flight stability in Flow

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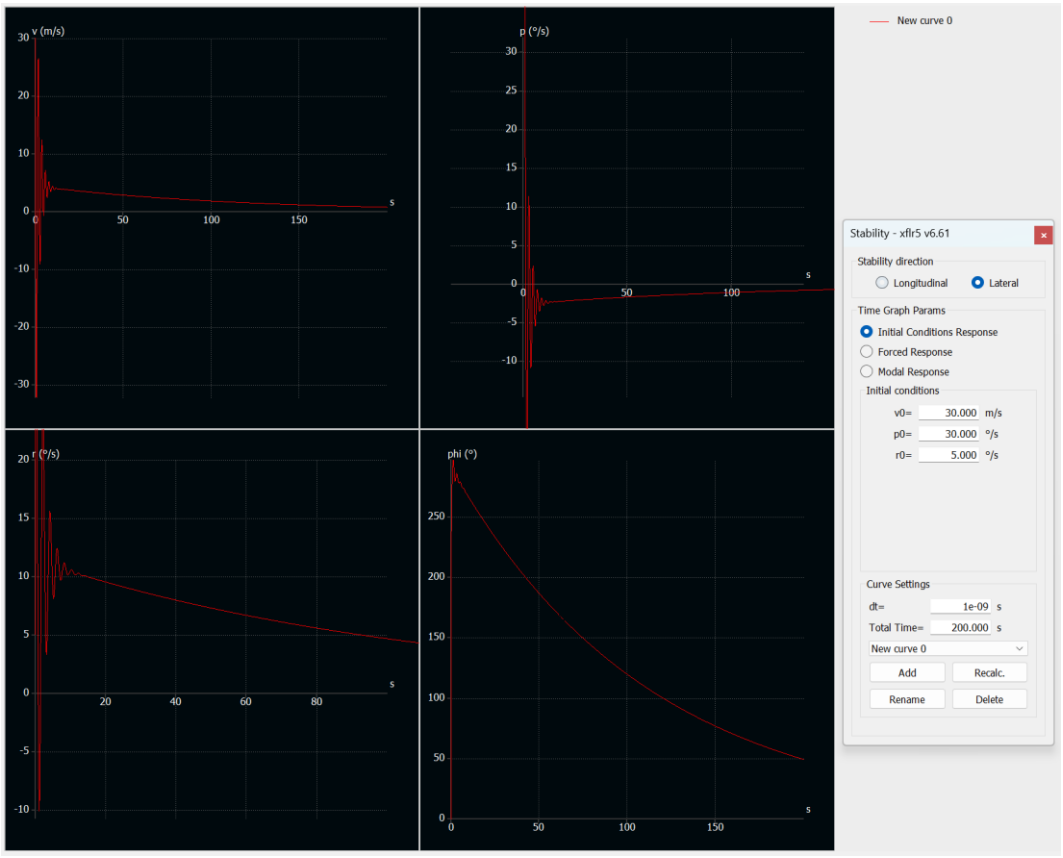

Figure 15: Short-Range-Jet: Dynamic lateral flight stability in Flow5

Figure 16: Short-Range-Jet: 3D model in 3D-Experience Generative Shape Design

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Figure 17: Short-Range-Jet: Rendering with custom "SN-145" livery

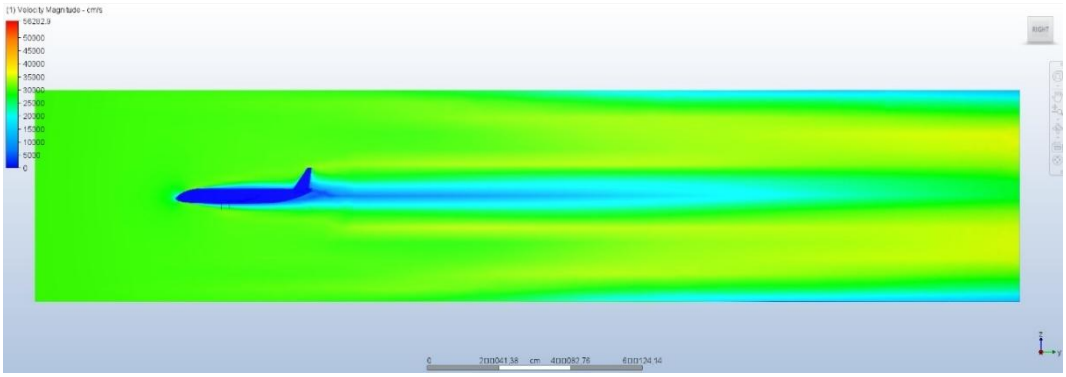

Figure 18: Short-Range-Jet: CFD-Simulation of far-field effects of the aircraft in longitudinal-lateral plane

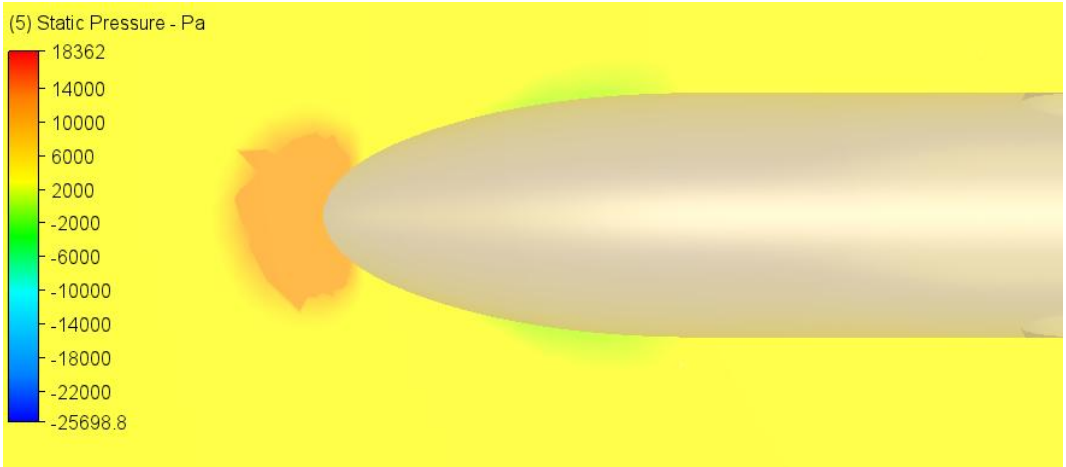

Figure 19: Short-Range-Jet: CFD-Simulation of the fuselage Nose Section

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9 Additional projects & samples

Additionally, Aviox Aerospace (or its Founder Nikolas Schalhaas) has completed over 50 smaller assignments for various private and commercial clients. These ranged from model aircraft designs to reverse engineering of individual components and CAD-Troubleshooting. 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)
  - Heinkel He-178 (August 2023)
  - Swift S1 Test Platform (March 2025)
- 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)
- Realistic Renderings of existing or purpose-designed CAD files
- Design of Mechanical Components
  - Gearboxes
  - Parts for Piston Engines
  - Parts for Jet engines
  - Axles & Bearings
- CFD simulations of various parts (aviation & non-aviation related)
- CAD-Troubleshooting
- Small-batch serial production of 3D printed parts

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Images:

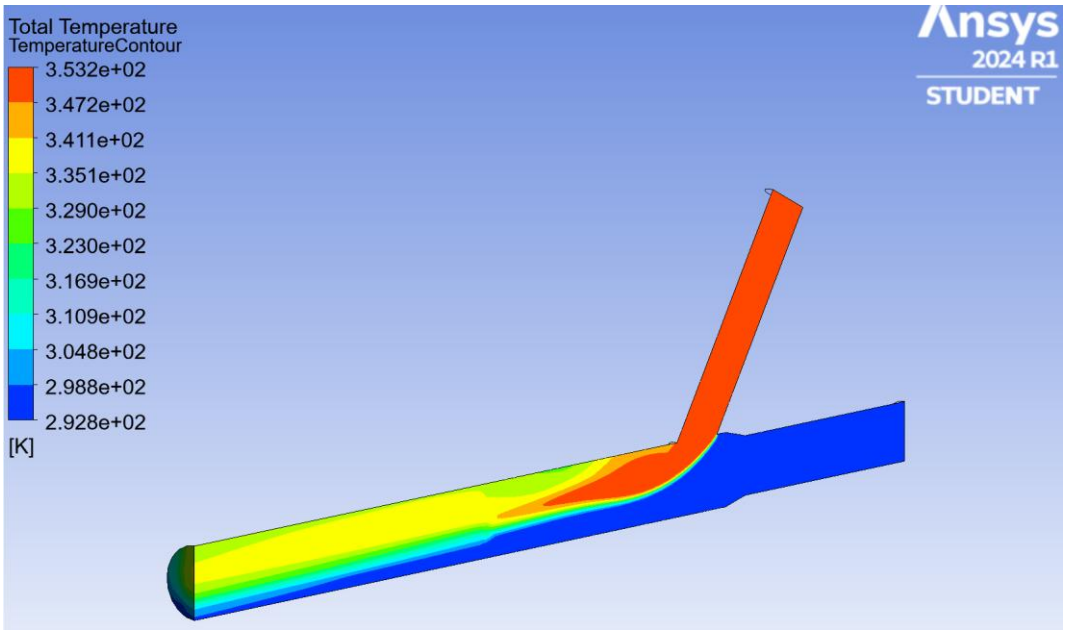

Figure 20: Sample Pictures: CFD-Simulation of a tube with hot and cold air mixing (temperature view)

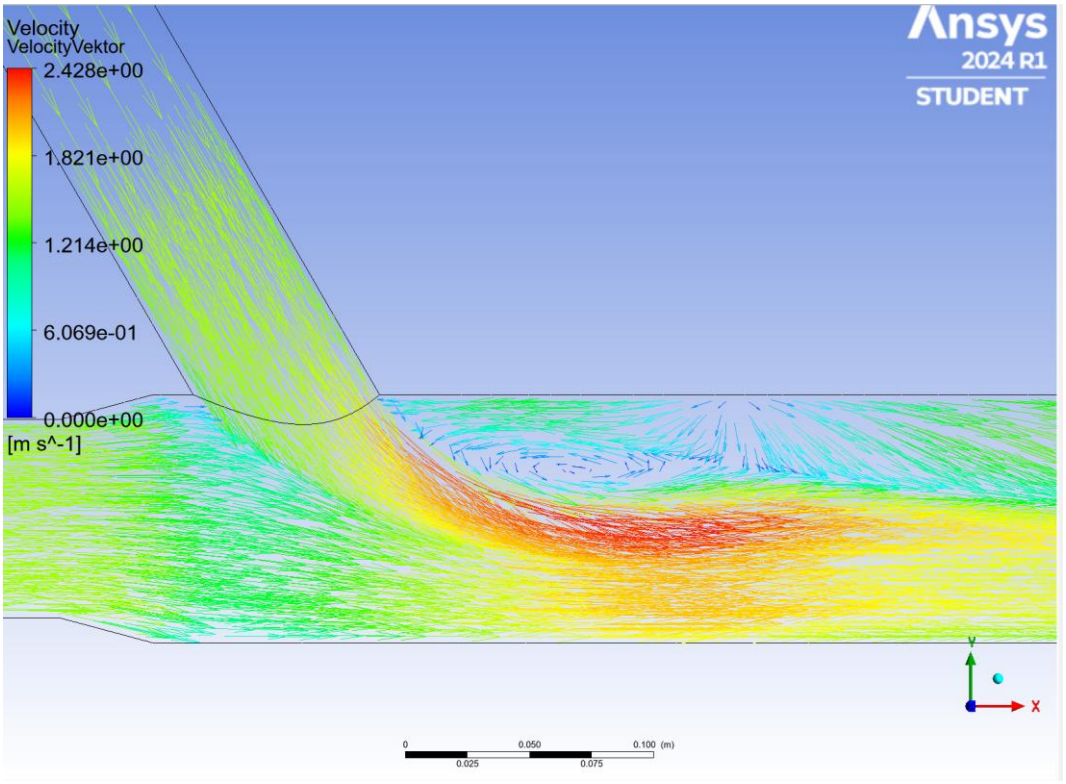

Figure 21: Sample Pictures: CFD-Simulation of a tube with hot and cold air mixing (velocity view)

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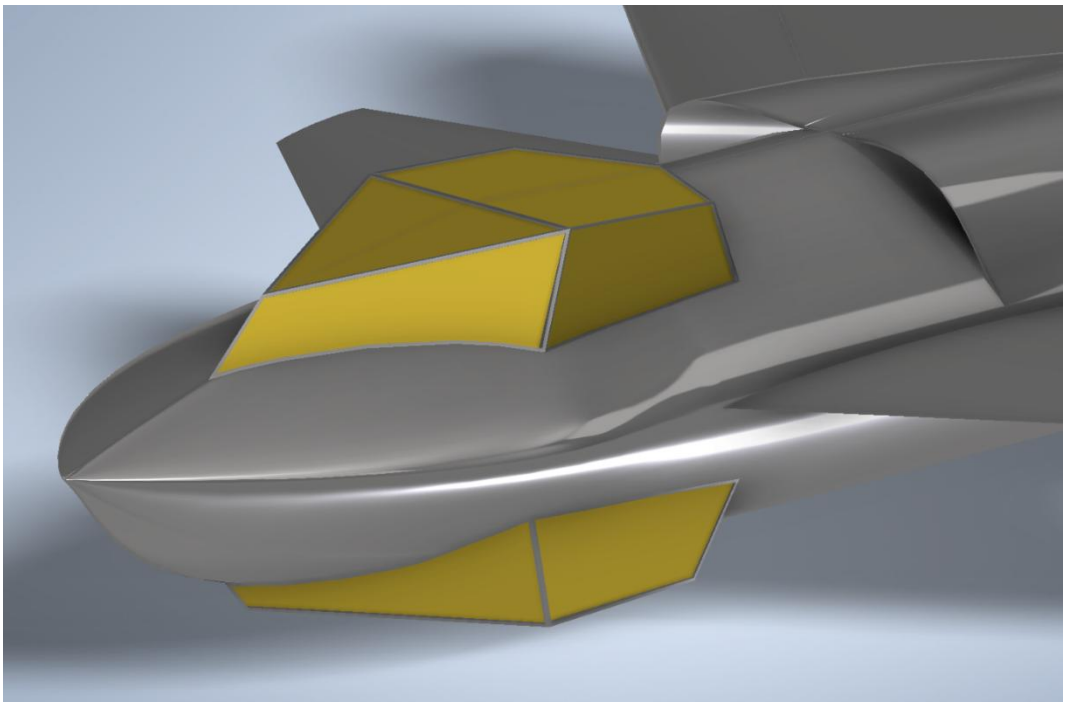

Figure 22: Sample Pictures: Stealth-UAV-Concept Visualisation following instructions from customer´s master´s thesis

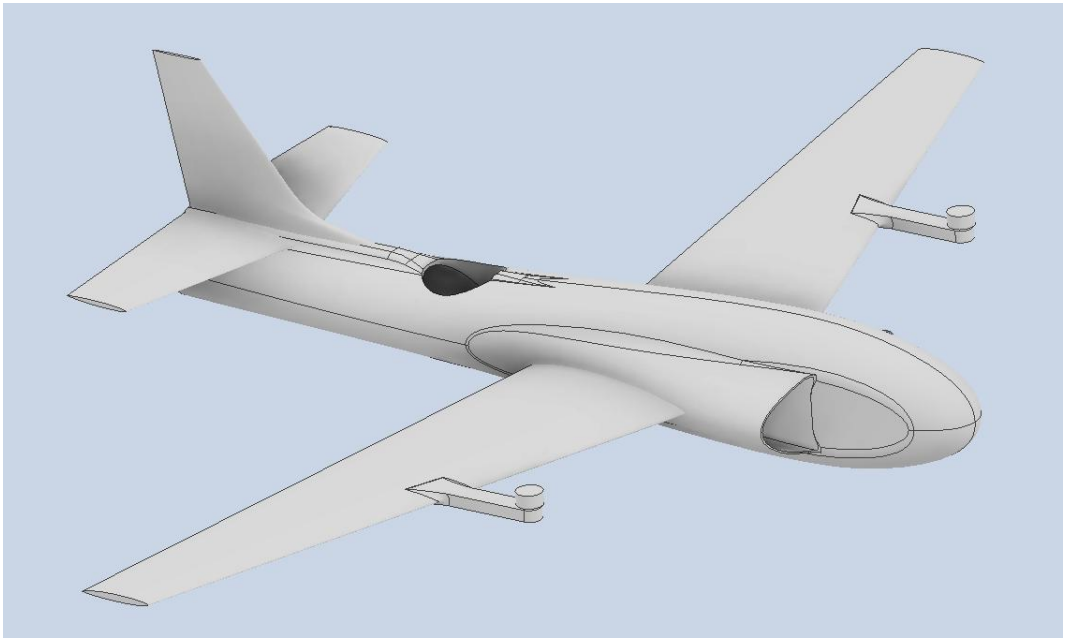

Figure 23: Sample Pictures: VTOL UAV

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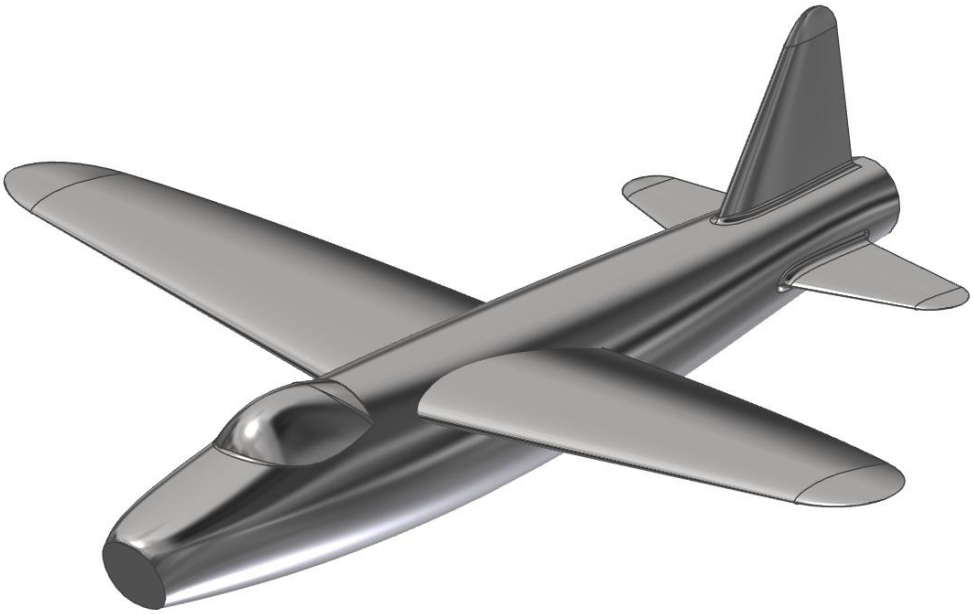

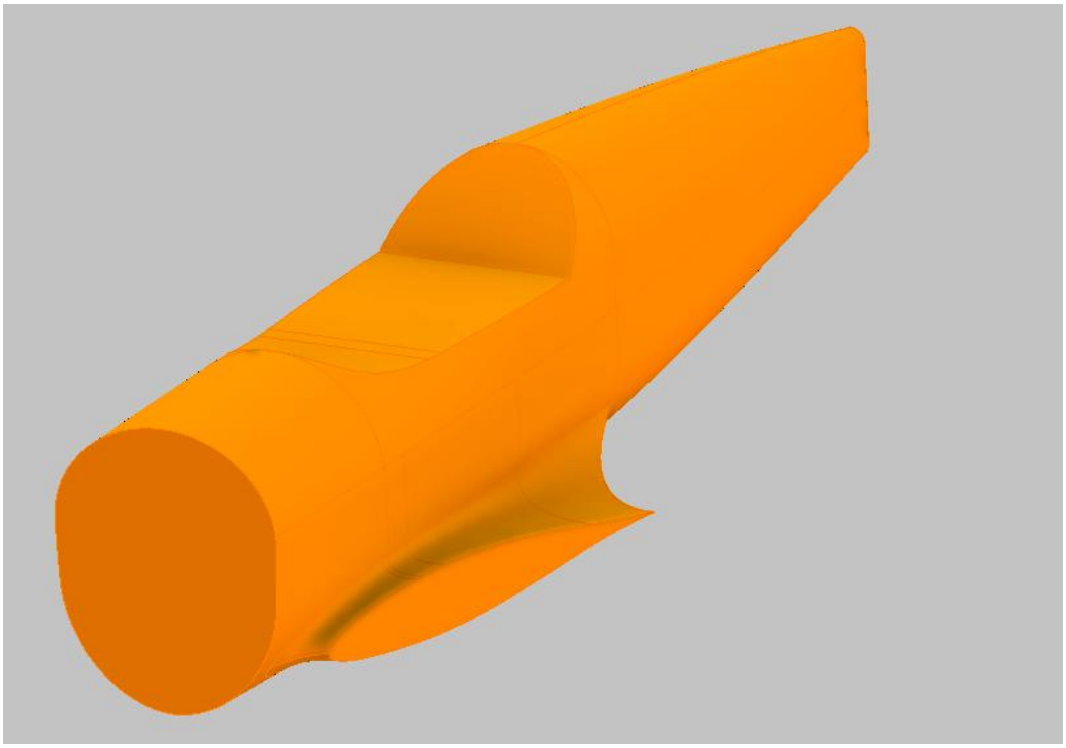

Figure 24: Sample Pictures: Fuselage of an ultralight aircraft, where the wing-fuselage-transition was optimized

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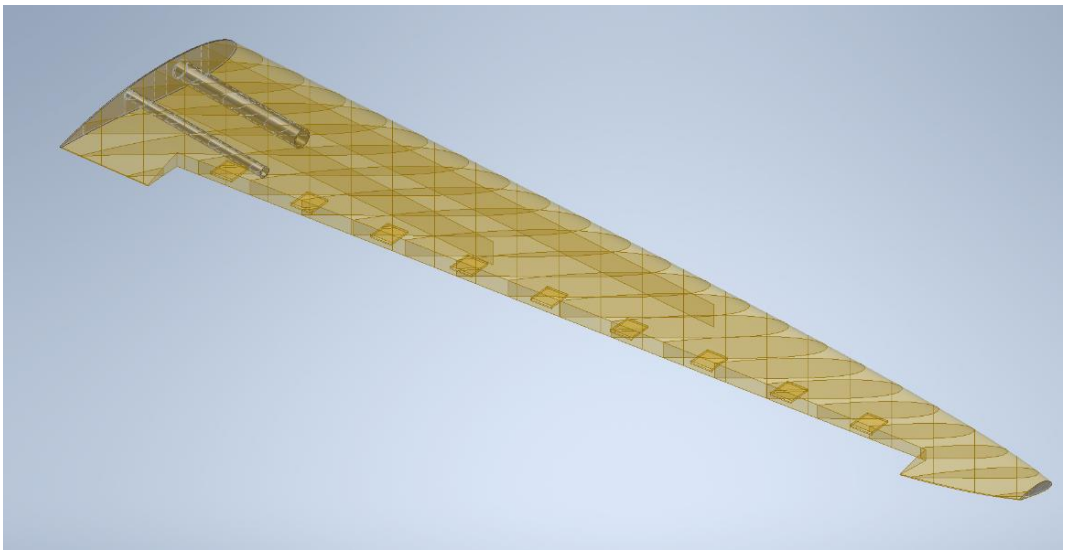

Figure 25: Sample Pictures: internal structure of a 3D-printable wing

Figure 26: Sample Pictures: Tail of a small-scale 3D-printable model aircraft (Douglas TBD-1)

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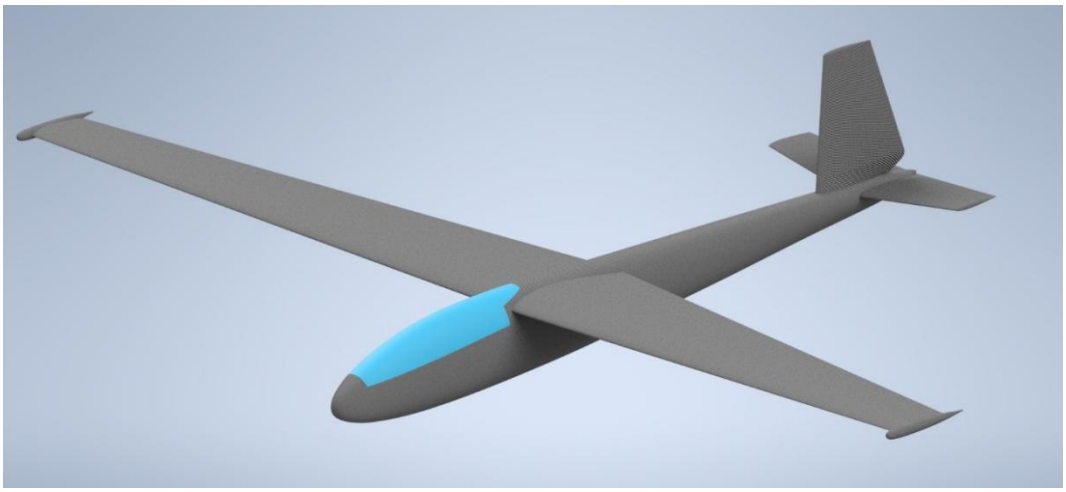

Figure 27: Sample Pictures: Blanik Glider

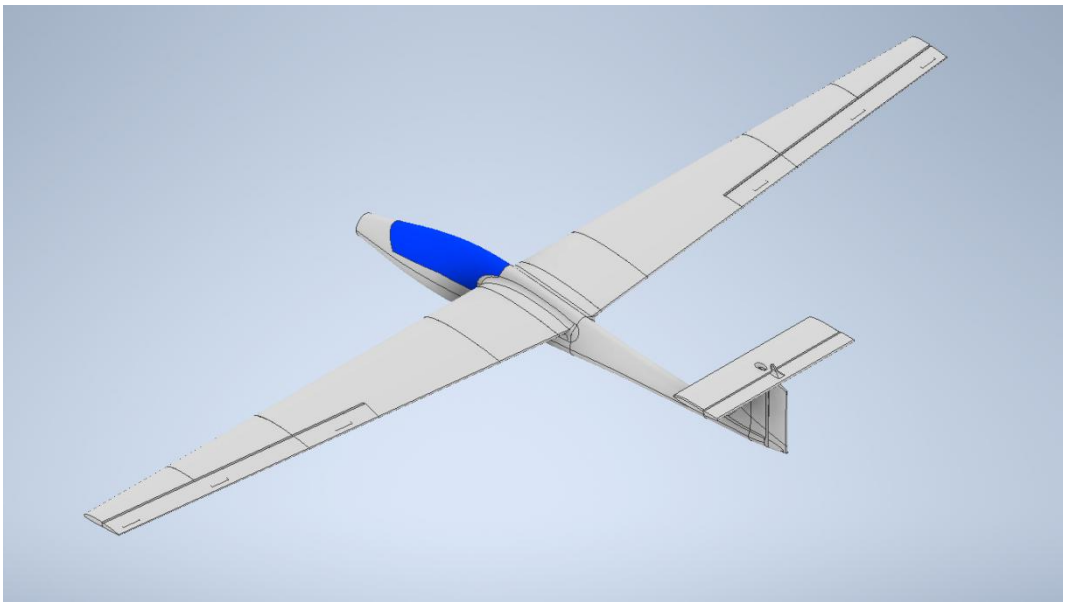

Figure 28: Sample Pictures: Simple Motorized RC Glider

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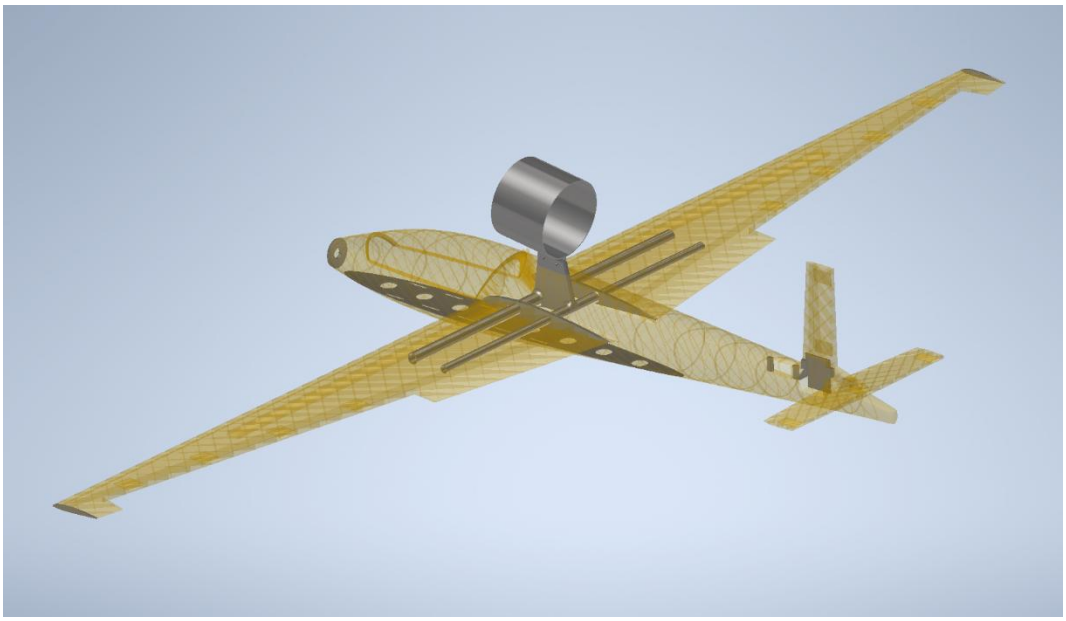

Figure 29: Sample Pictures: EDF-Powered Swift S1 RC Glider

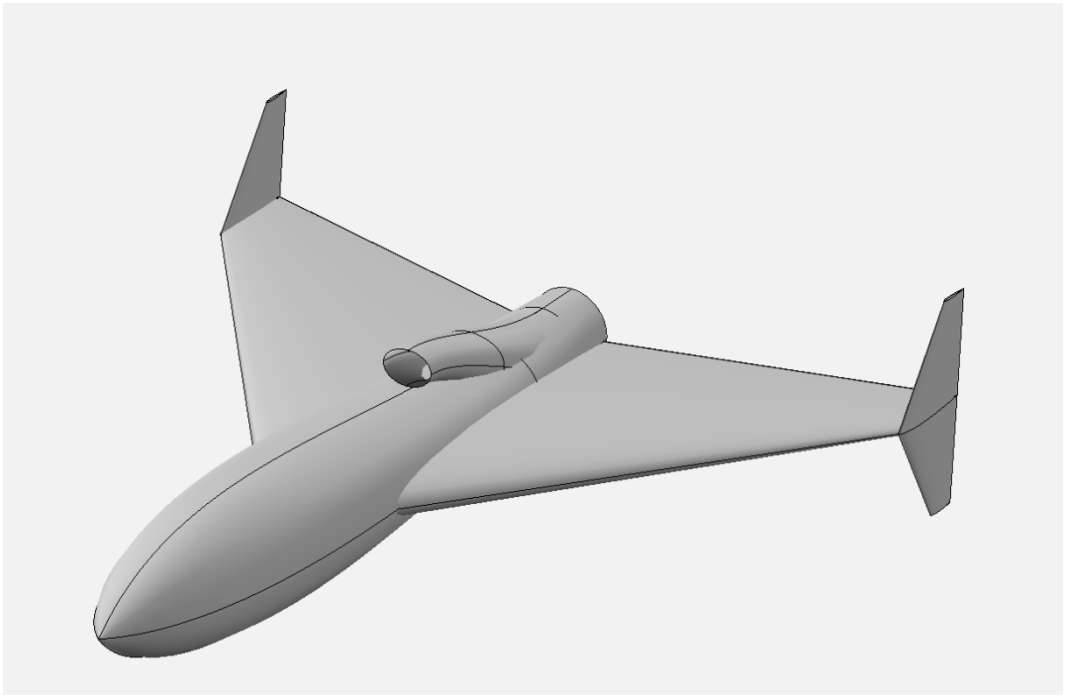

Figure 30: Sample Pictures: Turbine powered UAV inspired by Shahed 238, isometric View, in OpenVSP

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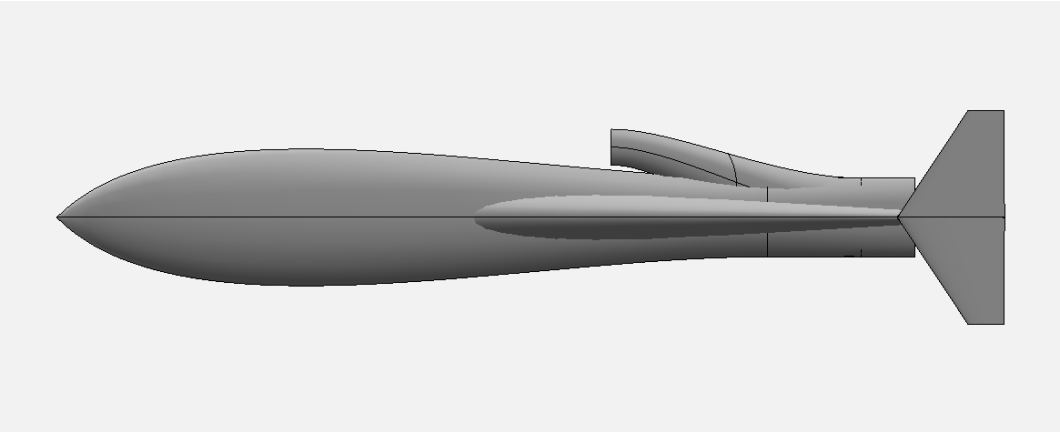

Figure 31: Sample Pictures: Turbine powered UAV inspired by Shahed 238, side view, in OpenVSP

Figure 32: Sample Pictures: Thorp T18 3D model, yellow livery

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Figure 33: Sample Pictures: Thorp T18 3D model, blue livery

Figure 34: Sample Pictures: Starlite 6 3D model, yellow livery

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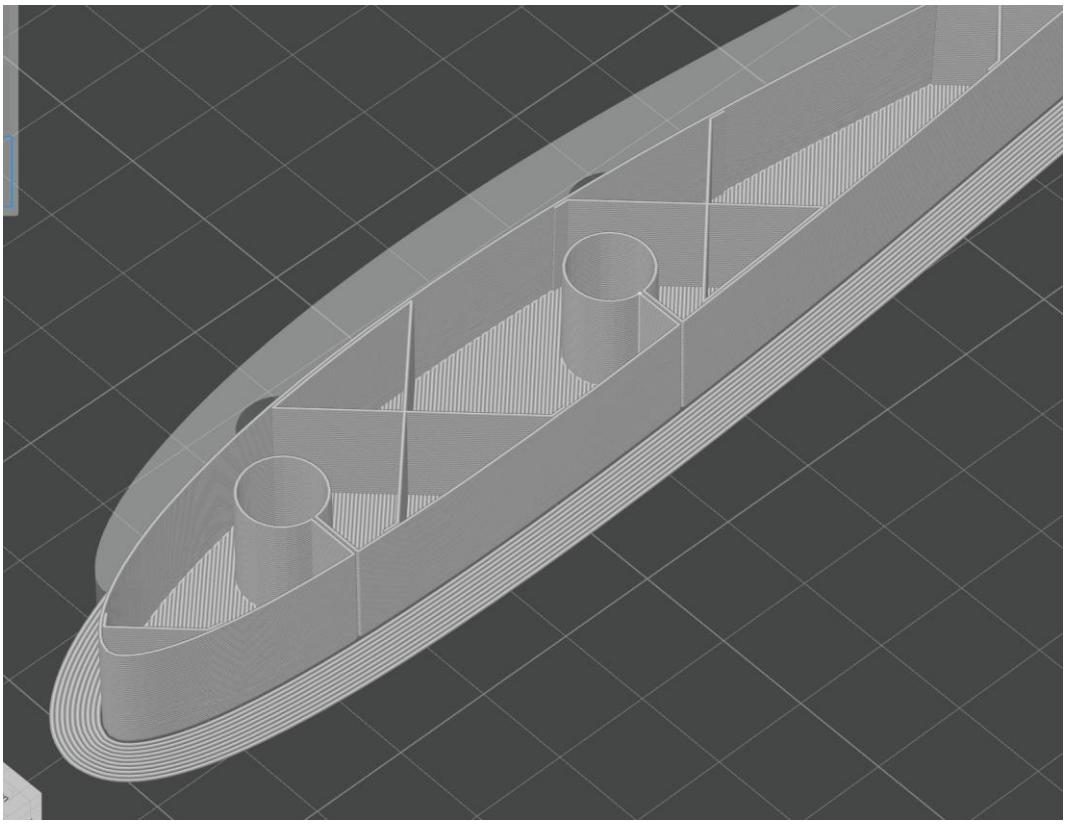

Figure 35: Sample Pictures: Internal structure of a 3D-printed wing in slicer-software "BambuStudio"

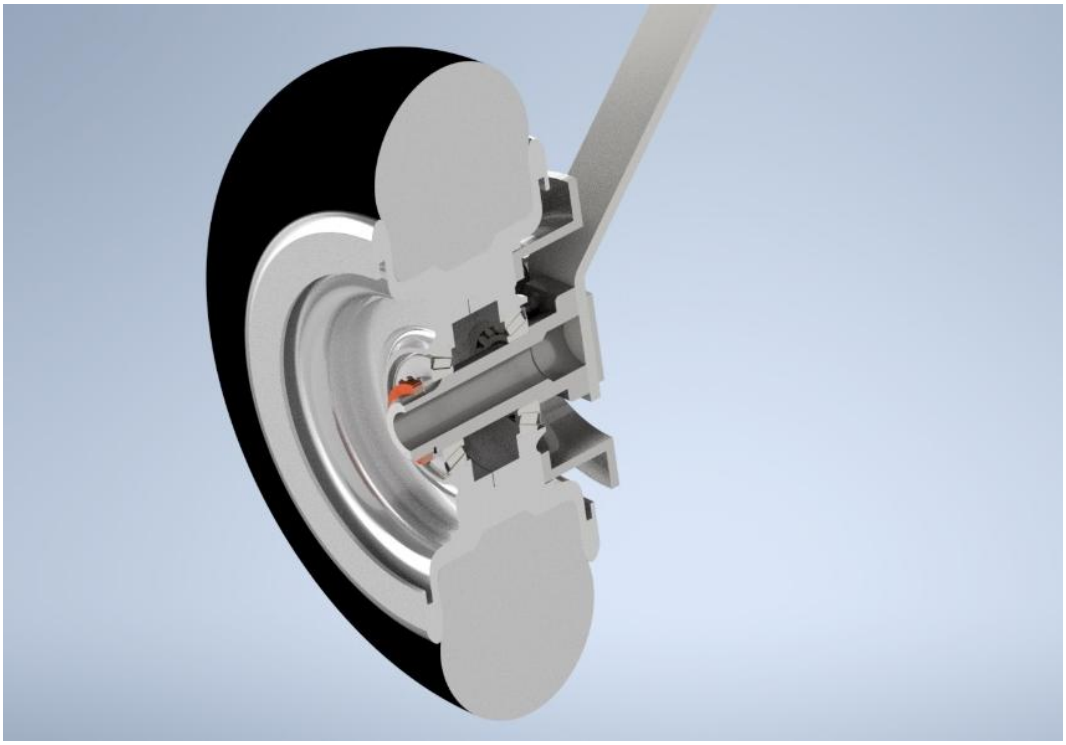

Figure 36: Sample Pictures: Cessna 172 Landing Gear reverse engineered

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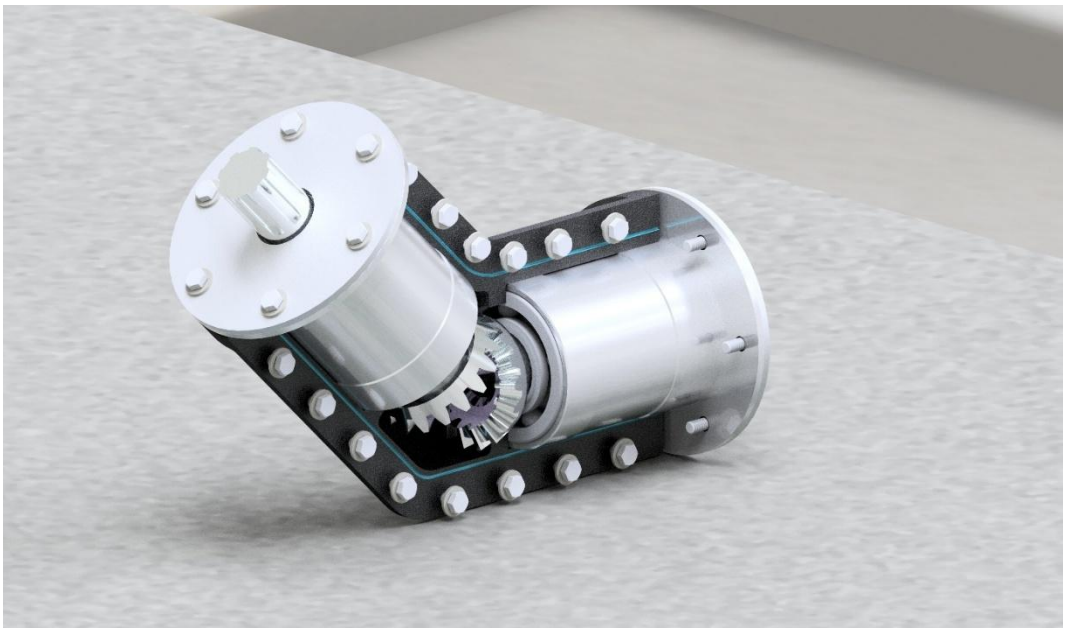

Figure 37: Sample Pictures: Gearbox with 135° bevel gears

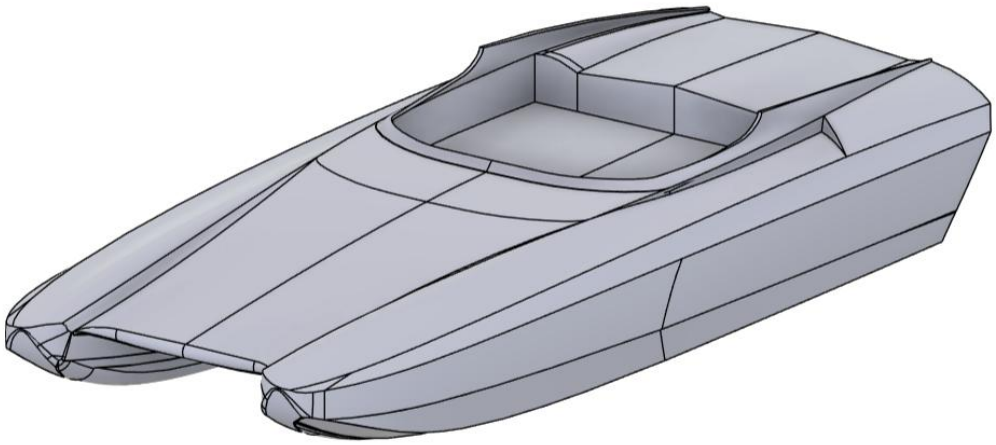

Figure 38: Sample Pictures: boat

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Figure 39: Sample Pictures: modern style vase with lid, optimized for 3D printing

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