Riga Technical University, Institute of Aeronautics

Challenges for international scientific and technological cooperation in aerospace area with the participation of Latvia

Professor Aleksandrs Urbahs

Conference on cooperation between European Union and Russian aviation industry «AVIA-INVEST 2014»

SEVENTH FRAMEWORK PROGRAMME

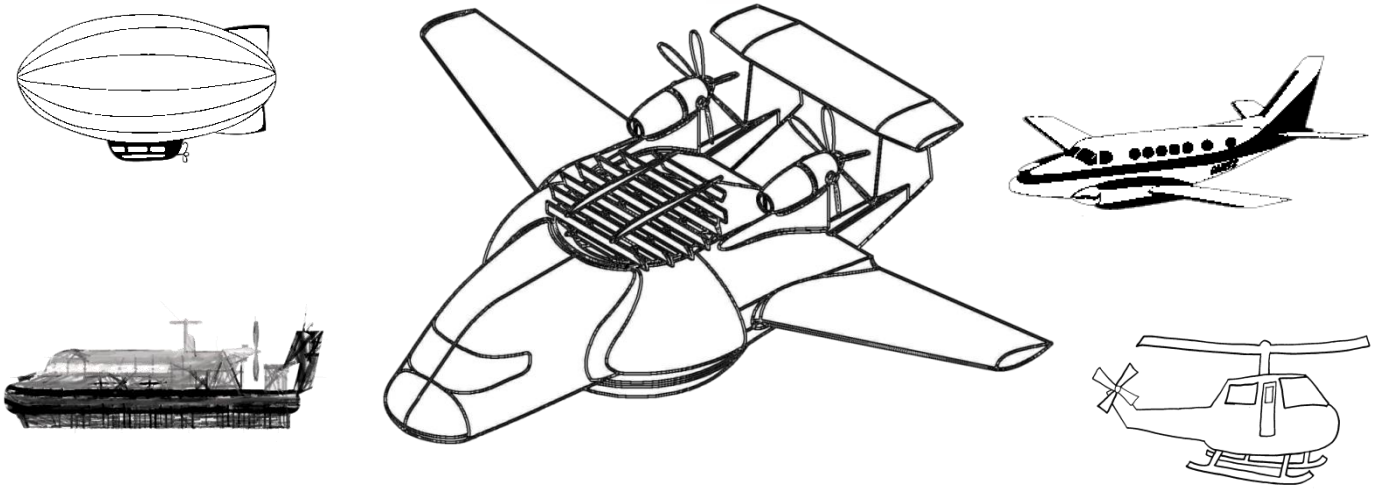
FLIGHT TO FREEDOM ESTOLAS

AVIA INVEST INTERNATIONAL CONFERENCE 2014

Riga, 10-11 April, 2014

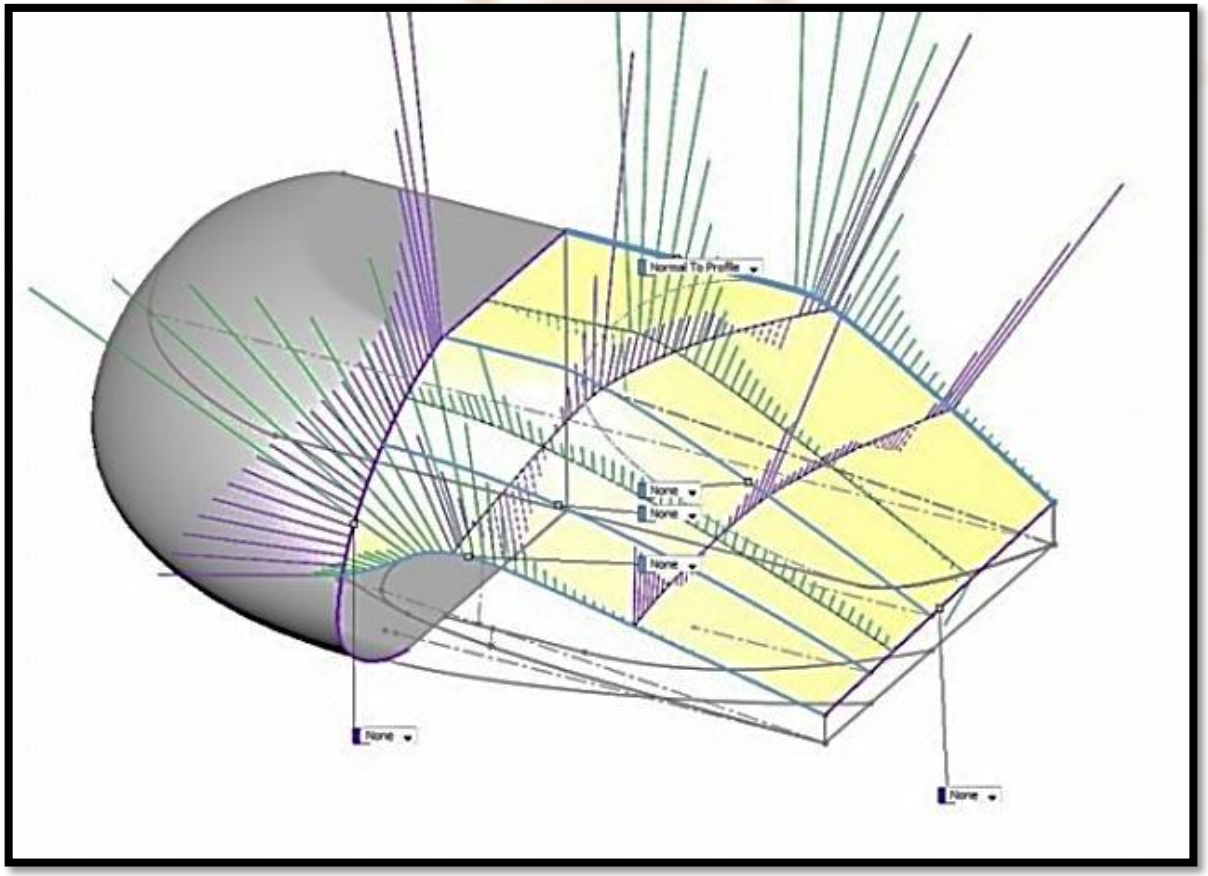
Project ESTOLAS

The concept of the project is to develop and validate the conceptual design of a hybrid aircraft a flying device combining the best qualities of an airship, a plane, a helicopter and a hovercraft. Such hybrid aircraft constitutes a completely novel type of an aircraft extremely short take off and landing on any surface (ESTOLAS).



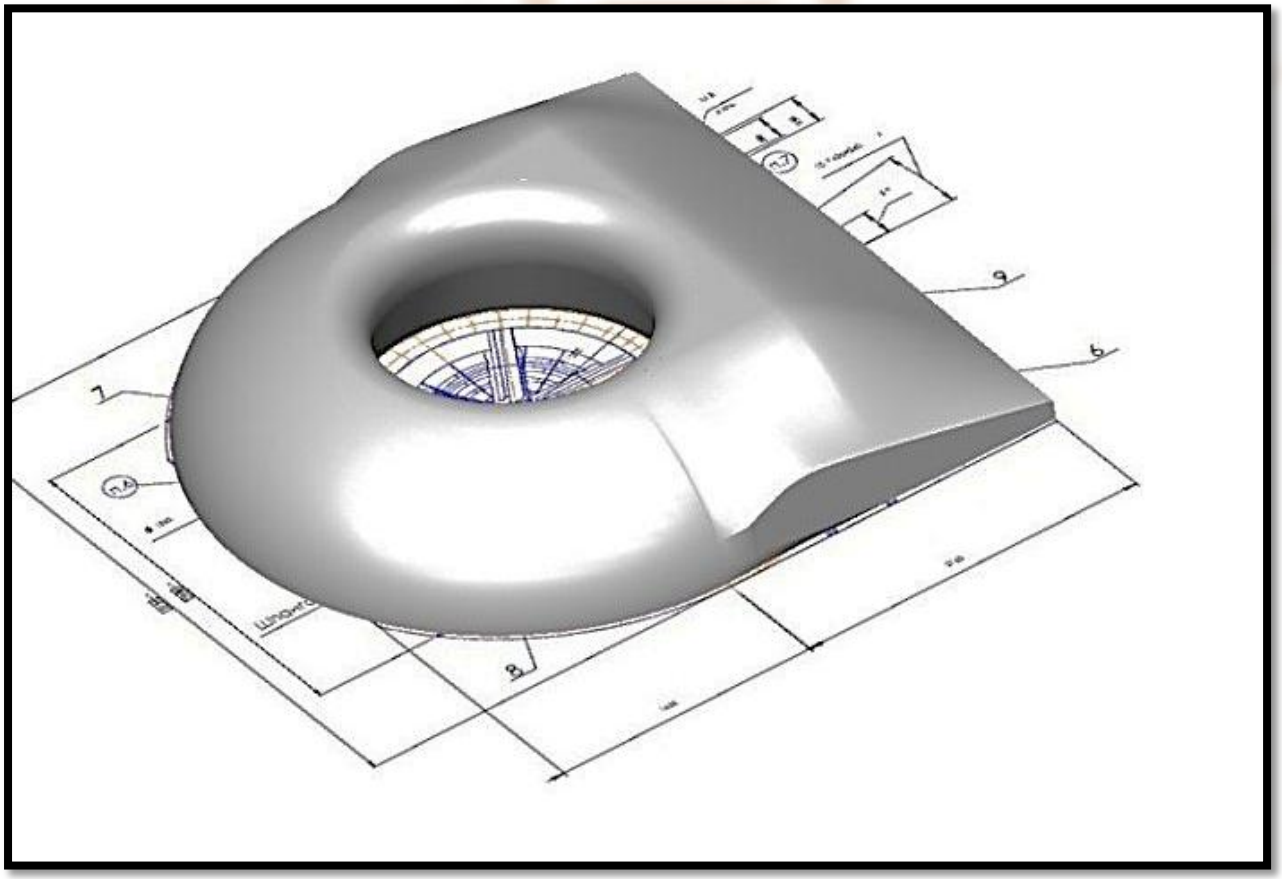
ESTOLAS prototype generation

Design of the central section of the aircraft



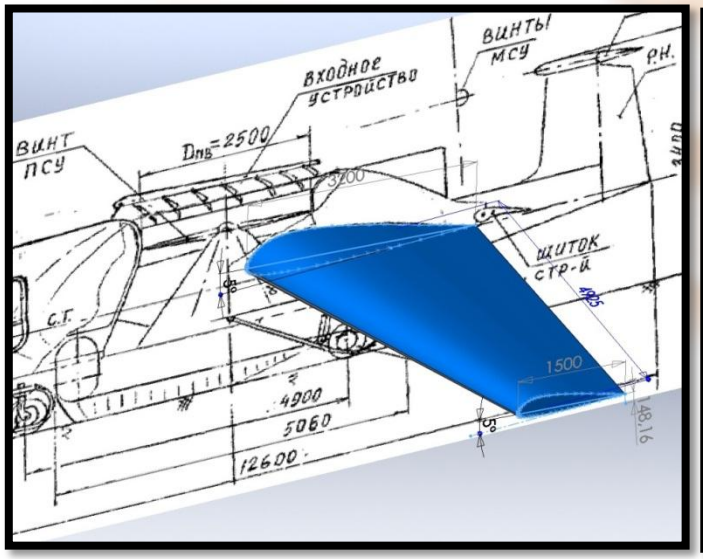
ESTOLAS prototype generation

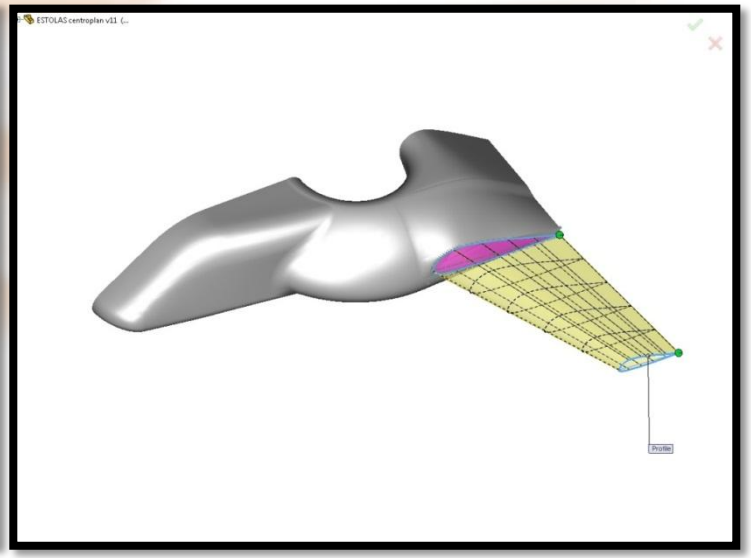
Design of the central section of the aircraft



Design process

Wing design (ESTOLAS)

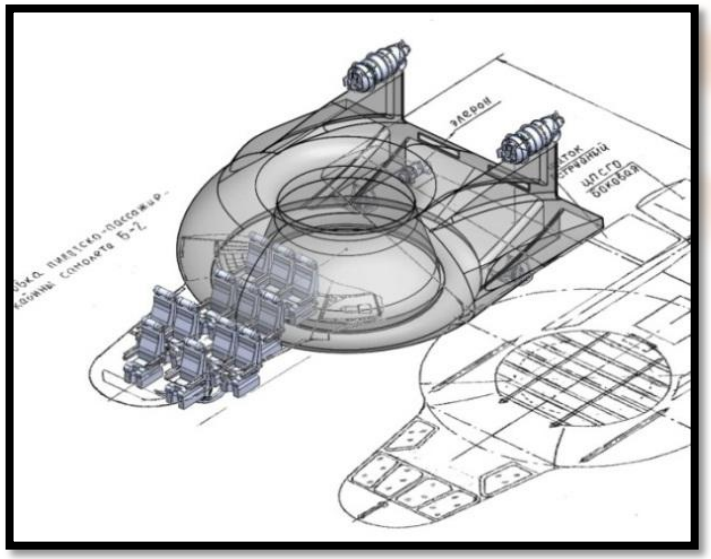




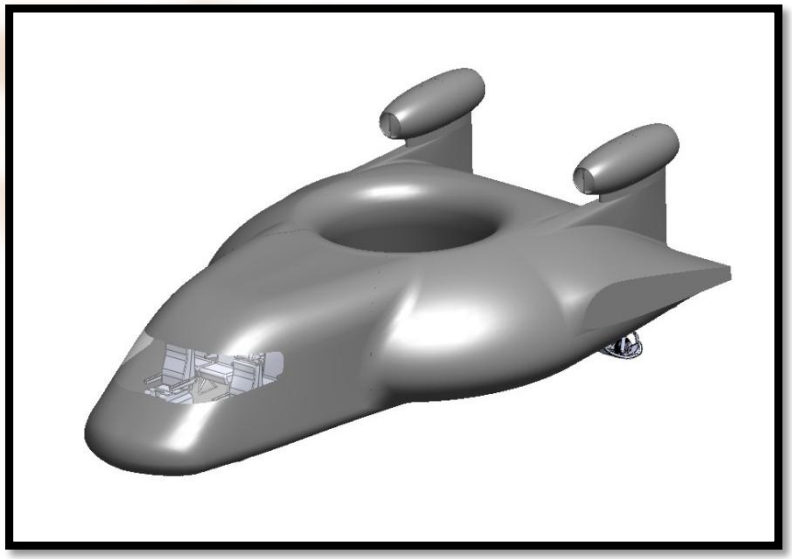
CAD generation of wing

ESTOLAS prototype generation

Fuselage design based on the original drawings and layout of seats



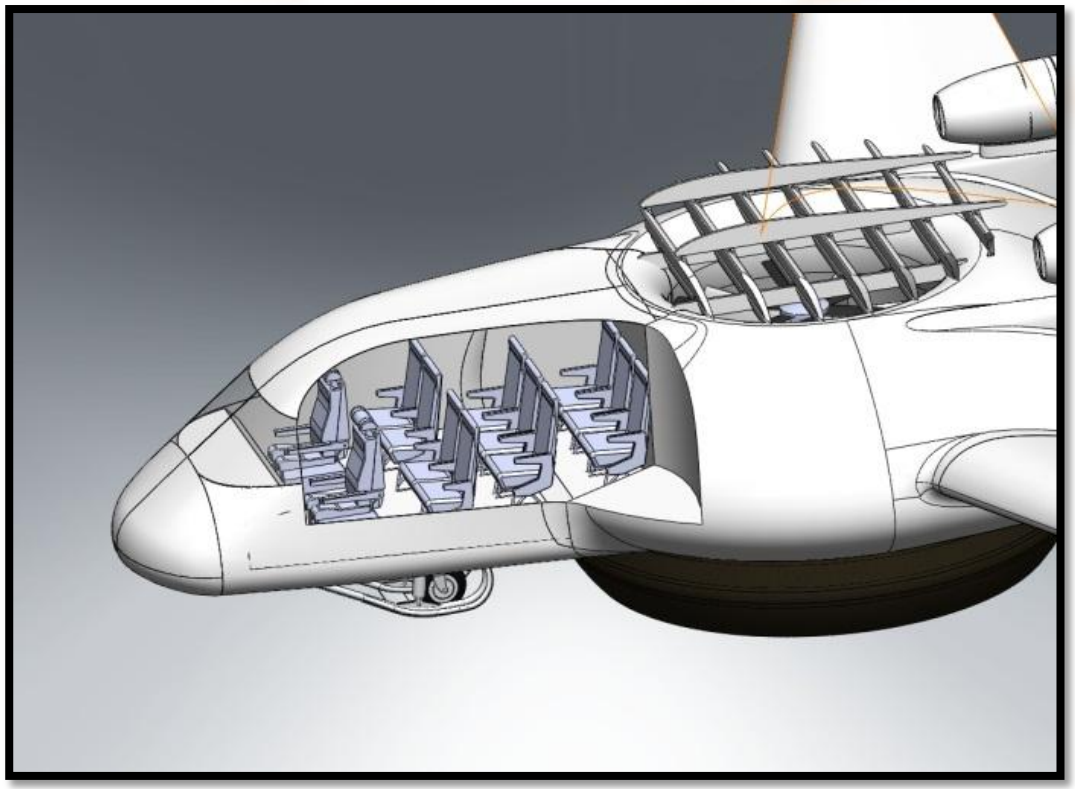
Seat layout modeling



Fuselage external view

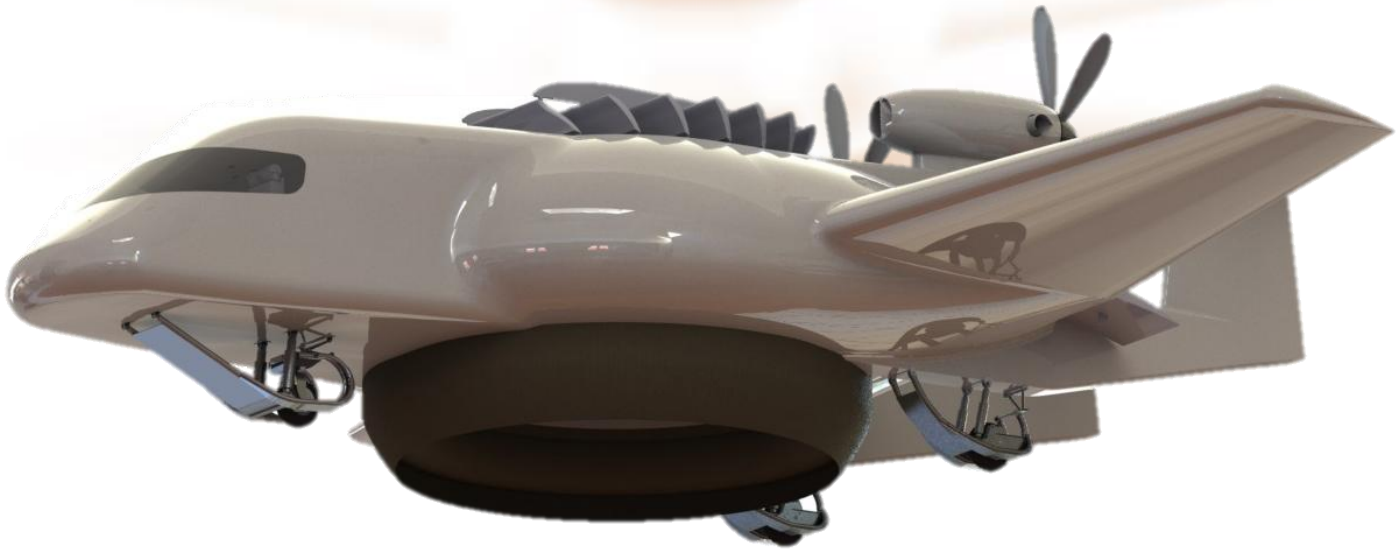
ESTOLAS prototype generation

Fuselage design based on the original drawings and layout of seats



Design process

«ESTOLAS» prototype final CAD model

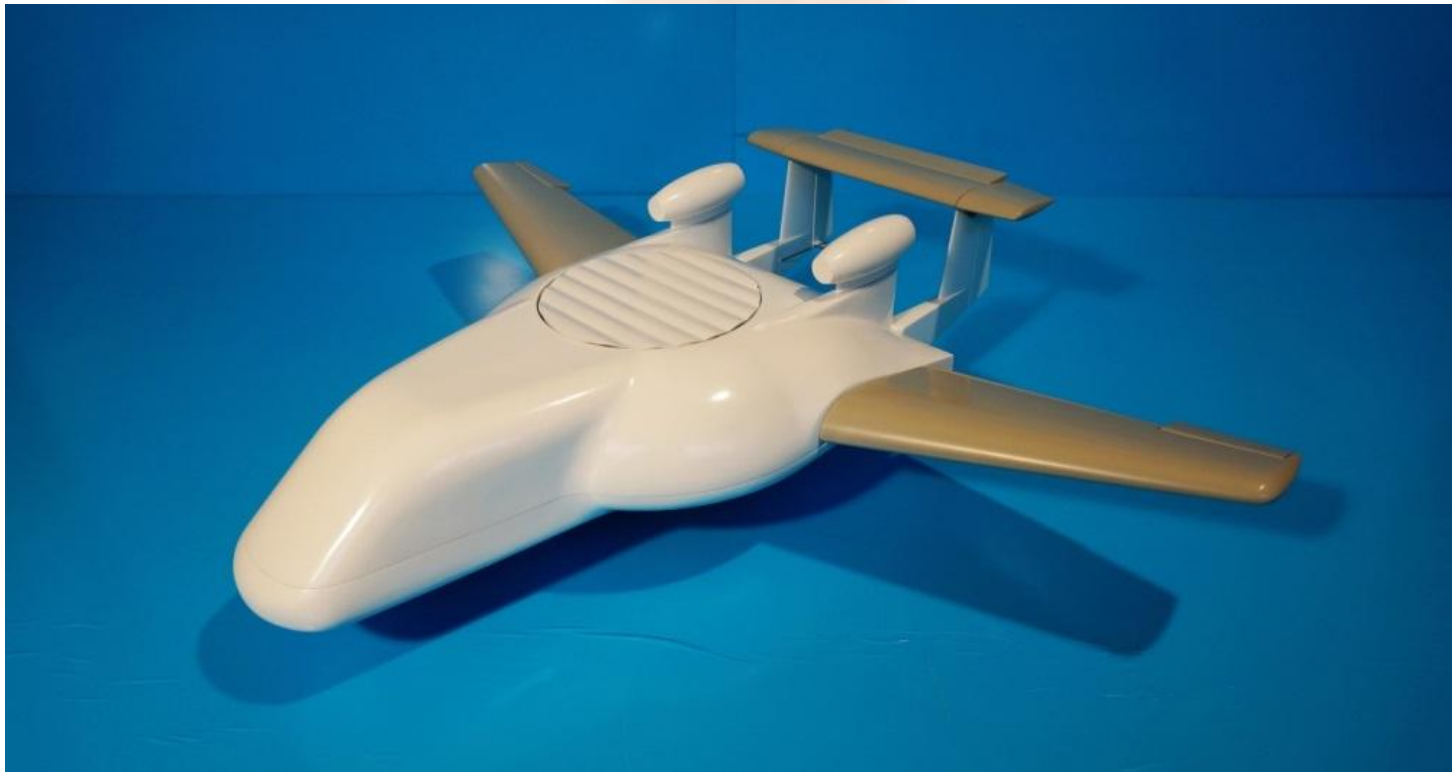


Model Manufacture [1]

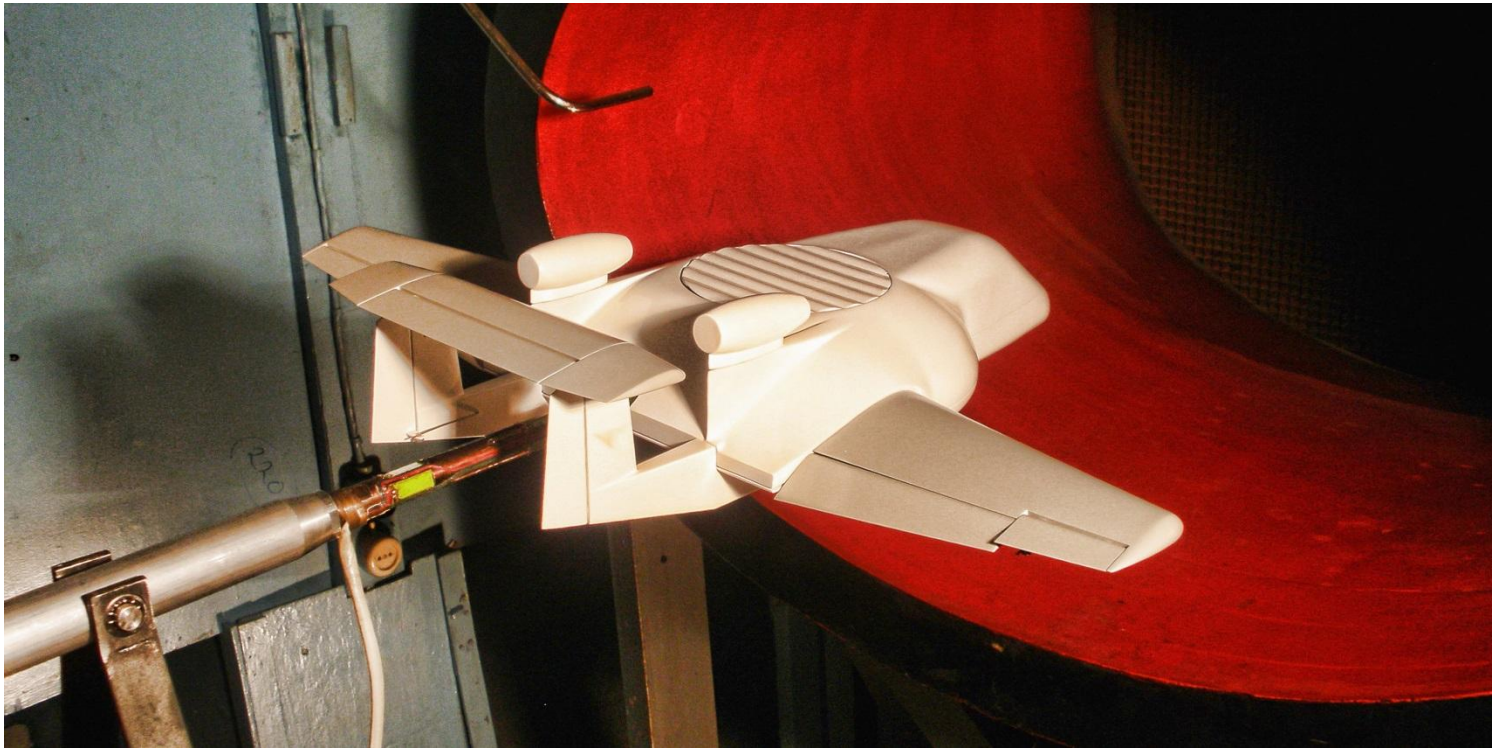
- “ESTOLAS” CAD model

Model Manufacture 2

- ESTOLAS Finished model

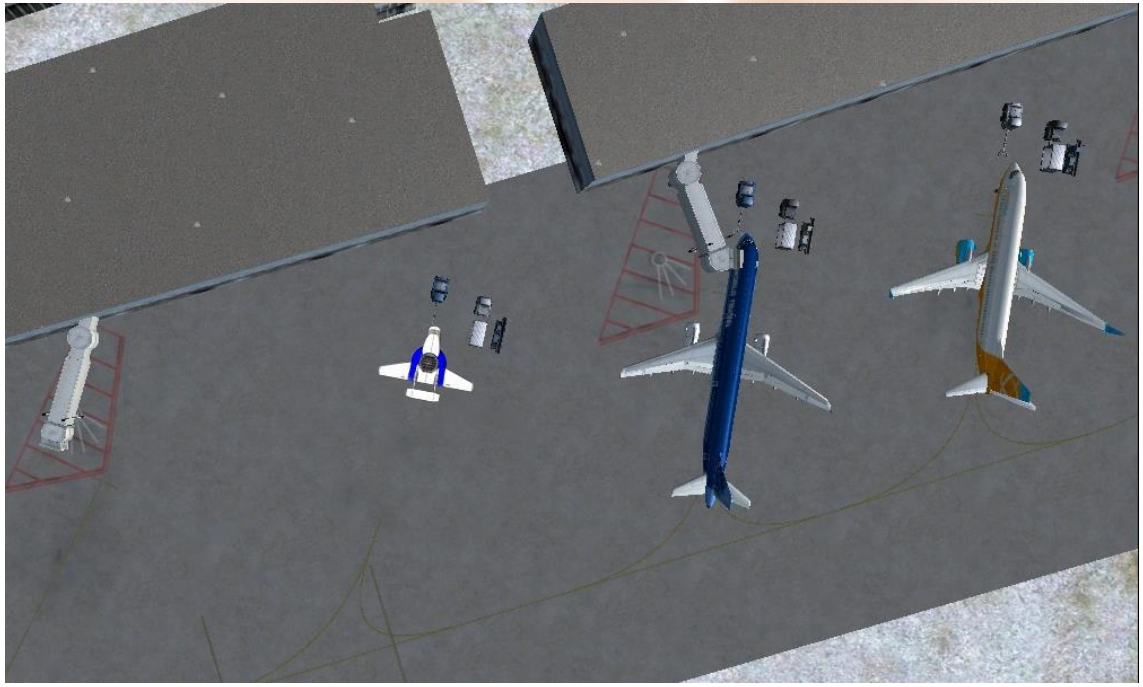


Aerodynamic Experiment



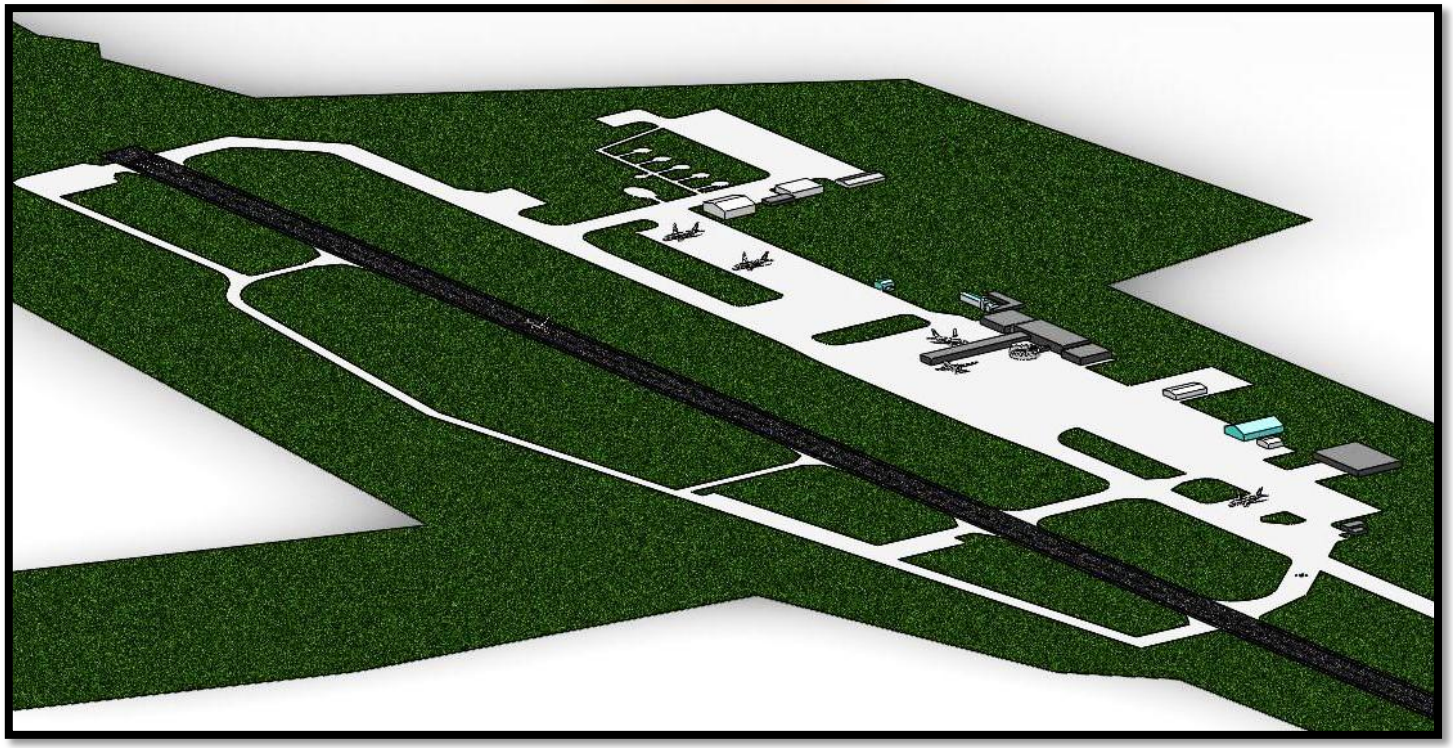
Categorization of the Hybrid aircraft from the point of view of operation at aerodromes

For a detailed study of operating possibilities it is necessary to carry out an approximate categorization of the Hybrid aircraft according to international standards – landing performance class, fire-fighting category, airport categories and other categories. Large-ESTOLAS example will be used.



Simulation of aircraft operation

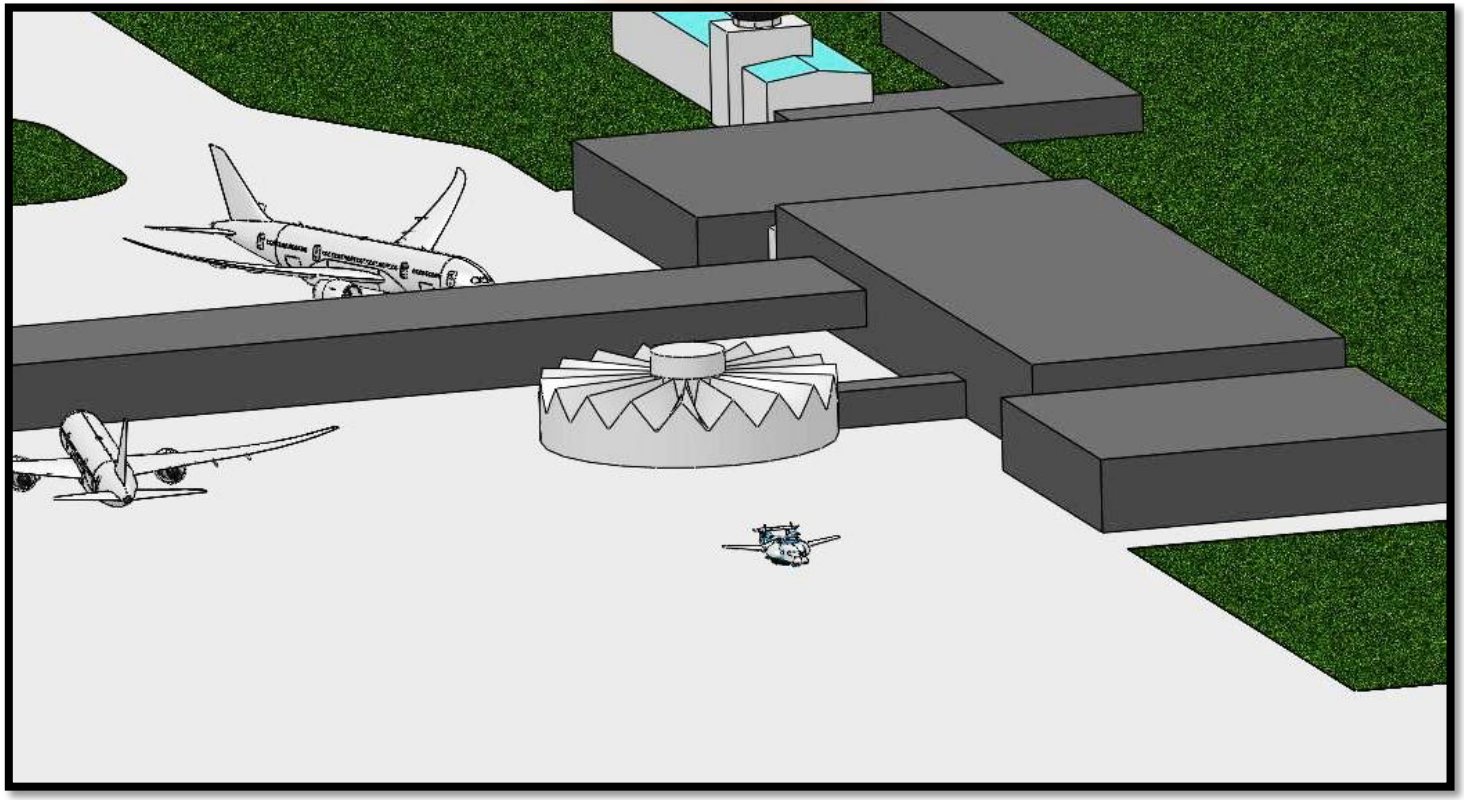
Aerodrome design



Riga International Airport computer model

Simulation of aircraft operation

Aerodrome design



ESTOLAS prototype at Riga International Airport

CREATION OF HEAT RESISTANT NANOSTRUCTURED COATINGS FOR GAS TURBINE ENGINE HOT TRACT PARTS

MULTICOMPONENT INTERMETAL-CERAMIC COATINGS

Functional intermetal - ceramic coating IMCER is supposed for the protection and restoration of the vehicle construction products working in high temperature conditions (up to 950–1050°C).

The coatings are formed in plasma from the fusions on the basis of aluminium and titanium. Maximum thickness of the coating reaches 40 mkm.

Coating properties are investigated and tested on turbine blades and other parts of the hot route of aircraft gas turbine engines.

GTE turbine blades operate under high temperatures

(up to 950 - 1050°C) being exposed to the effect of high temperature corrosion and erosion.

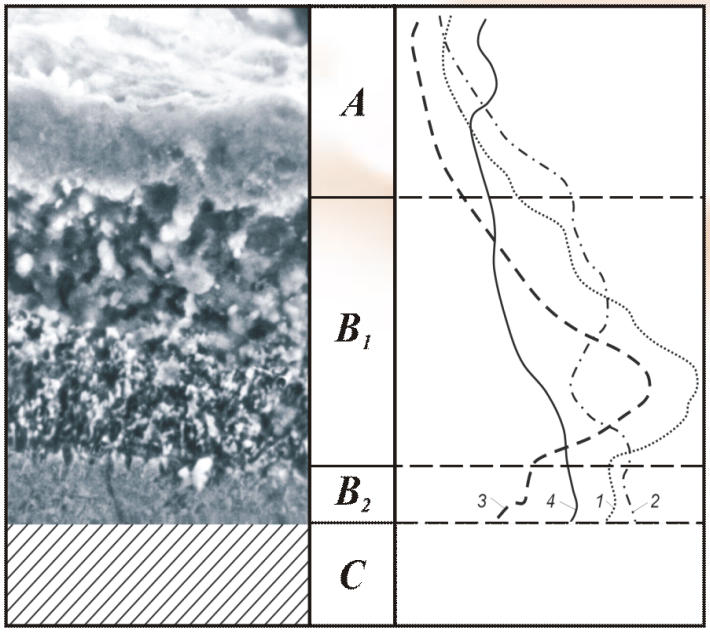
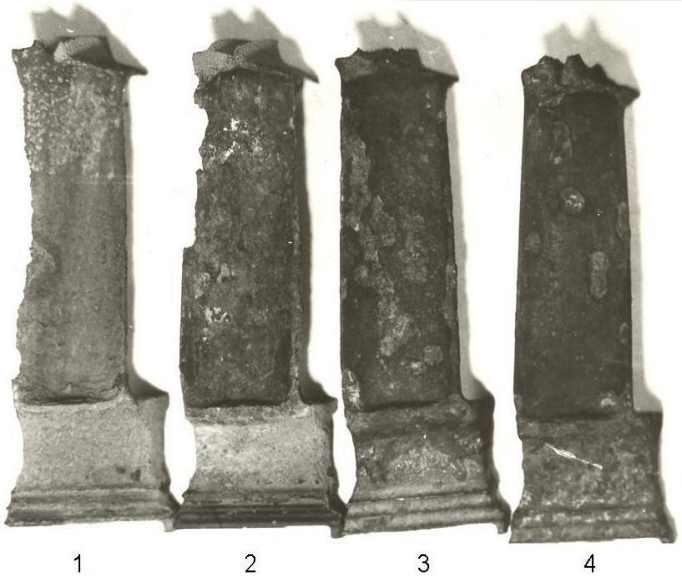
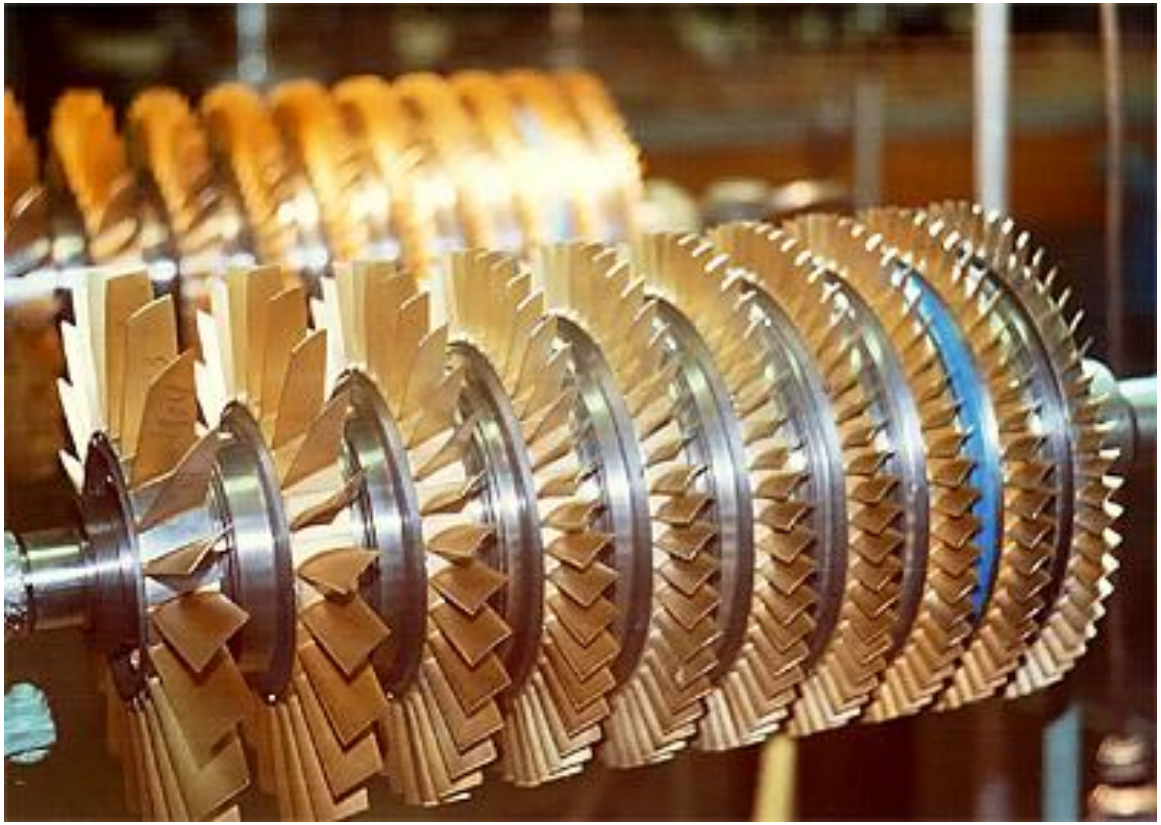


Fig. 4. Distribution of the basic elements of ЭИ867А fusion substrate within the intermetalic-ceramic coating after thermal testing (200 hours): A – ceramic area; B1, B2 – diffusion areas; C – substrate; 1,2,3,4 – distribution accordingly *Co, Ni, W, Cr*



Outward appearance of blades with the coatings after the thermal testing in the environment of glowing chlorine sulphide ash:
1 – standard aluminizing; 2 – standard aluminizing and annealing (900°C, 2 hours);
3 – zirconium aluminizing; 4 – IMCER coating



2011, Ural Works of Civil Aviation.

CREATION OF IONIC-PLASMA COVERINGS FOR PROTECTION AND RESTORATION OF DETAILS FOR VEHICLE POWER-PLANTS

The objects of development within the limits of the project are:

Details of power-plants for sea and railway vehicles (gas-turbine installations, diesel engines, combustion engines); details of the hydro-fuel equipment (valve pairs and plungers of hydro pumps, hydro motors, etc.)

RESTORATION TECHNOLOGY OF VEHICLE HEADLIGHTS REFLECTORS BY ION-PLASMOUS SPUTTERING

Defective headlight

Headlight with reflector coating restored by ion-plasmas method

UAS

1. **Research**
   Research on analog systems, pros and cons, comparison etc.

2. **Design & Development**
   Concept design, drawings, detailed component and assembly modelling

3. **Manufacturing**
   Production process

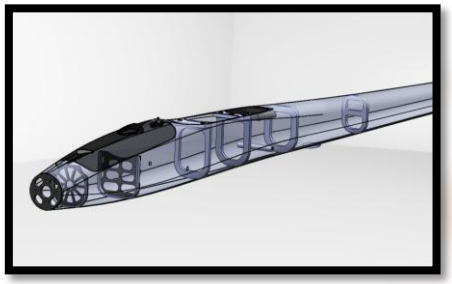
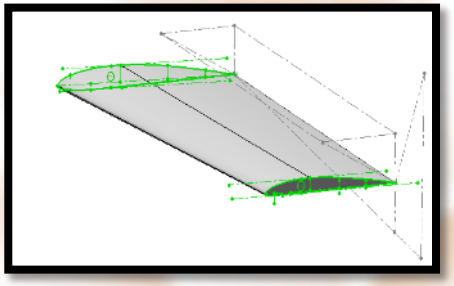
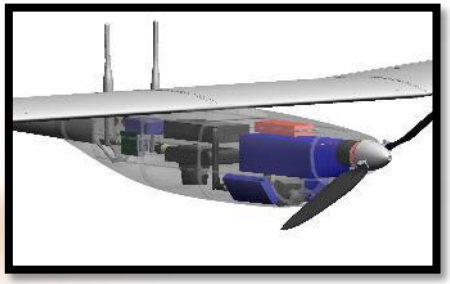
4. **Evaluation & Tests**
   Visual evaluation of the product, analysis and tests

5. **Taking Part in Missions**
   Miscellaneous operations

DESIGN & DEVELOPMENT

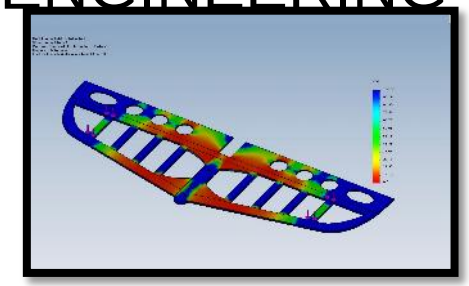
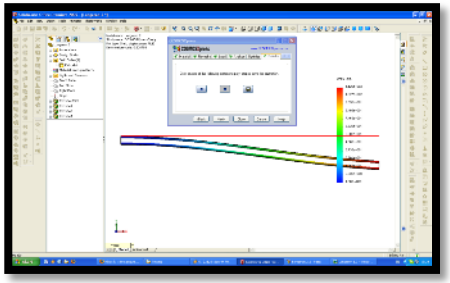
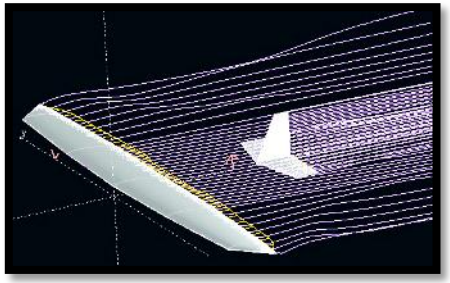
CAD TECHNOLOGIES

FULL CONCEPT DESIGN

CAE TECHNOLOGIES

AERODYNAMICS, CONSTRUCTION, ENGINEERING

MANUFACTURING

CAM TECHNOLOGIES

PROGRAMMS FOR CNC MACHINES

```
1  %0
2  N100 T121 M6
3  N110 S2000 M3
4  N120 G0 X10.404 Y10.799
5  N130 Z10.
6  N140 Z3.
7  N150 G1 Z-.487 F400.
8  N160 G2 X10.454 Y10.749 R.
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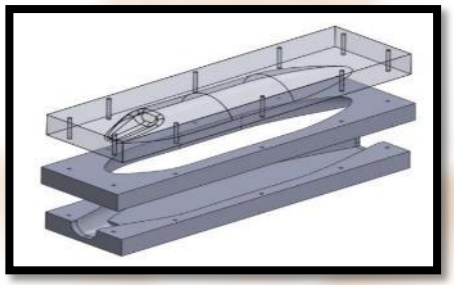
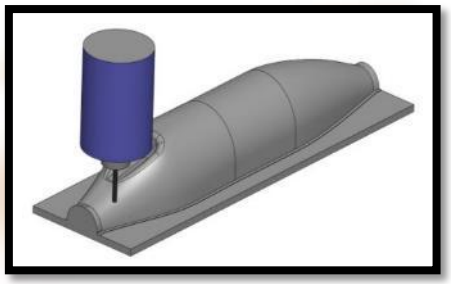




3 AXIS DRILLING MACHINE

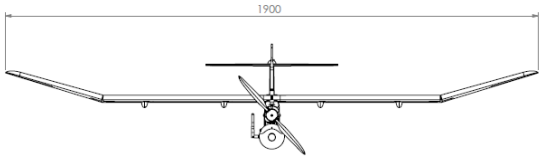
LASER CUTTING MACHINE

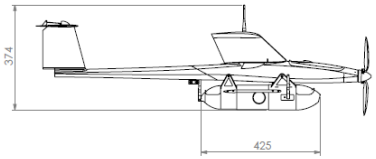
Results

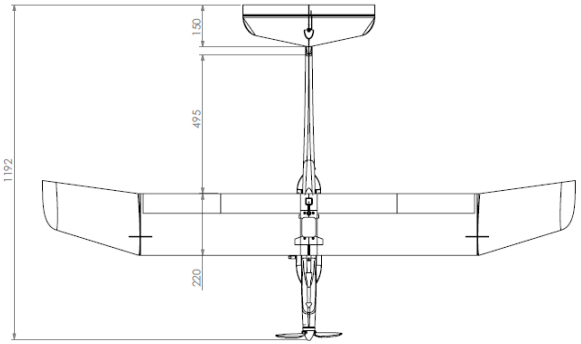
- Prototype of micro-class UAS

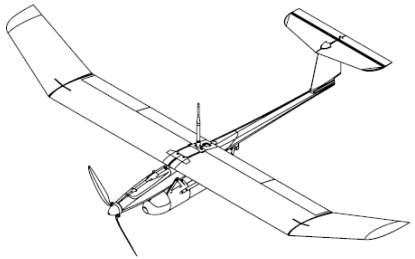
The designed UAS is characterized by the following key features:

- Construction weight – 2.5 kg;
- Flight duration – up to 1 hour;
- Flight altitude – up to 3 km;
- Payload – up to 1.5 kg;
- Engine type – electric.



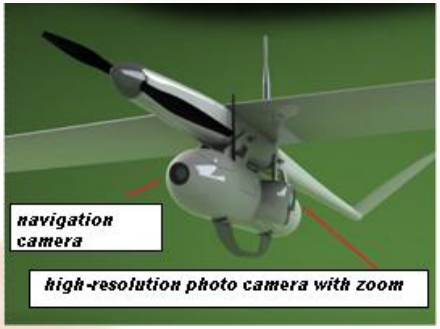






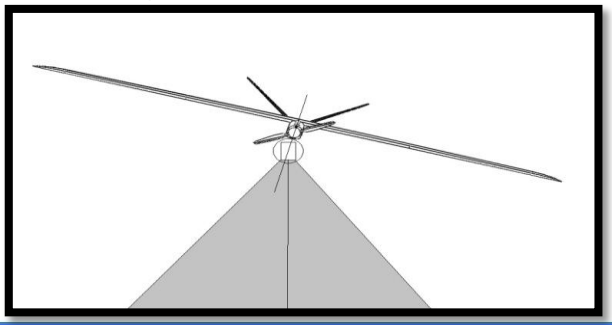
Results

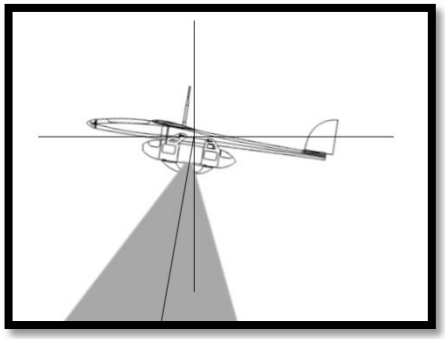
- **Features:**
- Gondola for payload
- Navigation camera for pilot
- Side camera with high resolution for aerial monitoring (include rotation possibility)



- Side camera with high resolution can be rotated at 230ºangle along the longitudinal axis. It gives possibility to shoot objects from both sides and directly below

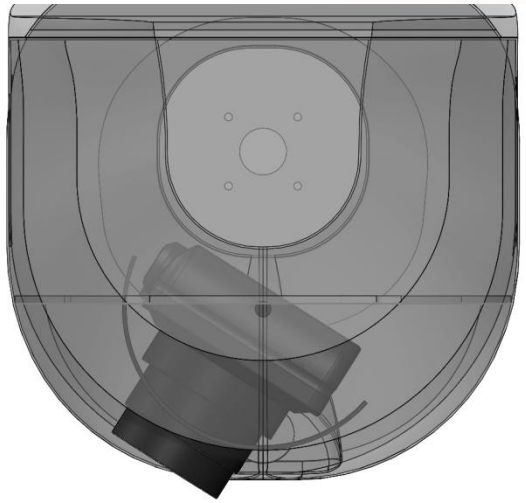
- The rotating part of gondola is also equipped with a stabilization system that allows to save the camera at the right angle, even when the aircraft is maneuvering.





Results

- **Features:**
- Navigation camera for pilot
- Special rotatable gimbal platform with stabilization and control for photo / video / other equipment, fully integrated in to fuselage.



- The rotating part of gondola is also equipped with a stabilization system that allows to save the camera at the right angle, even when the aircraft is maneuvering.

Design process

«P1-S» prototype final CAD model

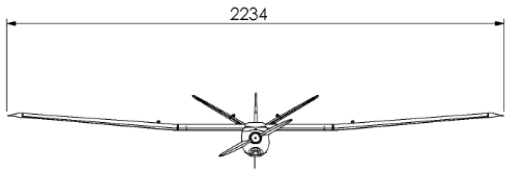
Results

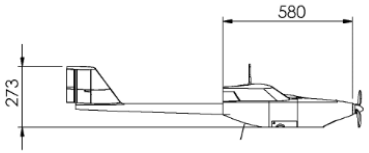
Results

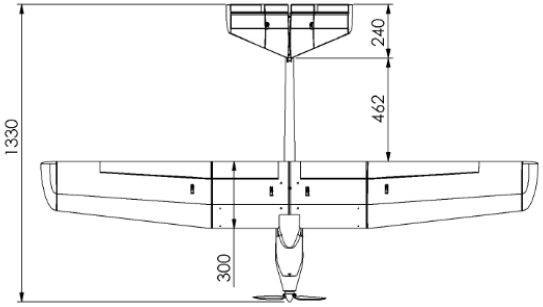
- Prototype of micro-class UAS

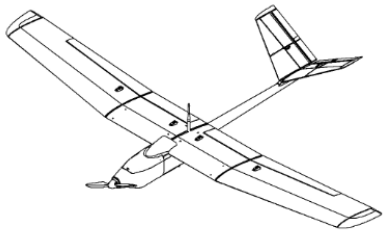
The designed UAS is characterized by the following key features:

- Gross Takeoff Weight 4.7 kg
- Wingspan 2.23 m
- Cruise Speed 50 km/h
- Endurance Up to 1,5 hours (depending on payload weight)

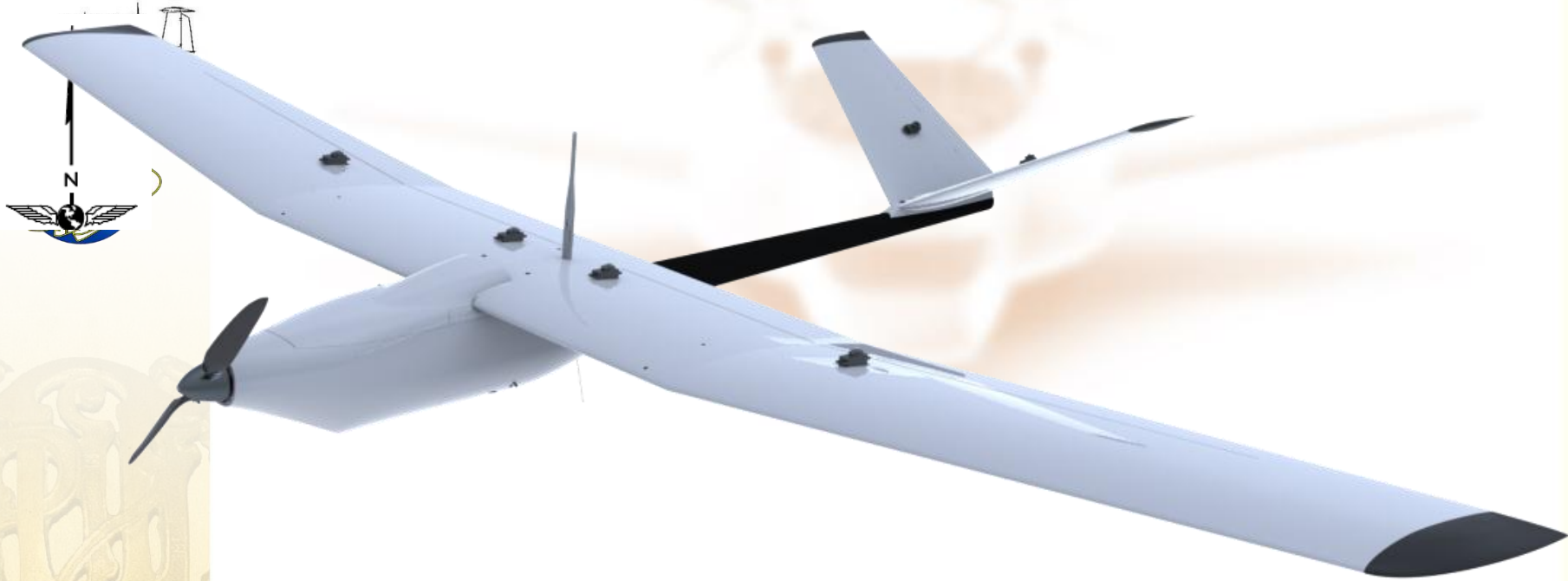






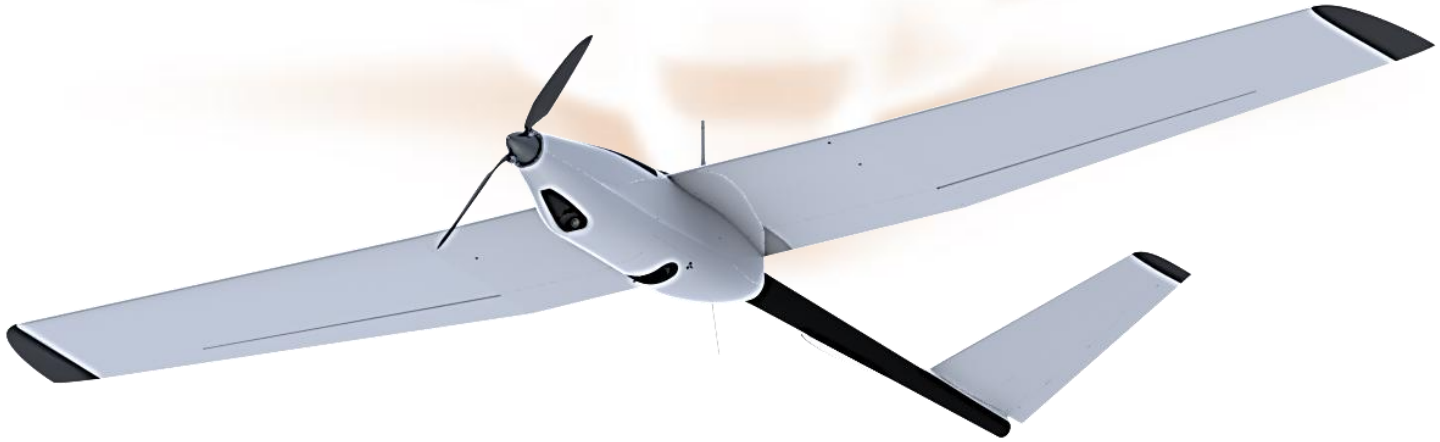


Results



Design process

«P-1B» prototype final CAD model



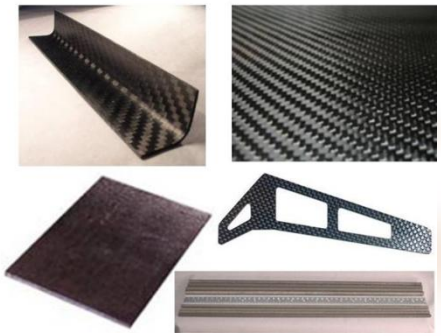
Design process

«ILLY-WP» prototype final CAD model

Technologies

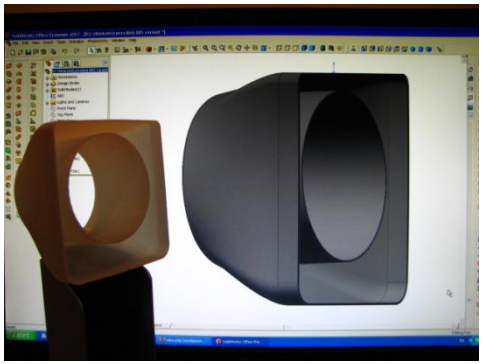
- **Using of modern materials:**

- Carbon / Kevlar composites



- **Using of modern technologies:**

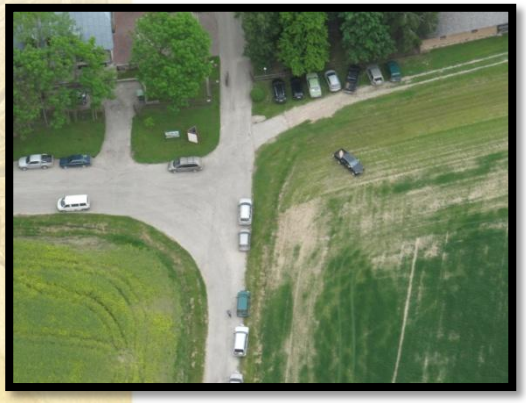
- 3D Printer Prototyping



Application field

AERTI aircraft can be equipped with fallowing video monitoring equipment:

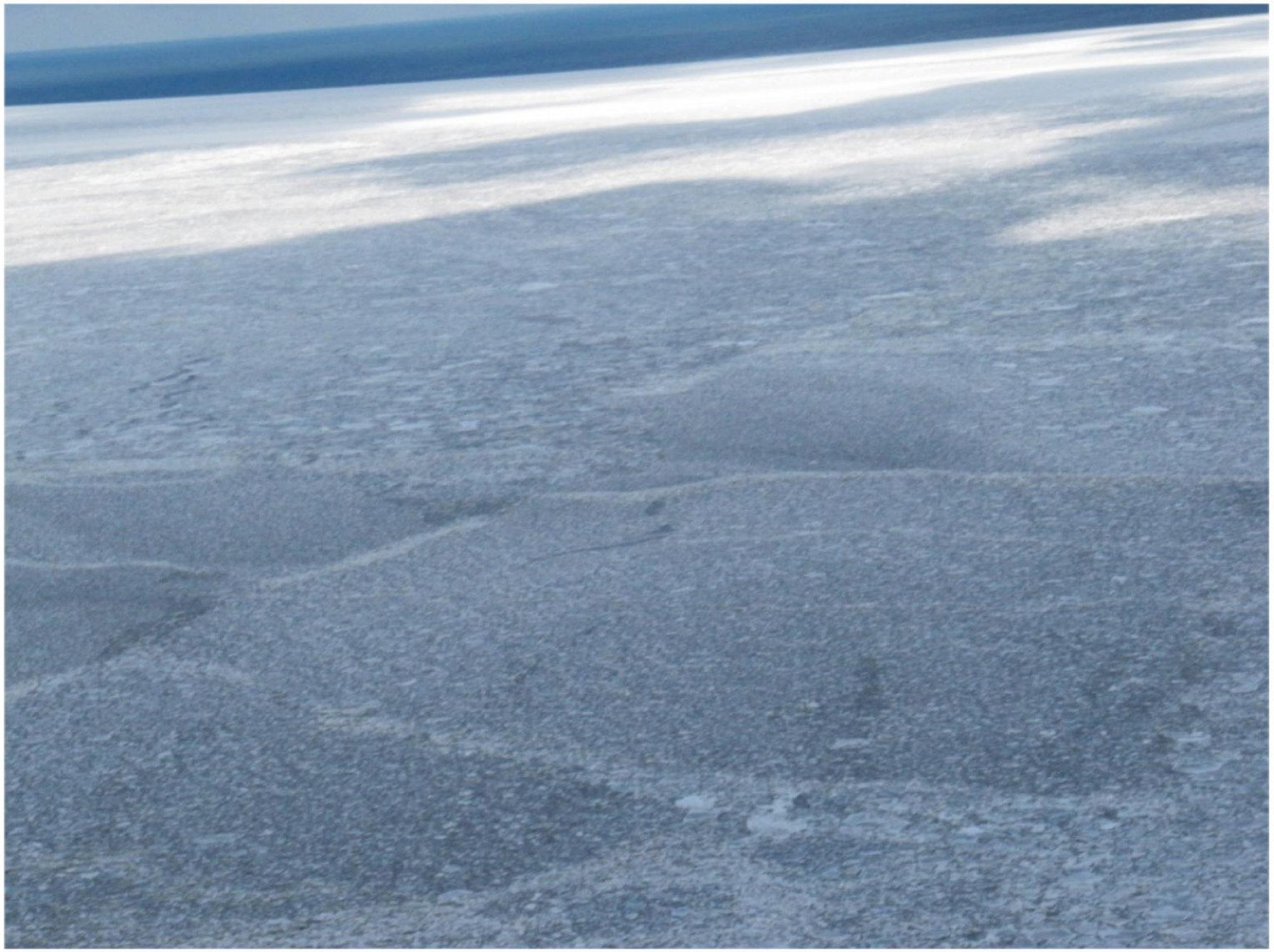
- Video cameras
- Photo cameras
- Infrared camera
- Thermal Camera
- Other devices



Searching / special operations

Searching / special operations

Ice Condition / Area monitoring



Ice Condition / Area monitoring

Precision Agriculture

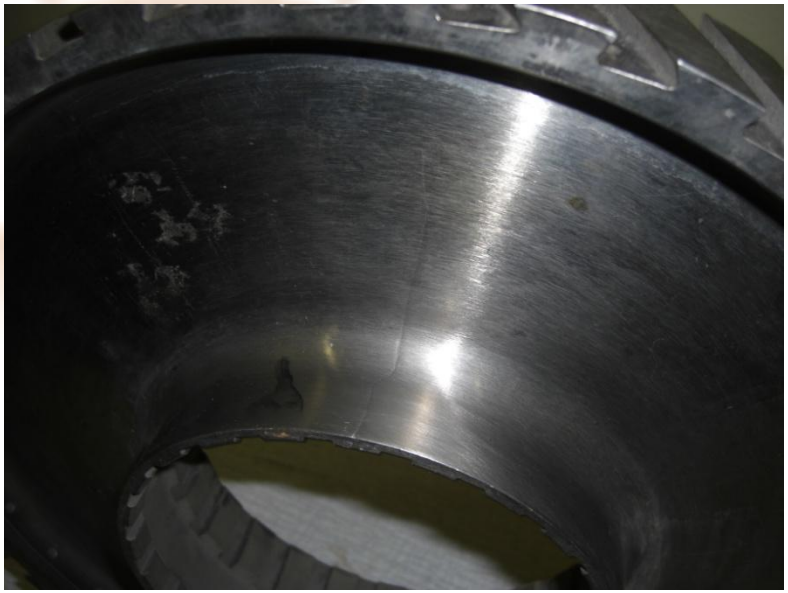
Precision Agriculture

Precision Agriculture

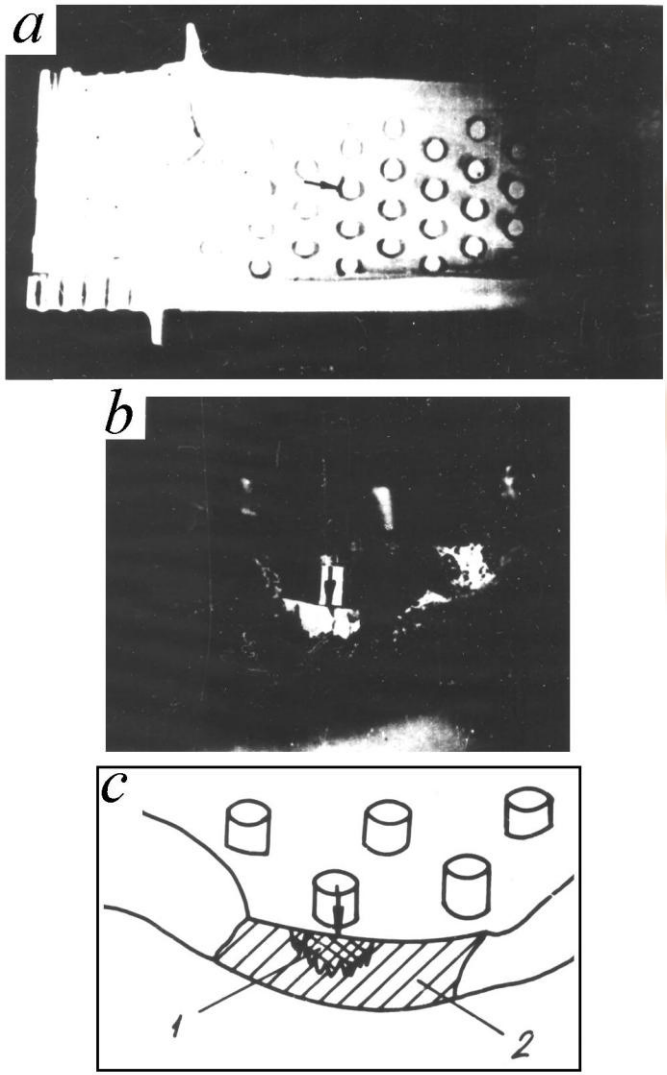
Aerial Photography / Area Security

Aerial Photography / Area Security

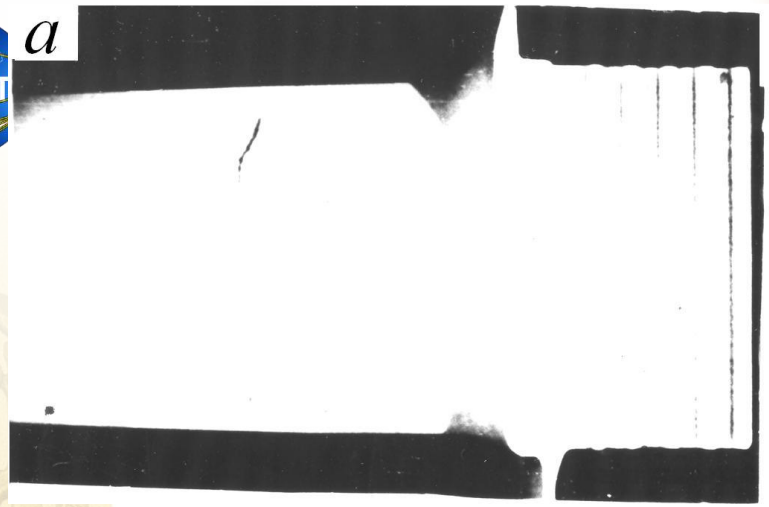
ACOUSTIC EMISSION TESTING of compressor discs

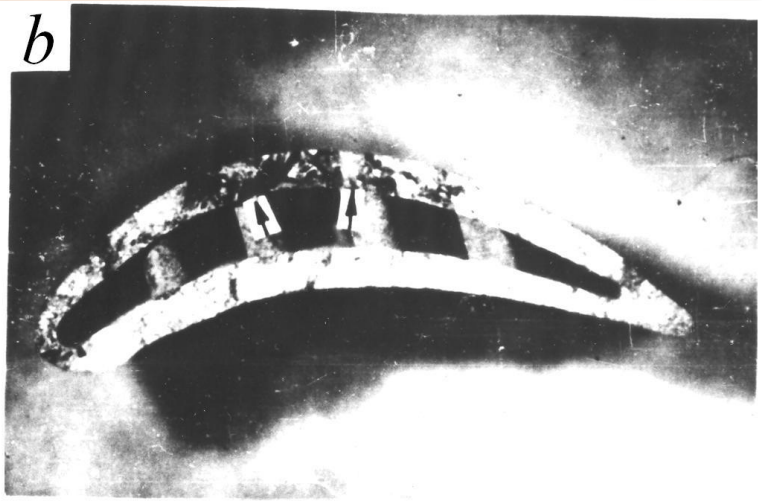


Checking of cooled turbine blades of gas turbine engines

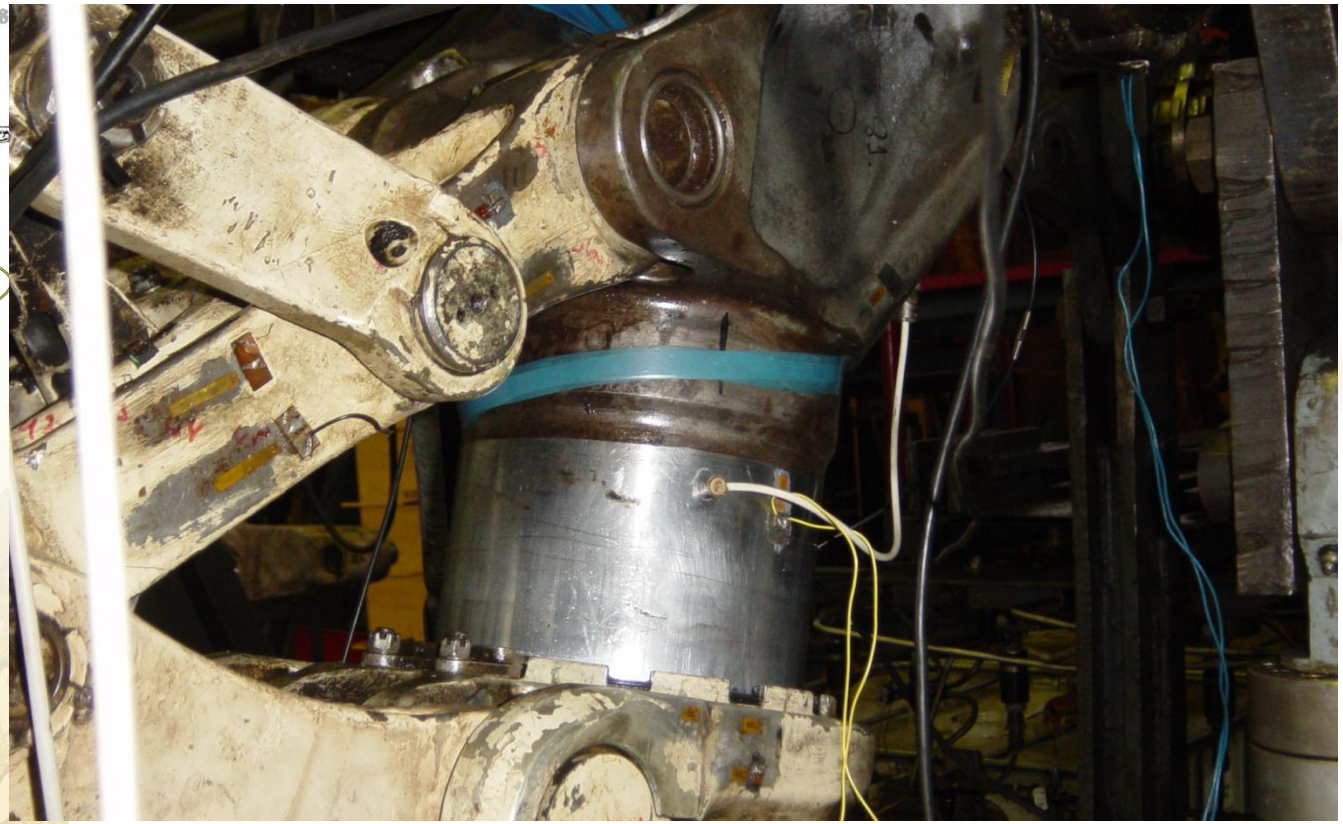


Checking of cooled turbine blades of gas turbine engines



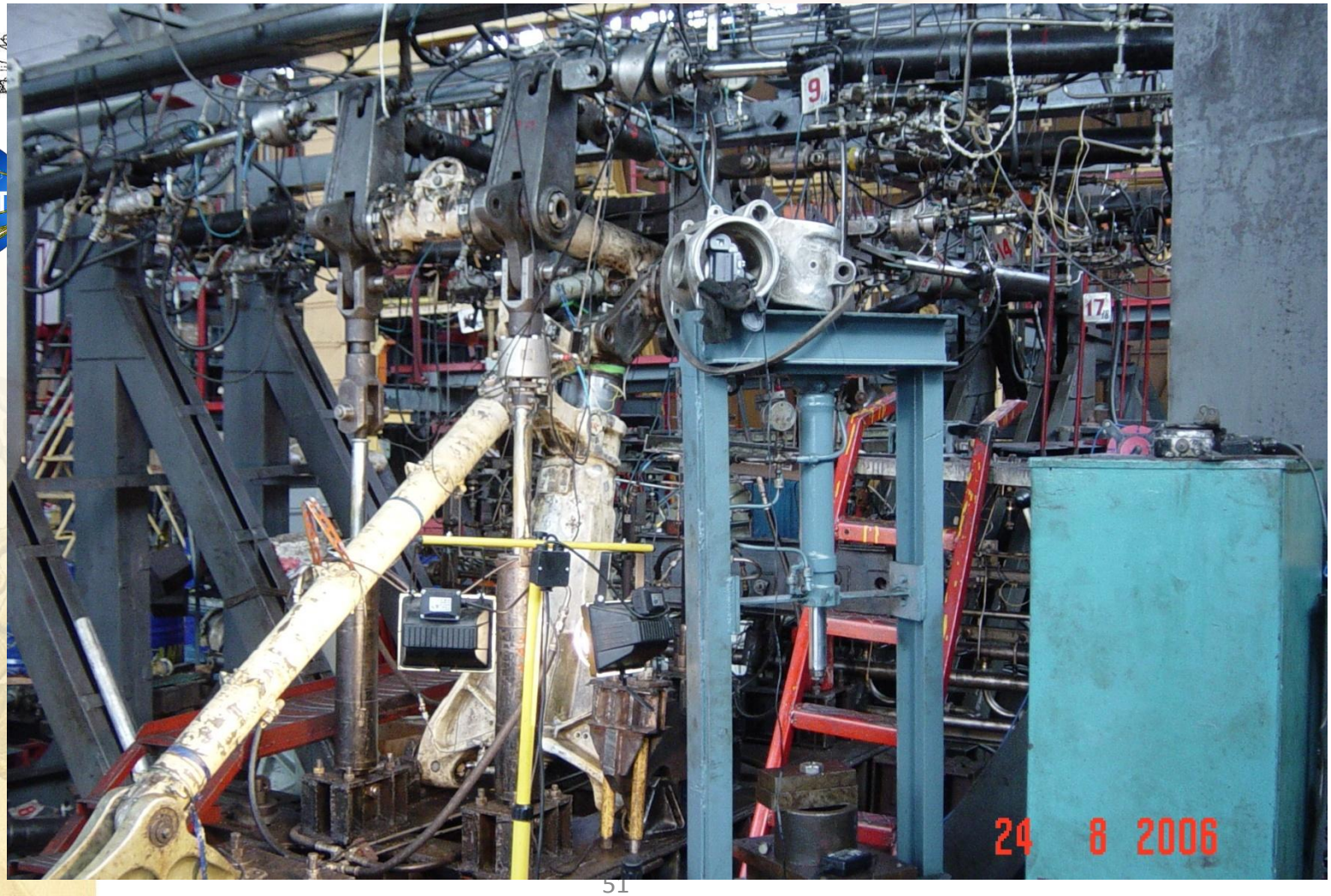


Aircraft main leg.



AE sensor and strain sensor

Test stand for landing gear testing



Thank you for your attention!