myCopter
newsletter #5

This is the fifth newsletter from the myCopter project, funded by the European Union under the 7th Framework Programme.

myCopter Project Day

On 20 November 2014, the myCopter Project Day will be held at the German Aerospace Center (DLR) in Braunschweig, Germany. Participation is free of charge and you can already register for the event. Please note that we have a limited number of available seats, and that we will confirm your registration.

During this day, we will present the outcomes of our project to relevant stakeholders and to the general public. In the last 4 years, we have investigated breakthrough technologies in several research areas:

- New concepts for control of PAVs (University of Liverpool)
- Novel human-machine interfaces (Max Planck Institute for Biological Cybernetics, Tübingen)
- Computer vision-based PAV automation (Swiss Federal Institute of Technology Zürich)
- Collision avoidance strategies and automatic landing place assessment (École Polytechnique Fédérale de Lausanne)
- Implementation and test of novel PAV technologies on the DLR experimental helicopter FHS (German Aerospace Center, Braunschweig)

Furthermore, we have explored the potential uses and risks of PAVs for society through technology assessment methodologies (Karlsruhe Institute of Technology).

With scientific presentations and demonstrations we hope to stimulate lively discussions between attendees during hands-on demonstrations of our findings. Furthermore, attendees of the myCopter Project Day will be able to experience demo flights with unmanned aerial vehicles and with DLR's Flying Helicopter Simulator. A detailed programme is already available.

Project Day
20 November 2014

PROGRAMME

PRESENTATIONS

10:00 Welcome
Prof. Dr.-Ing. Stefan Levedag, DLR Institute of Flight Systems

10:10 Introduction to the project
Prof. Dr. Heinrich Bülthoff, MPI for Biological Cybernetics

10:30 Scientific presentations of project partners
- New concepts for control and autopilots for PAVs
- Novel human-machine interfaces
- Camera-based PAV automation
- Collision avoidance strategies and automatic landing place assessment
- Implementation and tests of novel PAV technologies
- Potential uses and risks of PAVs on society

POSTER SESSION

12:00 – 13:30 Poster session with snacks and drinks

PRESS CONFERENCE

14:30 – 15:00 Press conference

DEMOS

13:30 – 15:30 Interactive demonstrations
Simulators, UAVs, Aircraft display and World Café

15:30 – 16:15 Flight demonstration with the Flying Helicopter Simulator

16:15 – 16:30 Farewell
Prof. Dr. Heinrich Bülthoff, MPI for Biological Cybernetics

VENUE

German Aerospace Center (DLR), Braunschweig, Germany

REGISTRATION

http://mycopter.eu/mycopter-project-day

Project funded by the EU's 7th framework programme

myCopter project members at the meeting in Zürich (Image: ETHZ)

Fourth project meeting

Towards the end of the third year of the project, we held another project meeting to report on each partner's progress and to discuss future goals. Our fourth project meeting was held at the Swiss Federal Institute of Technology in Zürich, Switzerland on 25 and 26 November 2013. Apart from presentations on project work packages, project partners had also prepared posters such that project details could be discussed in more depth.

We also invited Dr. Markus Möckli from RUAG Aerospace for a keynote presentation entitled "Airspace integration and certification of remotely piloted aircraft systems". This presentation gave us insight into the practical issues associated with the use of highly automated vehicles in future air traffic systems.

Scientific progress

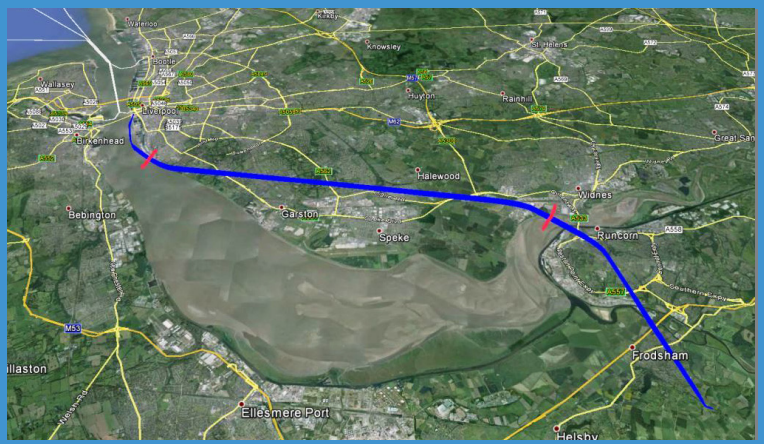
Focus group discussions

We have finished conducting focus group discussions in Germany, Switzerland and United Kingdom. These discussions aimed to explore the perceptions and expectations regarding PAV technologies. Key aspects of the discussion were the participants' feelings and impressions related to the existence and availability of PAVs in their local environment and the issues and challenges associated with this new travel option. Initially, participants were asked to state general problems in current urban transport systems and options for improvement, especially related to their daily commute. Then, PAVs were introduced as an additional transportation option and participants could experience a simulated PAV commuting scenario. This led to lively and critical discussions on potential challenges and solutions, e.g., about business concepts and autonomy levels.

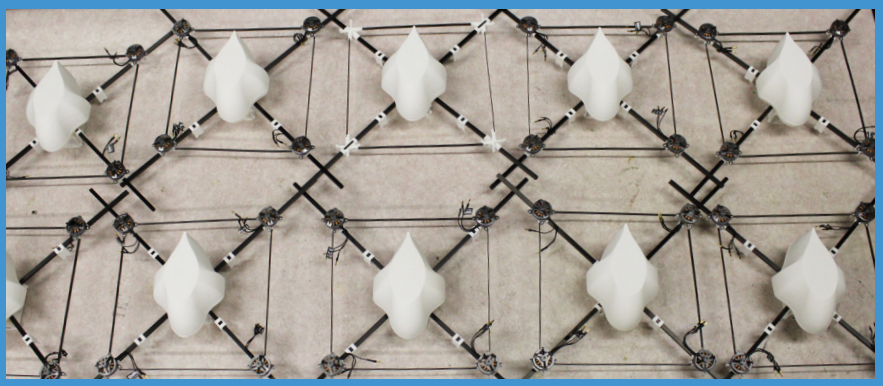
The outcomes of the focus group discussions are discussed in an in-depth report. The main concerns of participants are related to safety challenges on the ground and in the air. Furthermore, participants shared their thoughts on environmental issues (visual impact and noise), challenges with respect to infrastructure (city architecture, integration into existing ground traffic, maintenance and service), organisational and business models, level of autonomy and legal issues.

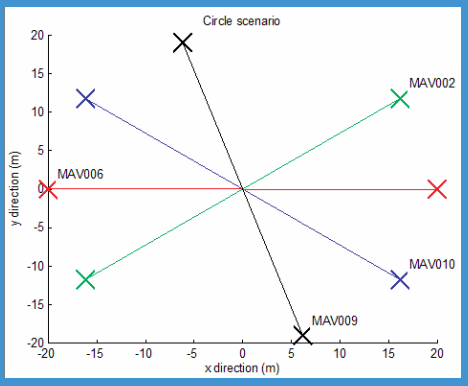
Outdoor collision avoidance experiments

In a PAV scenario, collision avoidance strategies must accommodate for high-density environments in which each flying vehicle has its individual goal. Our strategy is based on simulations of human crowds, where each individual has their own goal while performing collision avoidance with neighbours. Each vehicle can sense the position and the velocity of surrounding PAVs. At each time step, all vehicles perform a cycle of sensing and acting to ensure that the trajectories will



A focus group participant during a simulated PAV flight (Images: UoL)





Unmanned aerial vehicles in a high-density collision avoidance scenario (Images: EPFL)

remain collision free for a predefined amount of time. By repeating this operation at every time step, the whole trajectory becomes collision free. We have also proposed an extension to this method in order to consider passenger comfort. The level of discomfort is minimised by limiting the magnitude of the derivative of acceleration (also called jerk).

We tested our collision avoidance strategy in a worst case circle scenario, in which each vehicle is placed at a position on a circle at the same altitude. The goal of each vehicle is to fly to a point on the opposite side of the circle. Without collision avoidance, this would lead to a collision with all vehicles in the centre. Our testing in an outdoor environment demonstrates that our approach can reliably run in real-time with minimal computing hardware. Even though no collisions occurred, the dynamic constraints of the platform, the accumulated positioning and control errors as well as communication dropouts can lead to violations of the safety distance. We are conducting further experiments with more vehicles in order to improve performance by reducing the accumulated errors leading to insufficient separation.

PAV flight dynamics in the Flying Helicopter Simulator

Our myCopter PAV flight dynamics model has been adapted to offer car-like handling. The newest version of the model uses principles of thrust-vectoring to generate translational accelerations. Therefore, the pitch and roll attitudes remain constant during manoeuvring. Furthermore, the original PAV model can now be used with conventional helicopter controls, sidesticks and unconventional control inceptors such as a steering wheel for direction control and pedals for speed control. The height is still controlled with a collective lever. This concept will be demonstrated on the Flying Helicopter Simulator at DLR. The general flyability of the model has been demonstrated in ground-based simulation. Currently, this concept is prepared for test flights that will be performed later this year.

Publications

We publish our work in international journals and conference proceedings. An up-to-date list of our publications can be found on our website.

In the press

More than 60 news articles have been published about the myCopter project. Recently our project was presented at the 13th Future Congress 2014 in Wolfsburg, Germany. It was also featured in the New York Times. An overview of all press coverage is given on our website.

A car-like steering concept in the Flying Helicopter Simulator (Images: DLR)

http://www.mycopter.eu
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