Silesian University of Technology

Air Cargo Challenge 2011 – Oral presentation

Team 27 – High Flyers

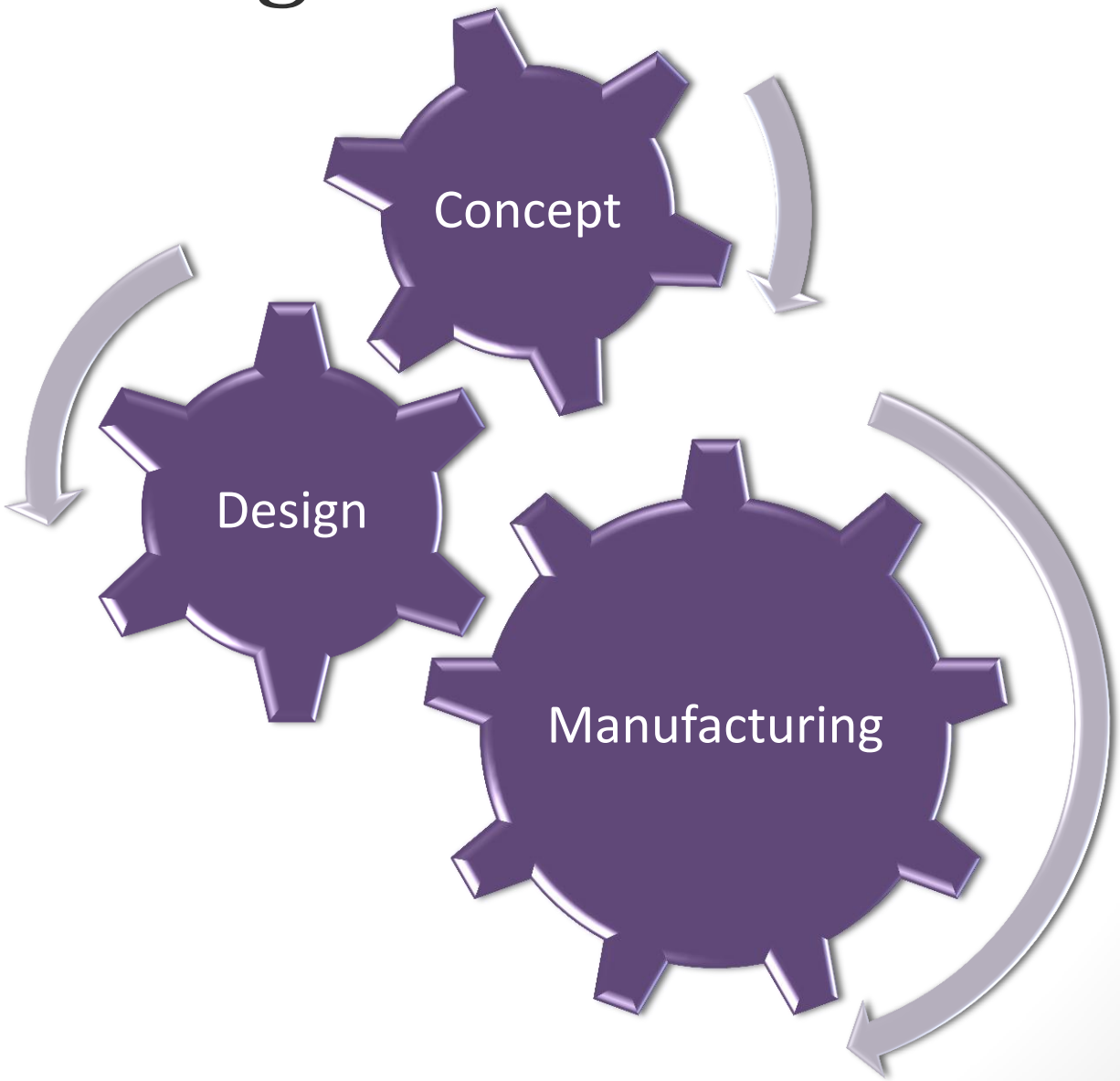
Content

- High Flyers
- Plane design
- Prototype
- Manufacturing
- In flight
- Evaluation

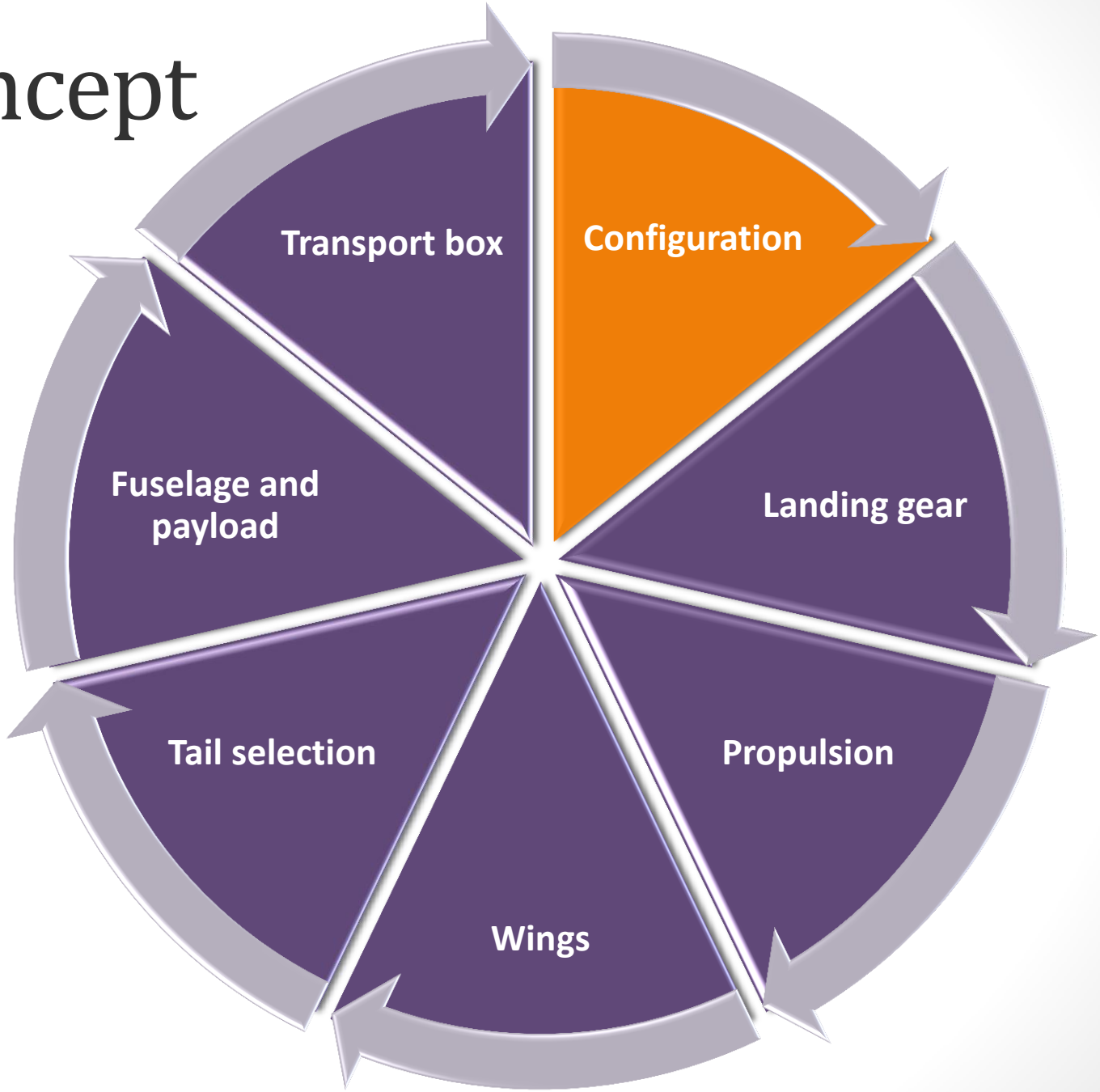
High Flyers

- Student's Scientific/Research Association
- Created in november 2010
- 1st to 5th year students
- Engineers in:
  - Electronics
  - Computer Science
  - Robotics
  - Automatics
  - Mechanics

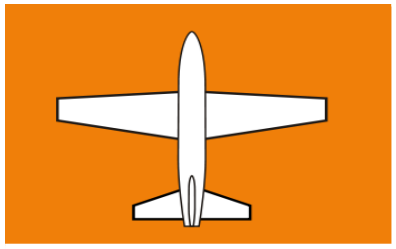
Plane design



Concept

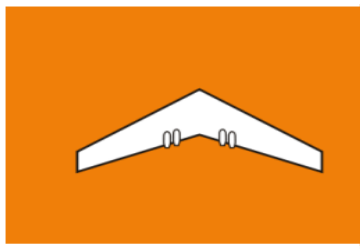

Transport box
Configuration
Landing gear
Propulsion
Wings
Tail selection
Fuselage and payload

Configuration



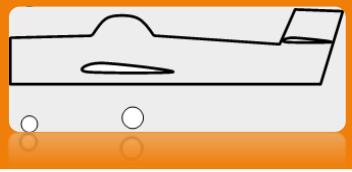
Conventional

Tandem



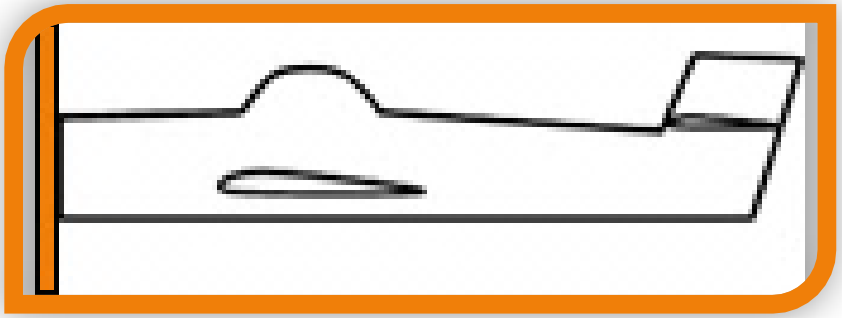
Flying wing

Landing Gear

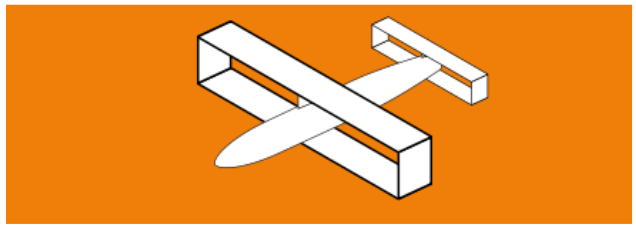
	
Tricycle landing gear	Conventional landing gear

Propulsion

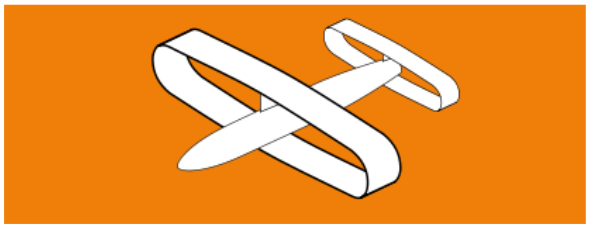
	
Tractor configuration	Pusher configuration



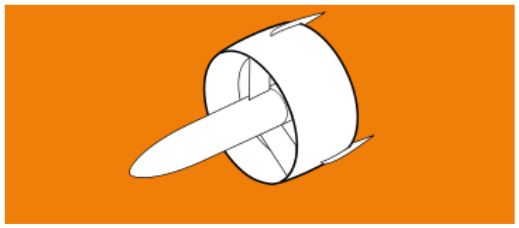
Wings configuration



Box wing

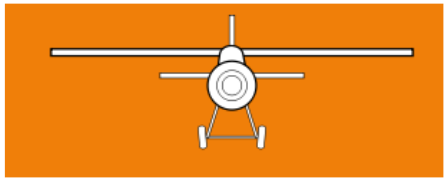


Annular box wing



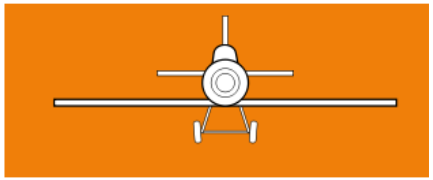
Cylindrical wing

Parasol wing

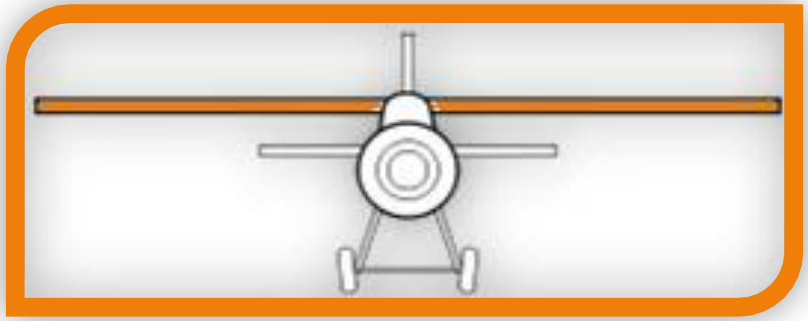


High wing

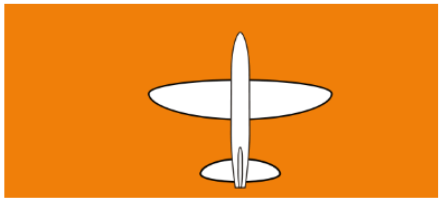
Mid wing

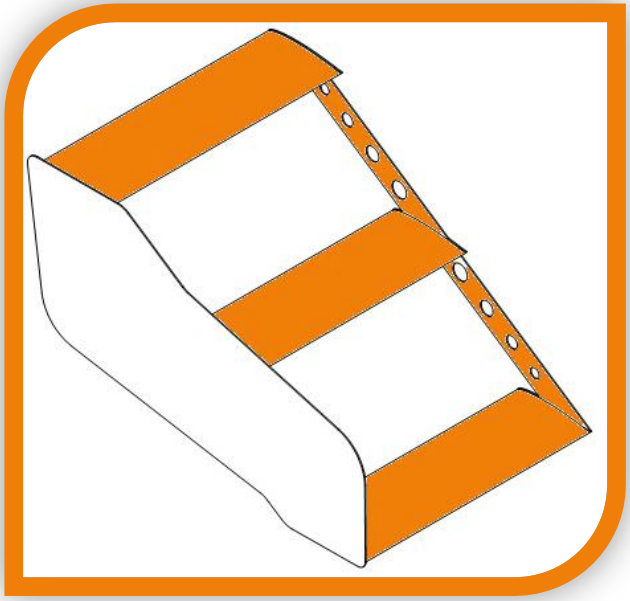


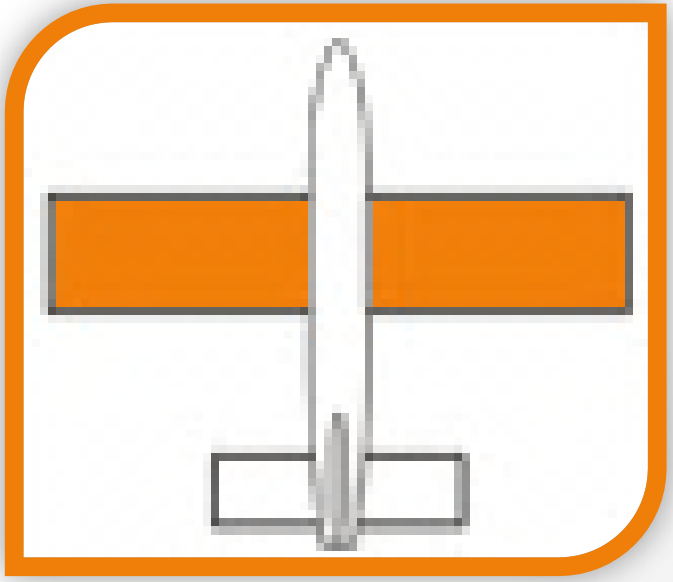
Low wing



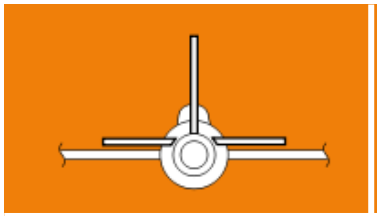
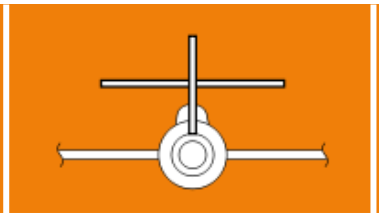
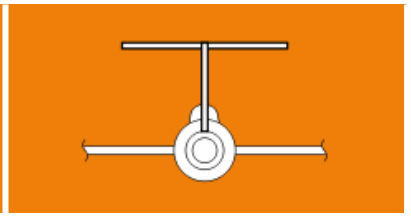
Wings shape

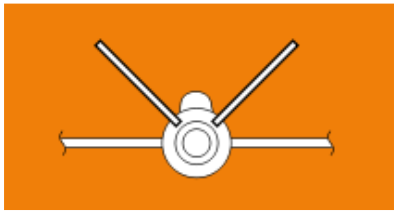
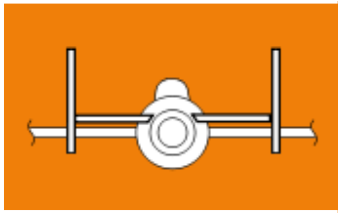
			
Constant chord	Tapered	Elliptical	Delta

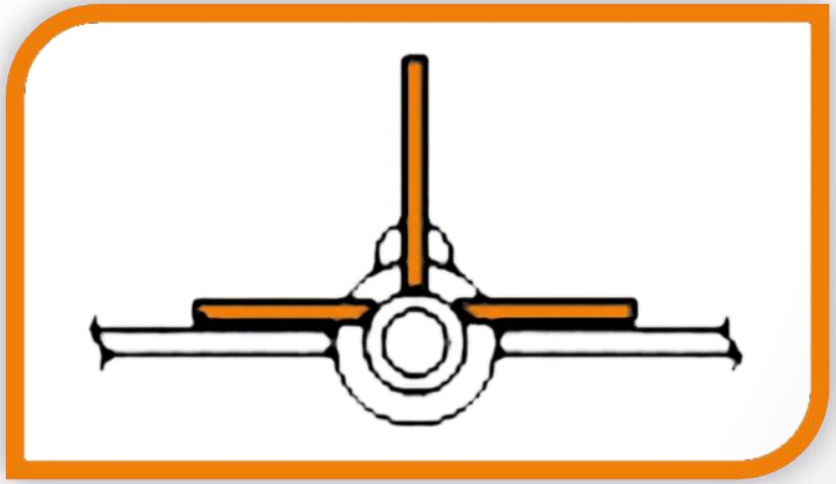




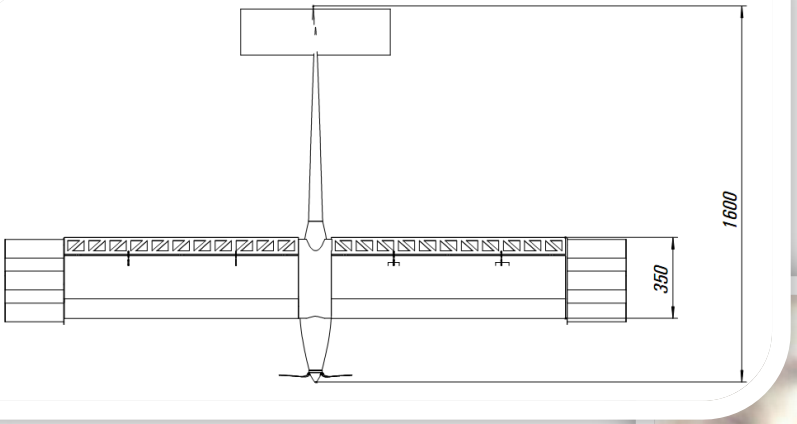
Tail selection

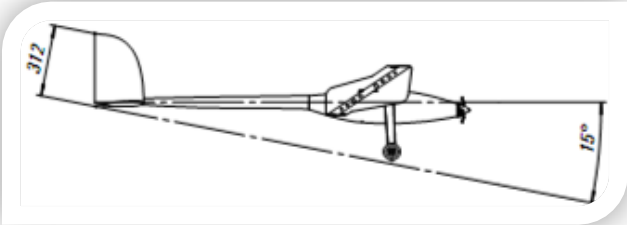
		
Tail boom mounted	Cruciform tail	T-tail

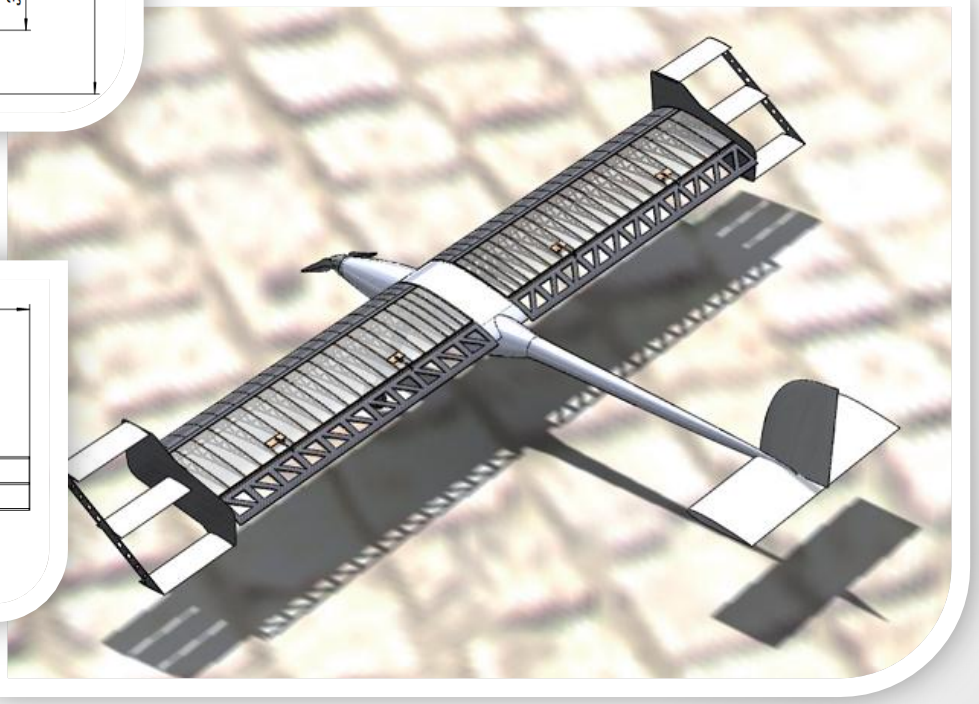
	
V-tail	H-tail

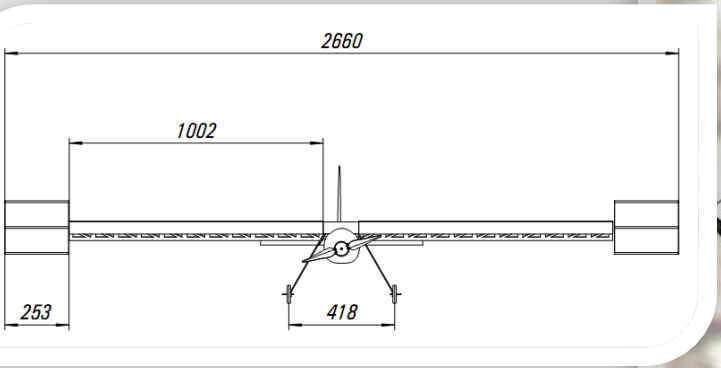


Final configuration



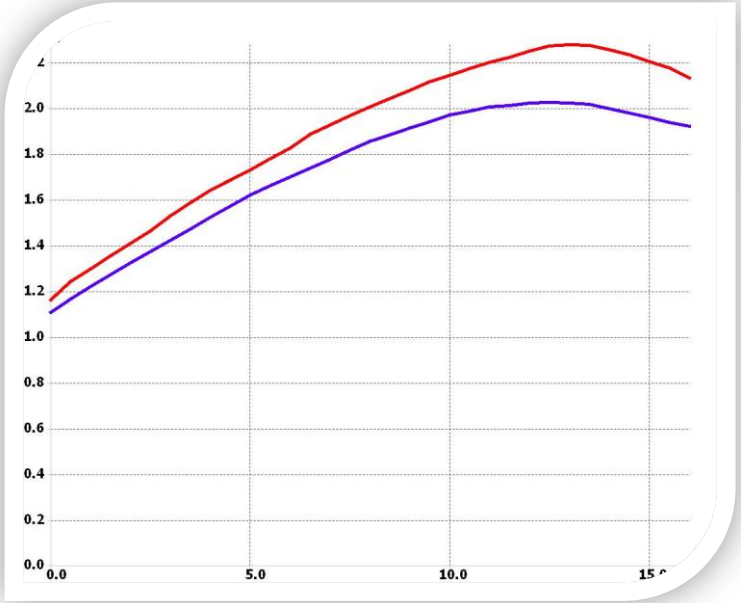




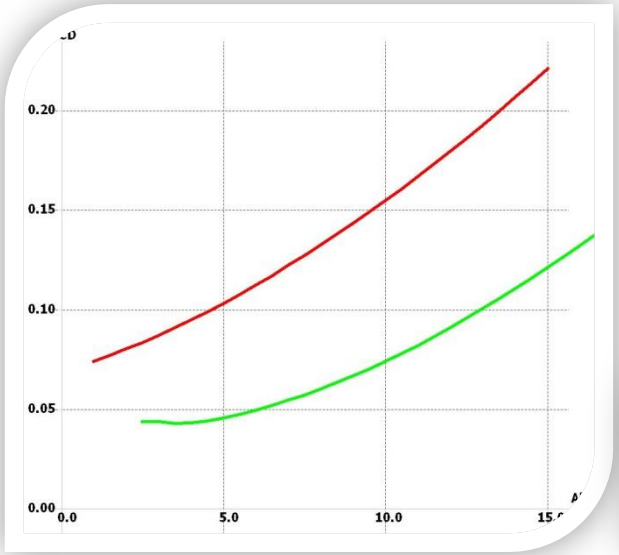


Performance – airfoil

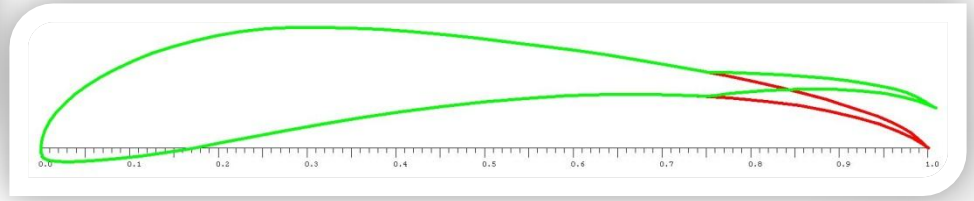
- Selig 1223 vs Eppler 423
- Negative flaperons
  - 50% less drag



CL vs Angle of Attack



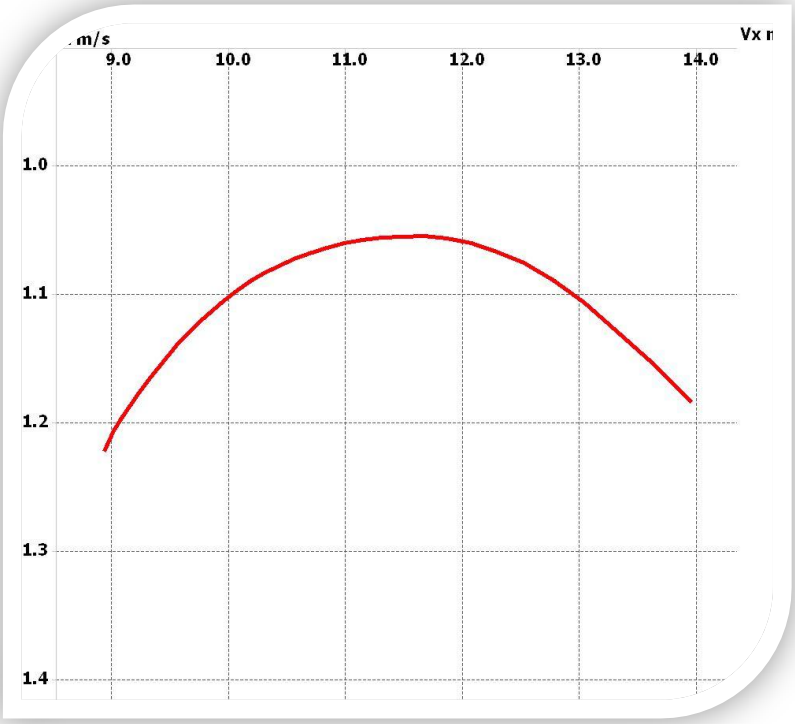
CD vs Angle of Attack



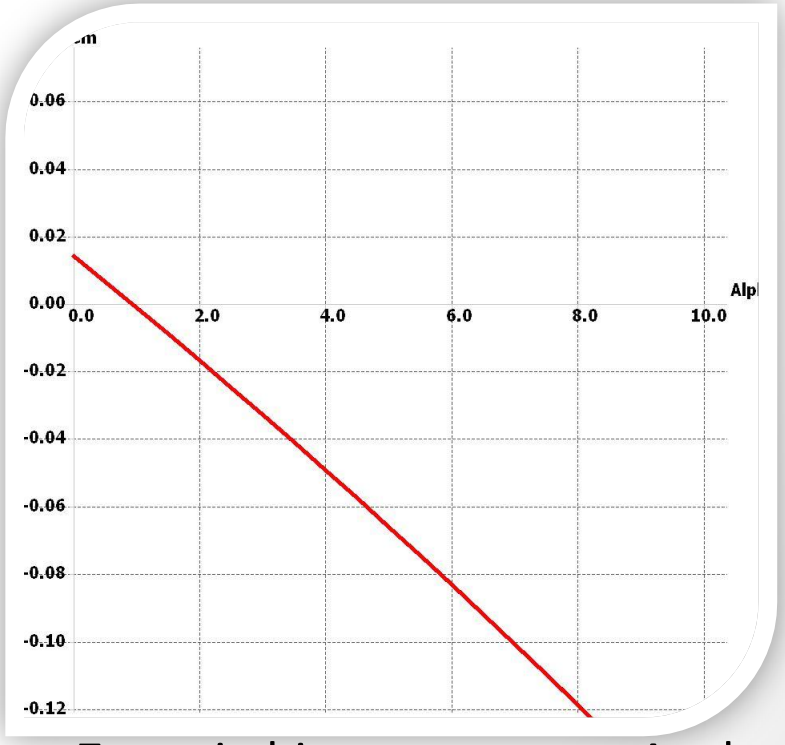
Selig 1223 Flaperon

Performance – stability, glide ratio

- Stability
- Glide ratio: approx. 10



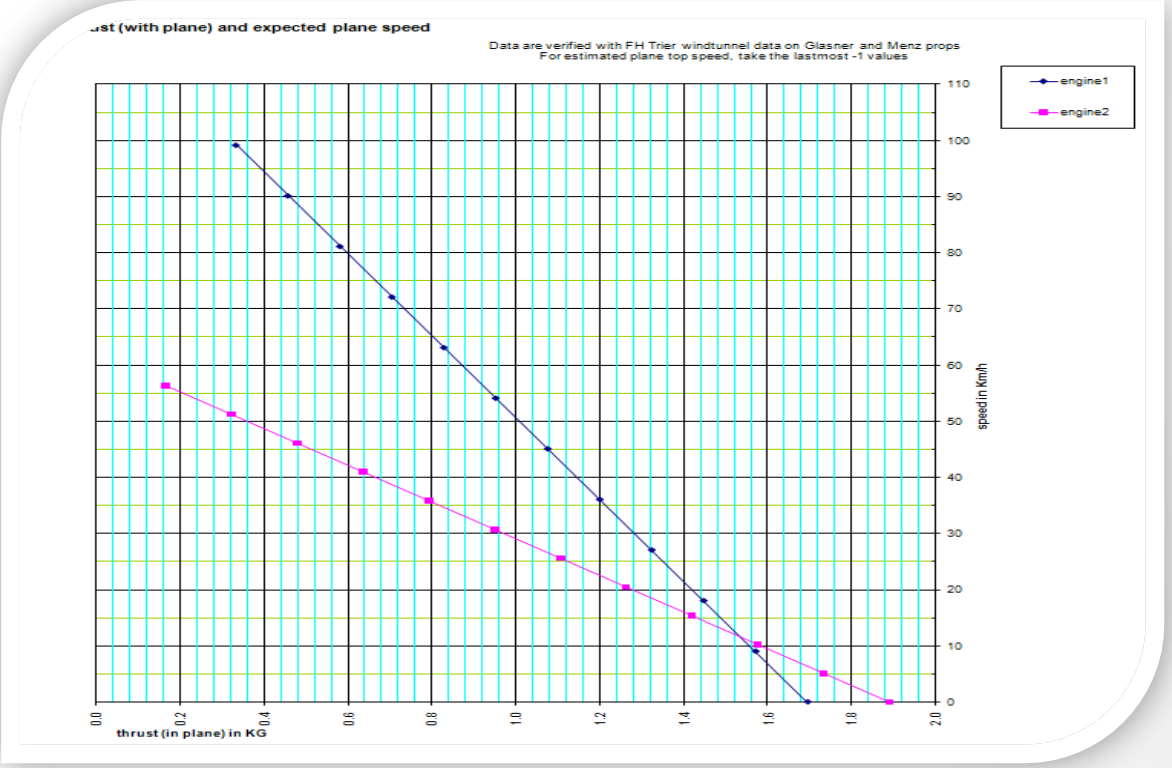
Plane polar



Zero pitching moment vs Angle of Attack

Performance – propulsion

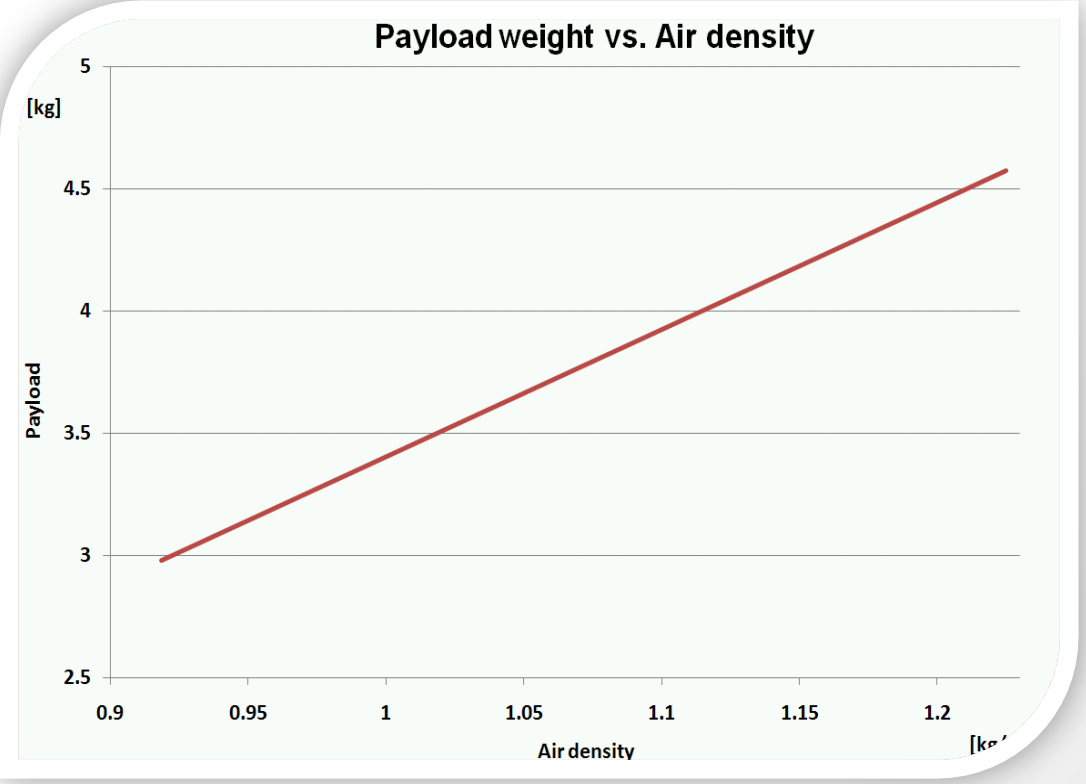
- Dynamic thrust
- Master Airscrew 11x8
- APC 12x8E
- APC 11x7E



APC 13x4E vs 12x8E

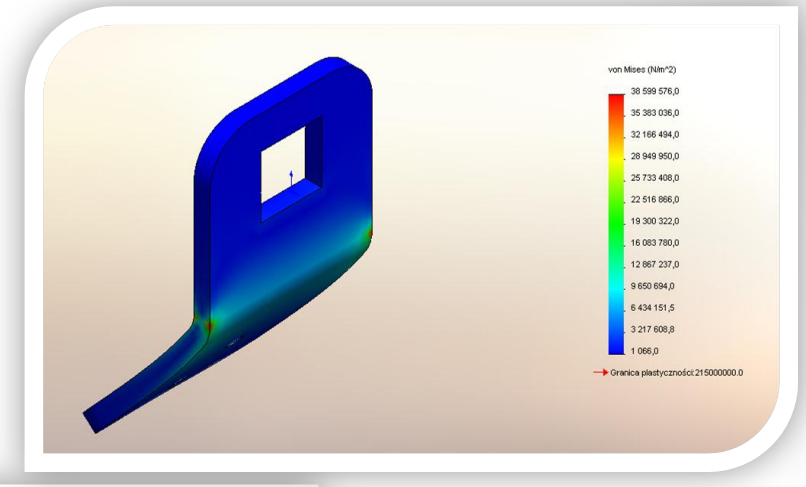
Payload prediction graph

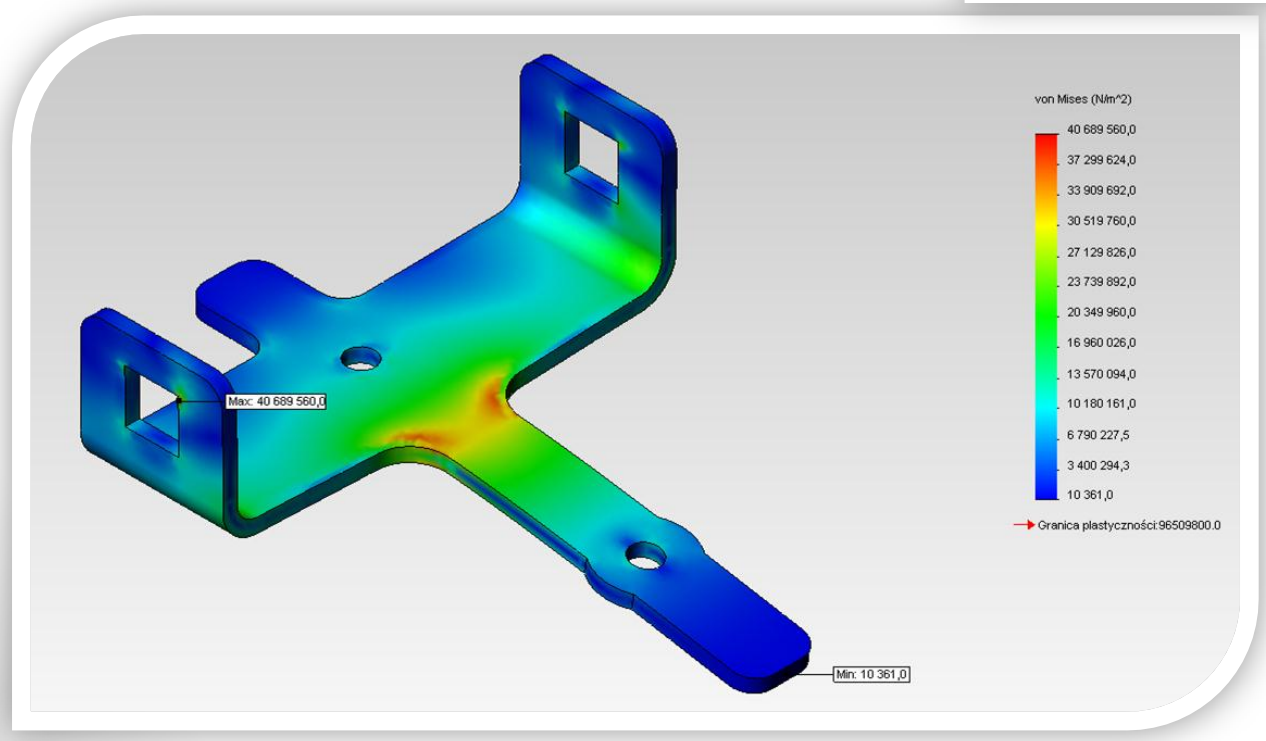
- Possible 20% error with XFLR software
- Predictible load: 4,5 kg



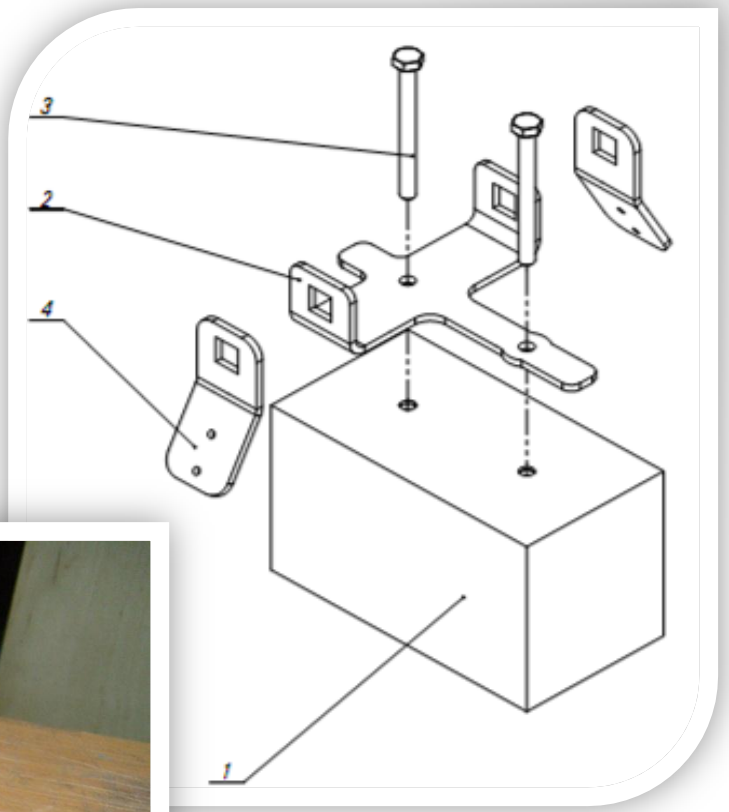
Endurance

- FEM software
- Optimalized construction
- CNC made



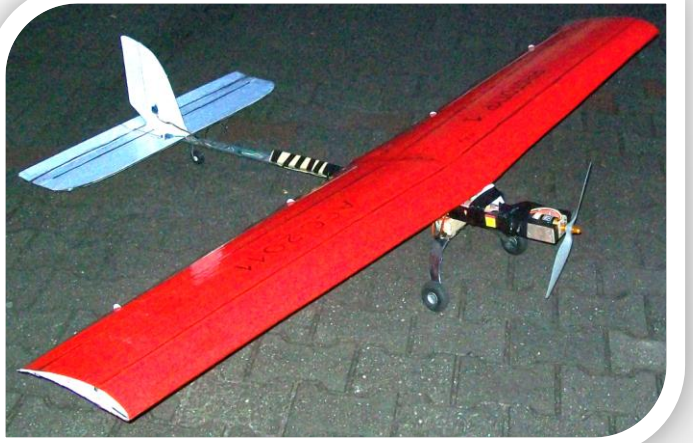


Cargo system

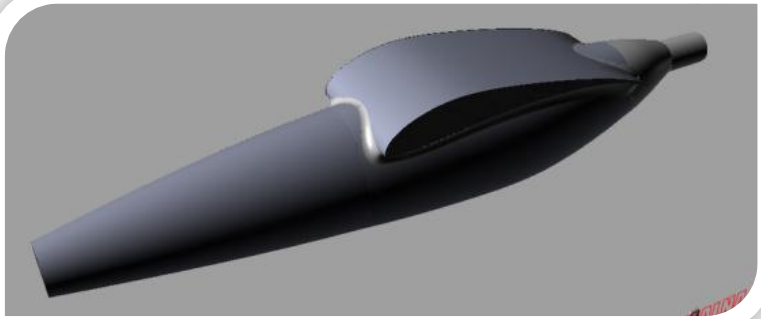


Prototype

- Styrofoam
- Vacuum cleaner pipe
- Carbon fiber
- Crushed in first flight
  - Wrong C.G.
  - Unstable elevator
- Next attempts succesful!

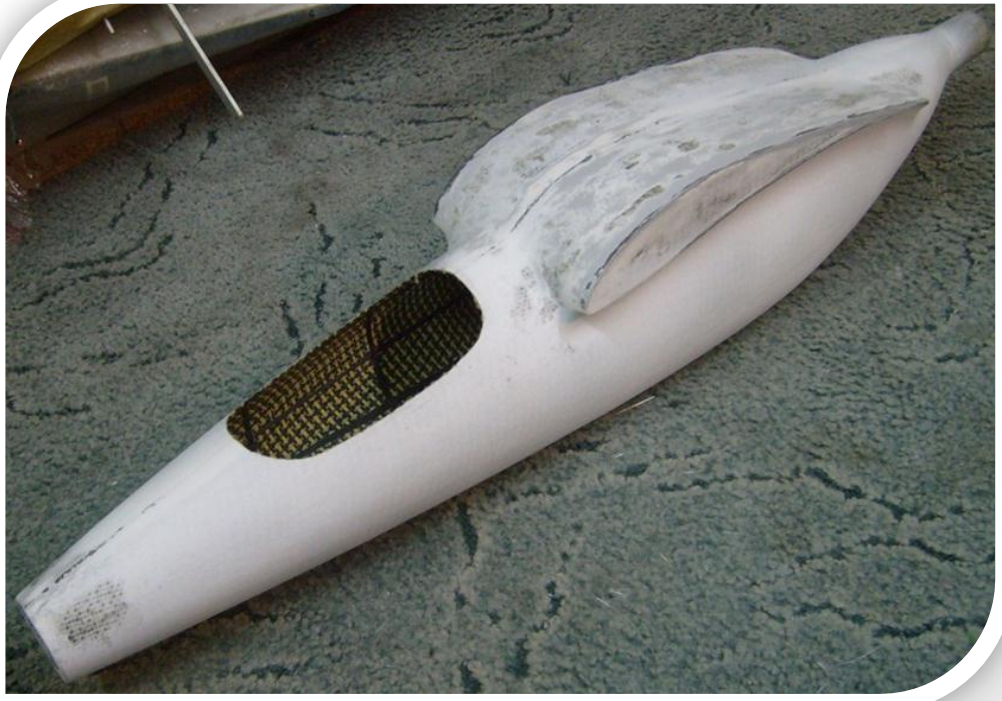


Manufacturing - fuselage



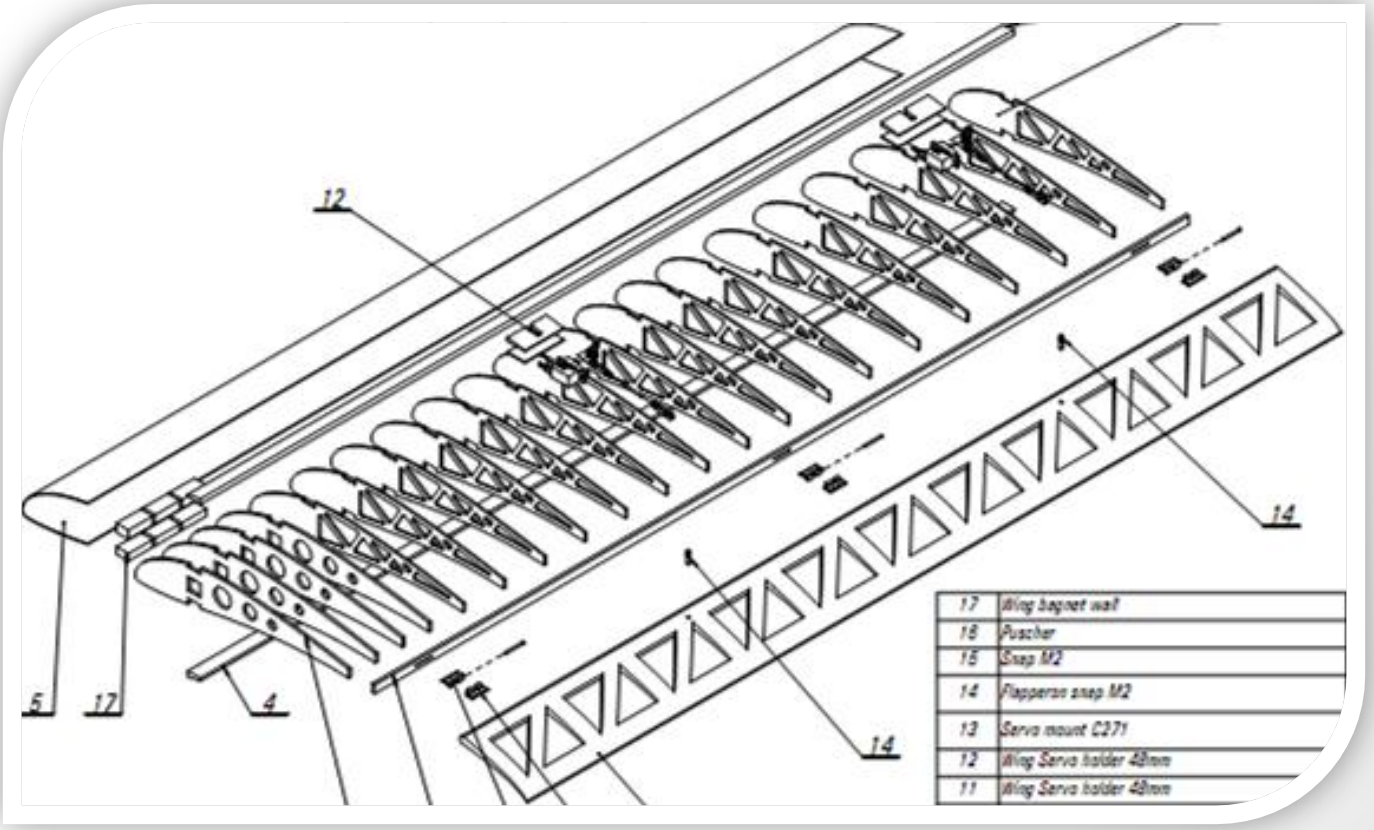
Manufacturing - fuselage

- Hybrid fibers
- 3D CAD design
- CNC miling machine made by us



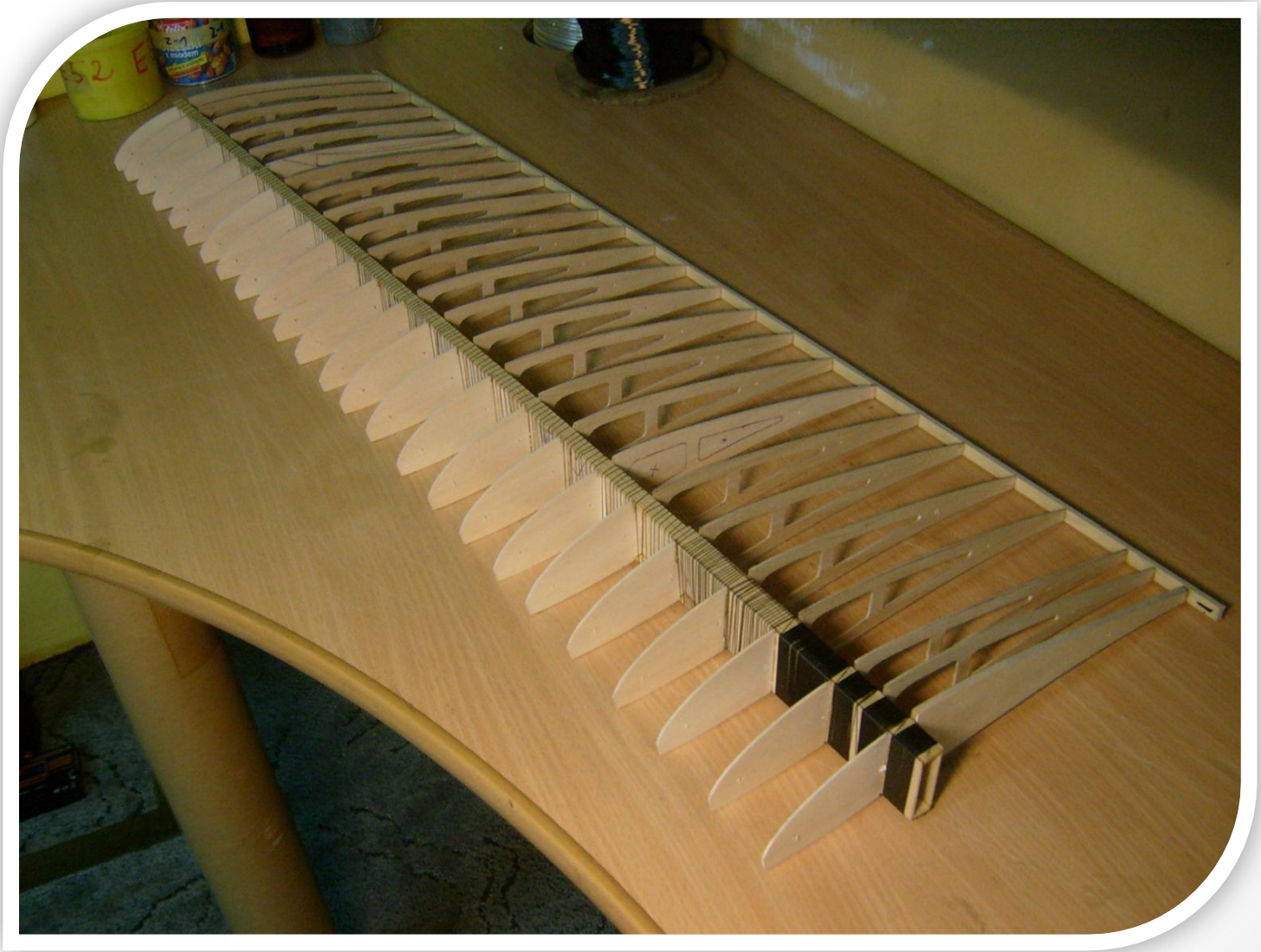
Manufacturing - wing

- Construction
- Caisson



Manufacturing - wing

Manufacturing - wing

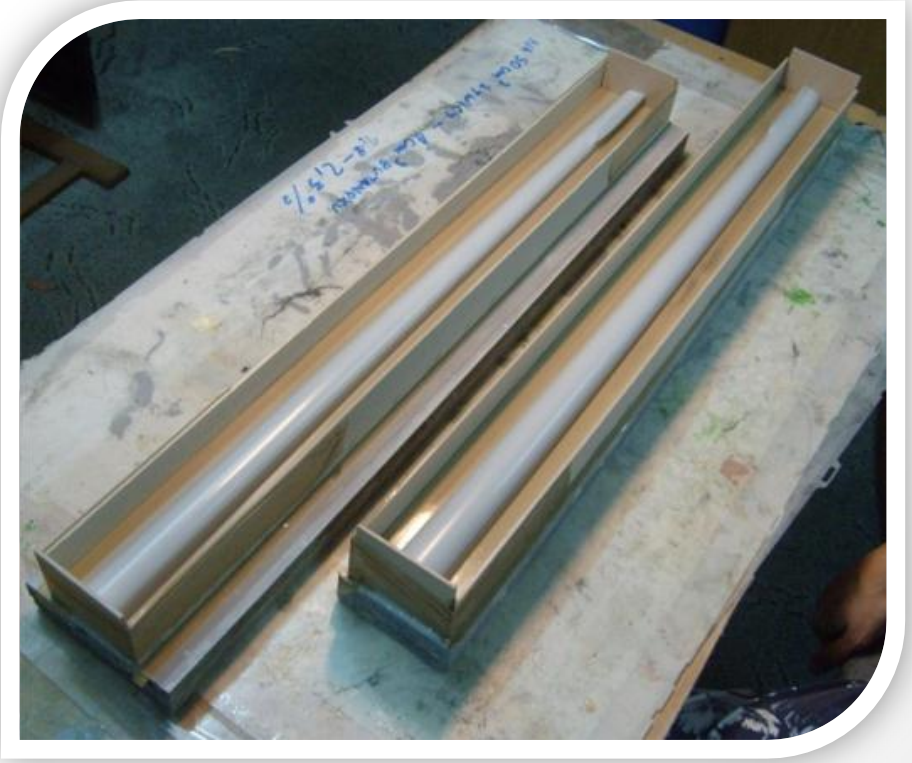


Manufacturing - wing

- Carbon strips attached to gain stiffnes

Manufacturing - empennage

- Carbon fiber tail boom
- Construction empennage



In flight

- Stable and controlable

Evaluation

- First attempt in Air Cargo Challenge
- Carefully designed plane
- Prototype and tests made
- Merge of theory and practice
- Plane suits competition requirements
- Opportunity to gain experience

Thank you for your attention

HIGH FLYERS

Sponsors

FLYTRONIC

POLITECHNIKA ŚLĄSKA

Questions?

Sponsors