

Design of a Hydrogen Fuel Cell Powered Long-Endurance Drone for Wildfire Detection

Task for a Bachelor Thesis

Background

Due to fast-proceeding climate change and resulting droughts also in Europe, more and more woodland is under threat of wildfires. An early detection of wildfires is crucial to suppress fires before they grow too big. As such, the costs and risks of a firefighting campaign can be kept down. Until now, regular manned small fixed-wing aircraft with gasoline engines are used to patrol and overfly threatened forest lands at high financial and environmental costs. Other methods in use are manned observation outposts or tower-attached cameras. But all these methods cannot provide a gapless monitoring of wide areas. On the contrary, an unmanned fleet of hydrogen powered aerial systems could have the potential to close the gaps. It could offer a 24-hour observation service, could be more flexible and could have lower climate impact and less noise pollution compared to conventional wildfire detection.

Task

Task of this thesis is to apply the method of preliminary sizing to design a hydrogen fuel cell powered drone for early wildfire detection. The drone should have a flight time as long as possible to keep operation costs low and should carry about 10 kg of payload in the form of cameras and sensors. Following subtasks have to be considered:

- Request system requirements from possible clients.
- Define requirements of the flying platform and mission.
- Evaluate design drafts regarding the defined requirements.
- Do a trade-off study of existing drone models with similar applications and specifications.
- Define an aircraft configuration and propulsion system.
- Calculate take-off mass, fuel mass, operating empty mass, wing area, and power of the propulsion system.
- Calculate the mass distribution and ascertain the position of the center of gravity.
- Calculate wing dimensions (aspect ratio, wing position, ...).
- Determine an empennage layout, calculate the dimensions and position.

The report has to be written in English based on German or international standards on report writing.