



**ACTIVITY 7.1.6. PIONEERING THE AIR TRANSPORT
OF THE FUTURE**

**AREA 7.1.6.2. Step changes in air transport operation
AAT.2011.6.2-1. Novel air transport vehicles**

Project Idea:

PACE-WIG

**Feasibility study of personal aircraft
with combined application of Coanda
effect and wing-in-ground (WIG) effect**



Application domain

There is a need to effectively solve the following tasks:



- Environmental monitoring



- Exploration of mineral deposits



- Delivery of people and cargo



- Fighting (sometimes unfortunately)

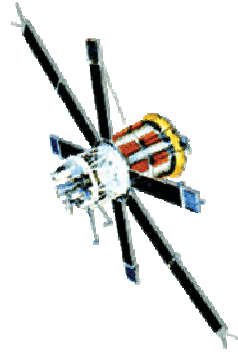
$$\text{EFFICIENCY} \uparrow = \frac{\text{PROFIT} \uparrow}{\text{COSTS} \downarrow}$$



The problem of flying vehicles efficiency

Satellite.

Disadvantages:



- expensive development & launching,
- dependence of the tasks solving quality on the state of the atmosphere,
- low ecological compatibility,...

Airplane.

Disadvantages:



- expensive development, maintenance & pilot training,
- low ecological compatibility,
- need in long runway,
- inability to hang over the required area, ...

Helicopter.

Disadvantages:



- expensive development, maintenance & pilot training,
- low ecological compatibility,
- risks due to unprotected aircrew,...



The problem of flying vehicles efficiency

Unmanned Aerial Vehicle (UAV).

- cheaper to procure,
 - no need to train pilots,
 - no need to use runway,
 - ecological compatibility,
 - elimination the risk for pilot's life,
 - ability to work in closed space, ...
- Disadvantages:**
- high exposure to fluctuations in the atmosphere,
 - limitations on the flight altitude,...



Coanda effect UAV is the special case of UAV.

Additional advantages:

- vertical takeoff and landing,
- the ability to hang over the desired area,
- large useful space for payload,
- protected screw,
- increasing lift due to the Coanda effect and WIG effect,...

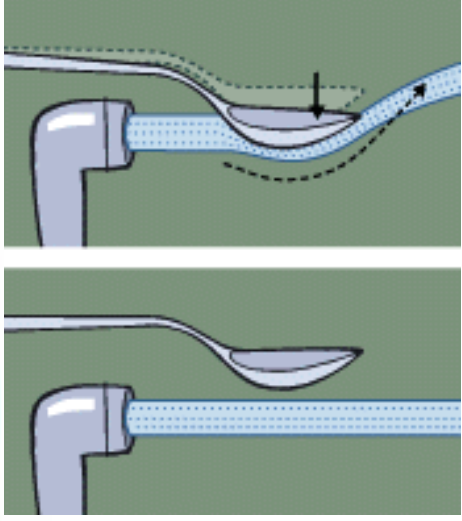
Additional disadvantages:

- windage,
- short flight duration on the electric traction,...





Coanda effect UAV. State of the art



Henri Coanda
(1886 – 1972)

The most known from Internet firm-developer is AESIR Ltd (Great Britain).



The main feature of AESIR UAVs: they are remotely-controlled ones.
(See for instance: <http://www.youtube.com/watch?v=KXVtUCABiv8>).



Coanda effect UAV in National Aerospace University "KhAI"

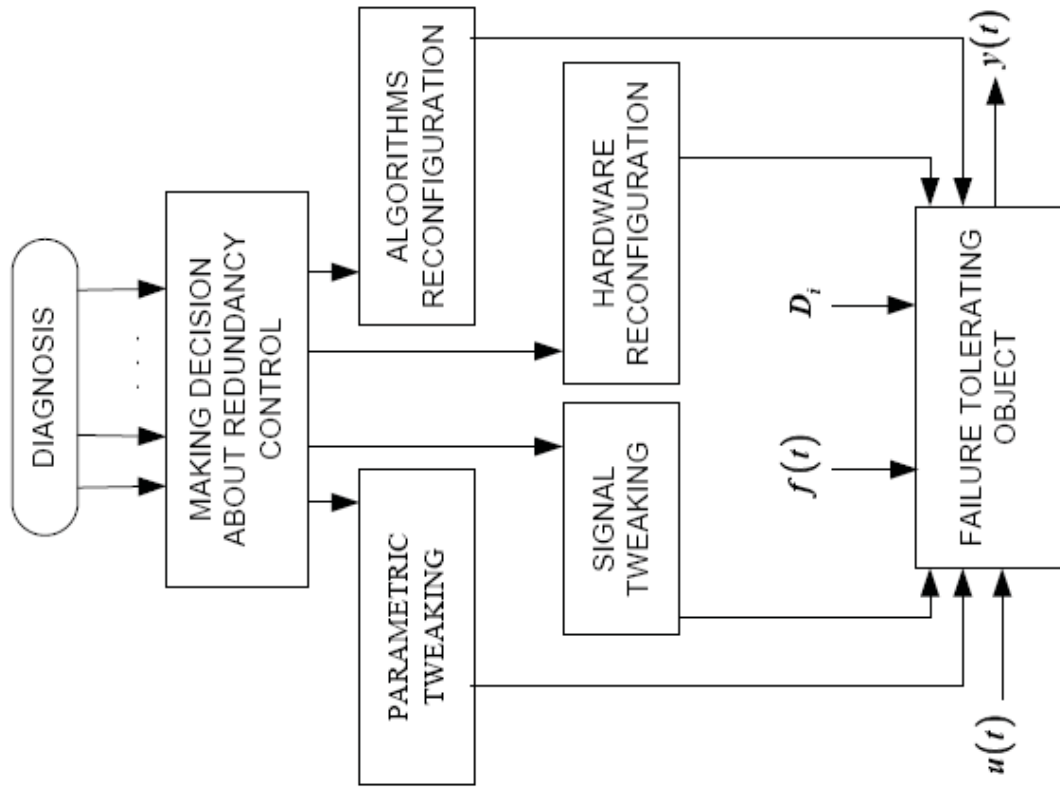
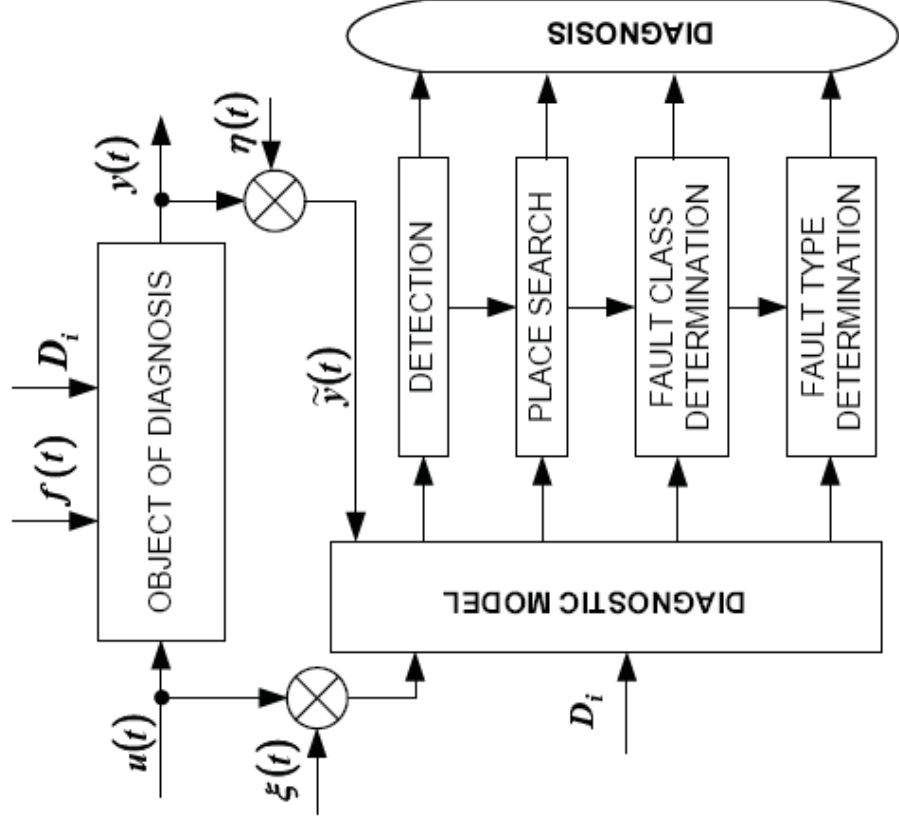


The main tasks:

- to develop navigation and stabilization parts of UAV control system to flight by both self-control and remote control;
- to develop tolerant to faults and robust to disturbances UAV with high liveness;
- to research the possibilities to delivery people and cargo.

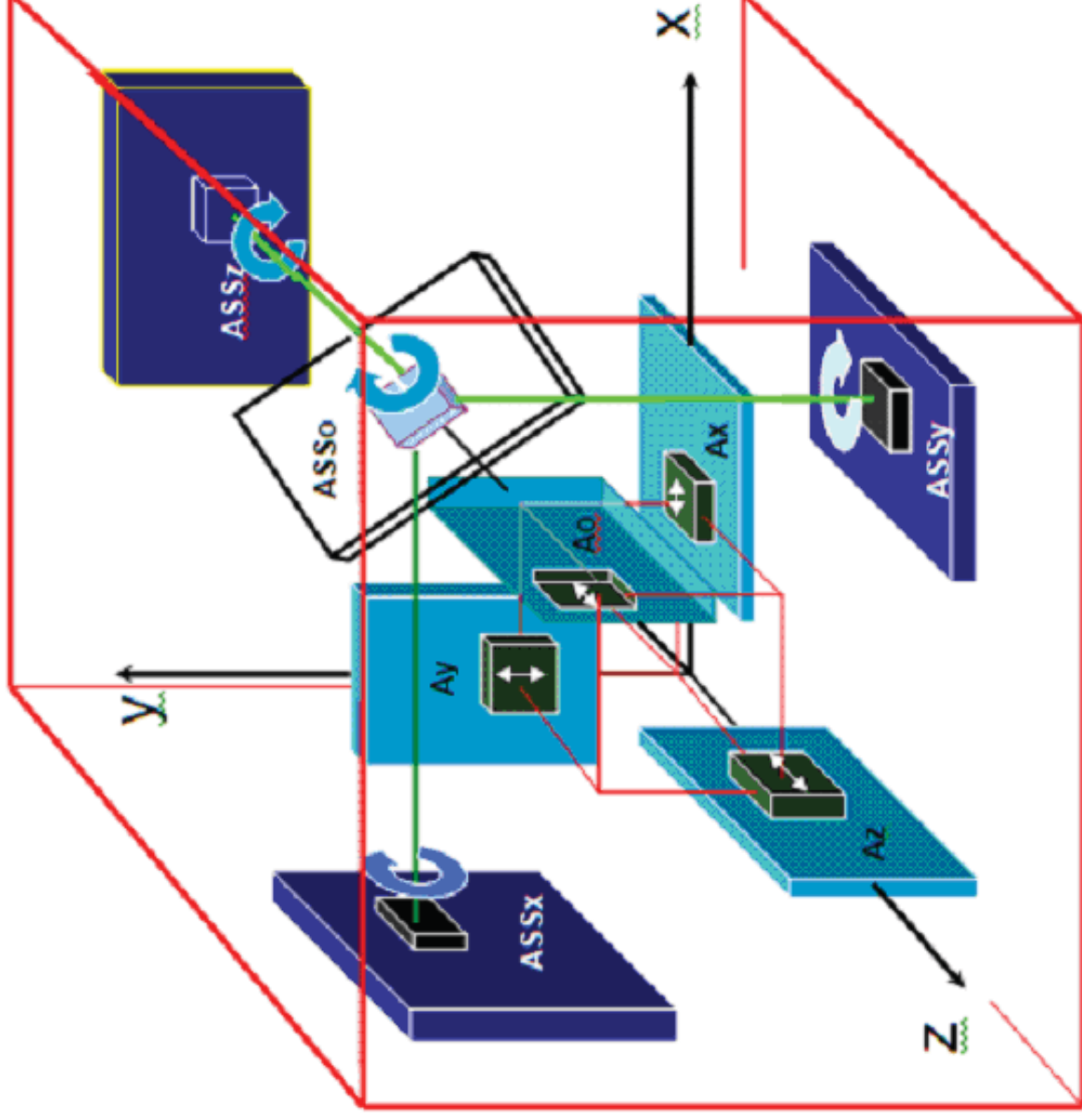


The conception of active fault-tolerant control in abnormal modes



Coanda effect UAV in National Aerospace University "KhAI"

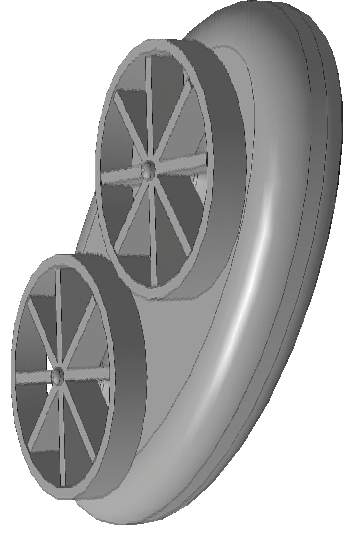
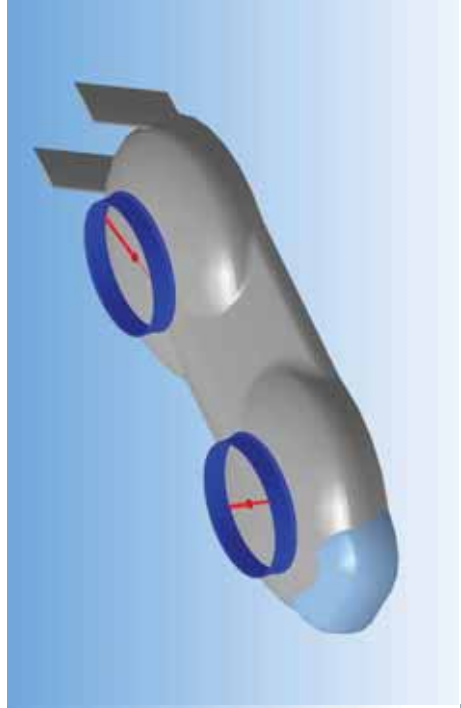
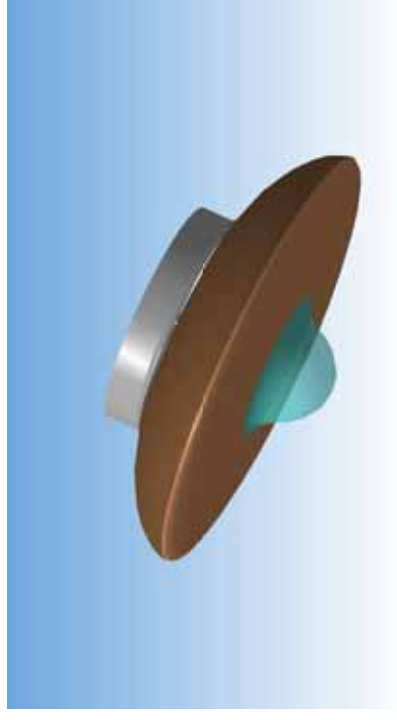
The strapdown inertial navigation system with the minimal structural redundancy







Potential configurations of UAV





The benefits of proposed UAV

- cheaper to procure,
- ecological compatibility,
- no need to train pilots,
- elimination the risk for pilot's life,
- no need to use runway,
- ability to work in closed space,
- vertical takeoff and landing,
- the ability to hang over the desired area,
- large useful space for payload,
- protected screw,
- increasing lift due to the Coanda effect and WIG effect,
- improving liveness via fault-tolerant control,...



Work Packages assumed

- System requirements definition,
- Aerodynamic study (CFD, wind tunnel tests) of main relationships of Coanda and WIG effects,
- General design approach alternatives formulation,
- Propulsion approaches study,
- Control system alternatives study,
- Scaled prototype manufacturing and testing.



**Thank you
for attention!**