

The final conference of the POLNOR-LEADER project

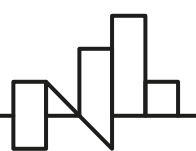
Further applications of HALE UAVs

W. Moczulski



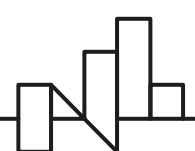
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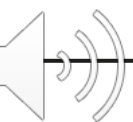
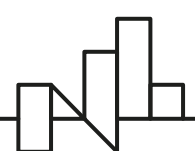
Important features of HALE UAVs

Advantages	Challenges
Unlimited endurance	PV-based power supply
	Long-range high-speed communication system
	Advanced autonomy of controlling the mission
Possibility to fly at high altitudes	Efficient power supply, high-thrust propulsion system
	Overcoming limitations of the airspace
Collecting measurements and observations over large areas	Storing and transmitting massive databases
...	



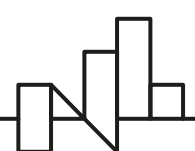
HALE UAVs in the role of pseudosatellites

- This idea was brought to the LEADER project by Prof. W. Skarka
- UAVs fly at the altitudes approaching 20 km ASL
- Several countries, and companies, have developed and flown such vehicles with encouraging success
- The world record for a vehicle of HALE class is held by 'Zephyr', manufactured by Airbus, that flew for 64 days in 2022
- HALE AUVs can take over significant tasks that carry out satellites located at the Earth orbits, by incomparable lower costs of construction and operation
- Important issues are implied by law regulations (wingspans, MTOWs, altitudes, BVLOS)



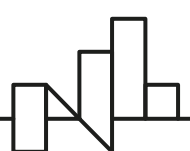
HALE UAVs as mobile observation, monitoring and measuring stations

- Long (unlimited) endurance allows long-term monitoring of critical objects, or habitats
- Communication limits require processing data and images onboard
- Reliability of the systems is the challenge



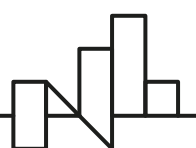
Future research

1. Methodology of optimal designing of HALE UAVs
2. Fault-tolerant design of HALE UAVs
3. More efficient power sources
4. Energy-efficient measuring systems, observation devices, communication
5. Software for data and images processing onboard
6. AI-based autonomy of drones supported in rare situations by a virtual teleportation of the remote operator
7. Cooperation with institutions creating law regarding the use of airspace in the scope of modifying this law enabling the operation of HALE UAVs with significant wingspans and MTOW



Research projects

1. Advanced control system for UAV with incidental intervention of a remote operator (MSCA)
2. Assessment of the impact of the greenhouse effect on the expansion of thermophilic species to cooler biotopes (HE)
3. Further research on air pollution (low emission, industrial and natural emission)



Conclusions

- LEADER project has opened an unlimited area of research concerning HALE UAVs
- There are several threads of research:
 - Design of HALE drones
 - Manufacturing and integrating the drones
 - Assuring long endurance of the flight
 - Autonomy of HALE UAVs
 - Energy-efficient scientific payload
 - Intelligent software for planning missions, controlling them, presenting and analysing data
- All these threads were addressed by the LEADER project
- The research group composed for carried out this research is going to continue the research
- We want to collaborate with other teams interested in this research area



Thank you for your attention!

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