Concept, How did we get here?

Everything starts with an idea. Our team wanted to create something different—something new for us. That's how the idea for *Szczerbatek* was born.

3D Design

Wing design

The next step was converting the aerodynamic data into a fully developed 3D model. Our team primarily uses **Autodesk Fusion** as our main CAD software, and the final project was initially created using it.

However, Fusion has some limitations—particularly in complex surface modeling. During the wing and tail design stages, it became necessary to use alternative software. In our case, we chose **Rhino 8**, which handles intricate surface operations more effectively and provides better control over profile continuity through lofts and sweeps using multiple profiles and guide rails.

At first glance, the results from Fusion appeared satisfactory. However, an **isocurve analysis** revealed that the profiles (in this case, airfoils) were skewed and deformed—a serious issue, considering the significant time invested in developing these airfoils.

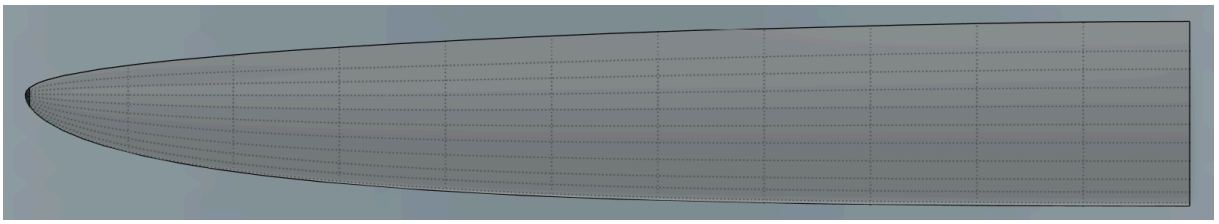

Fig 1.3 Isocurve analysis of Right wing designed in Rhino 8 exported to Fusion

The solution was to use Rhino 8 and then export the completed wing and tail to Autodesk Fusion for further design.

Fuselage Design

The last crucial component designed was the fuselage. It was created in Autodesk Fusion, as it does not require the same level of surface accuracy as the wings or tail.

Shape was optimised to fit all the necessary equipment while still allowing easy accessibility to the battery and other crucial elements.

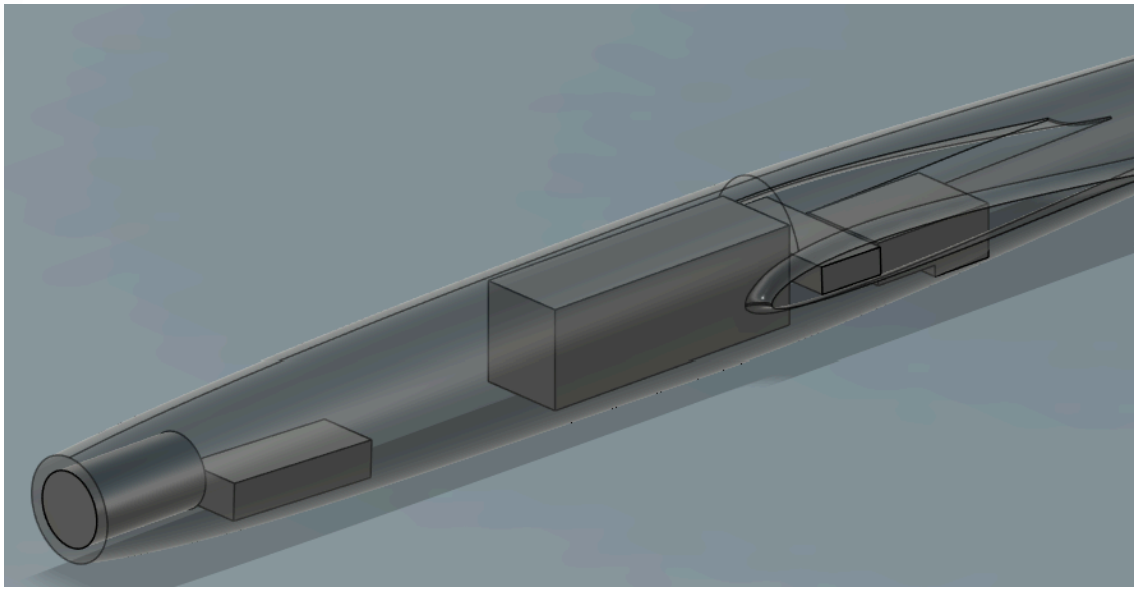

Fig 1.4 Main components in fuselage

A challenging part of designing a fuselage is the wing–fuselage and tail–fuselage transitions. These areas are important because they allow for a smooth connection between components, and if designed correctly, they can significantly reduce drag.

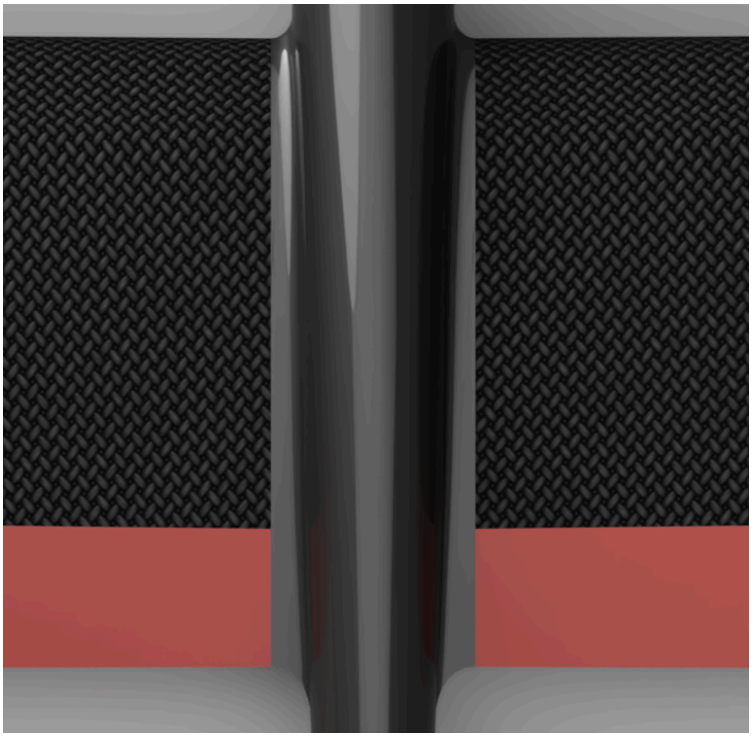

Fig 1.5 Top view on the wing-fuselage transition

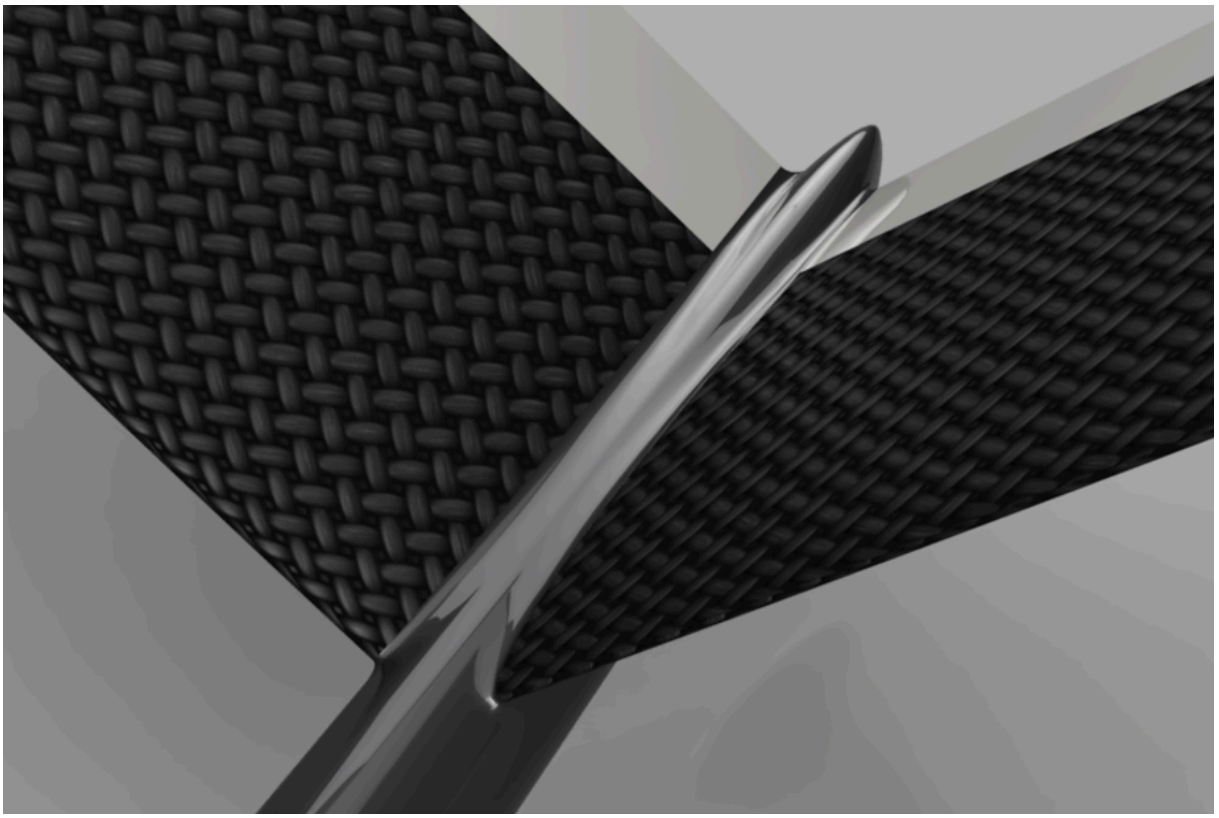

Fig 1.6 View on the tail-fuselage transition

All the efforts resulted in complete assembly of the whole plane. It allowed us to visualize proportions of the plane as well as further simplify the design proces of internal construction and mechanisms.

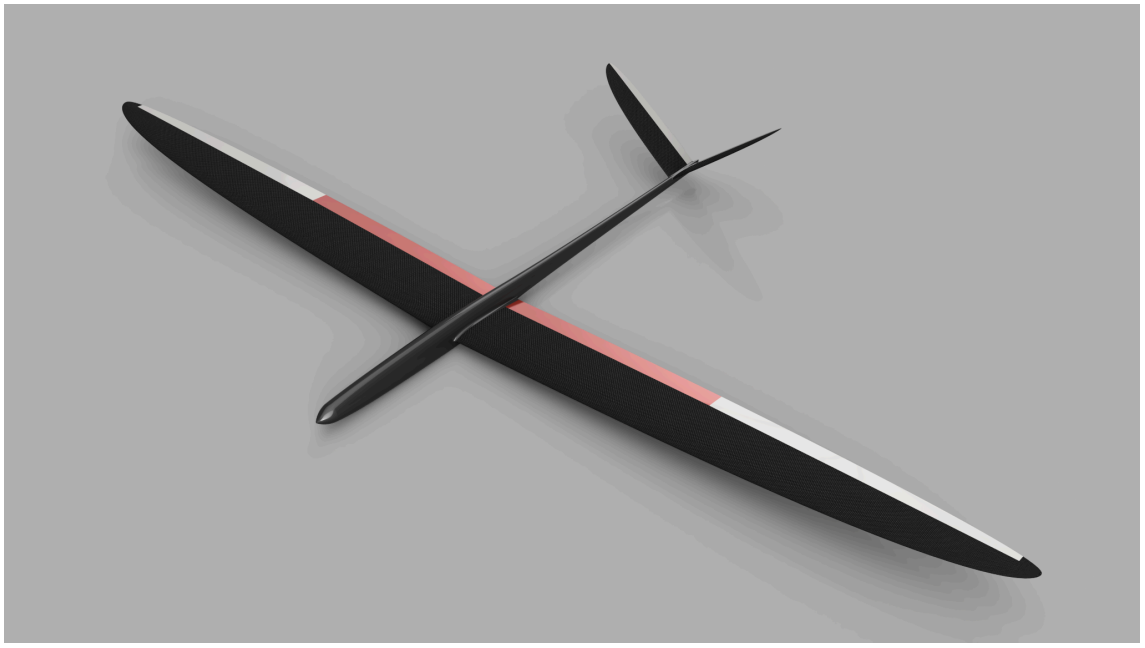

Fig 1.7 Assembly of “Szczerbatek”

Internal Construction

This was the most tedious part of the design process, as it required many approximations and calculations. The wings will be a hollow composite structure with some reinforcements. The laminate will have a certain thickness, but accurately predicting it is difficult due to the many influencing parameters, some of which are beyond our control. For this reason, we approximate the skin thickness to be 0.047 inches.

Internal structure included:

- Main spar
- socket for wing joiner
- Flaps and ailerons spars

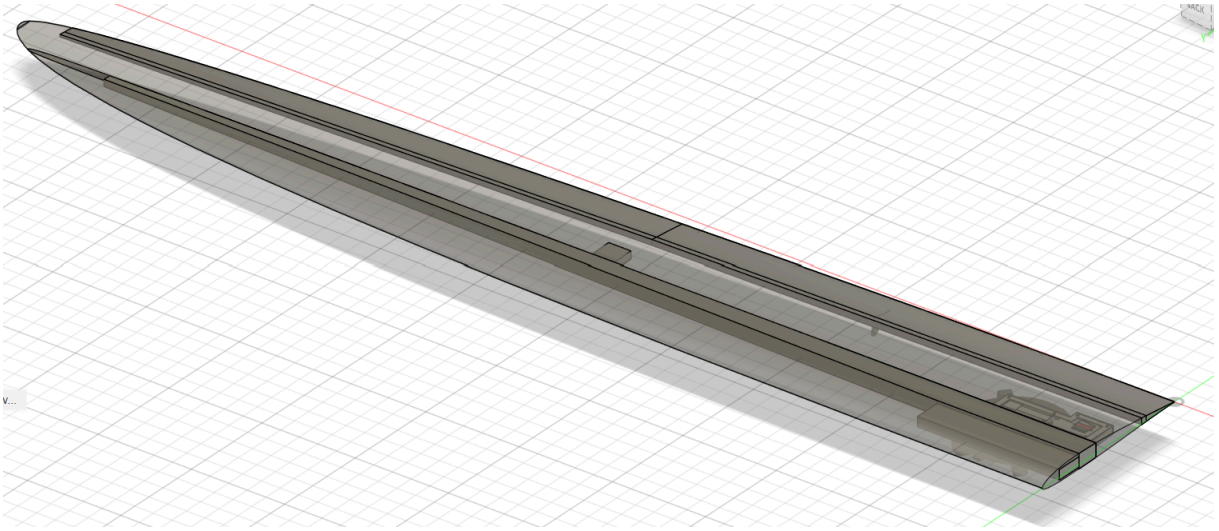

Fig 1.7 Visualization of wings internal components.