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

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

Riga, 10-11 April, 2014
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

- “ESTOLAS” CAD model
Model Manufacture

• 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 intermetallic-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.
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
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

3 AXIS DRILLING MACHINE
LASER CUTTING MACHINE
• 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 230° angle 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 into 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
AERTI aircraft can be equipped with the following video monitoring equipment:

- Video cameras
- Photo cameras
- Infrared camera
- Thermal Camera
- Other devices
Searching / special operations

Fire seat detection with a help of navigating camera
Searching / special operations
Ice Condition / Area monitoring
Ice Condition / Area monitoring
Precision Agriculture
Precision Agriculture
Aerial Photography / Area Security
Aerial Photography / Area Security
ACOUSTIC EMISSION TESTING
of compressor discs

[Image of a compressor disc with a crack indicated]
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!