Deliverable D1.6 / D8.2 / D8.3

Final international workshop and live demos at DLR Braunschweig

Contractual delivery date:

December 2014

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December 2014

Partner responsible for the Deliverable:

MPI

Authors:

Frank Nieuwenhuizen, Julia Mihatsch

Dissemination level[1]		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

[1] Dissemination level using one of the following codes: **PU** = Public, **PP** = Restricted to other programme participants (including the Commission Services), **RE** = Restricted to a group specified by the consortium (including the Commission Services), **CO** = Confidential, only for members of the consortium (including the Commission Services)

Document Information Table

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Project full title	myCopter – Enabling Technologies for Personal Air Transport Systems
Deliverable number	D1.6 / D8.2 / D8.3
Deliverable title	Final workshop and live demos at DLR Braunschweig
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Partner responsible for Deliverable	Max Planck Institute for Biological Cybernetics
Reviewer(s)	Prof. Dr. Heinrich Bülthoff

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement no 266470.

[2] Nature of the deliverable using one of the following codes: **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

Revision Table

Version	Date	Modified Page/Section	Author	Comments
1.0	December 2014	Initial revision	Frank Nieuwenhuizen, Julia Mihatsch	

Executive Summary

This deliverable documents the myCopter Project Day that was held on 20 November at the German Aerospace Center in Braunschweig, Germany. At this event, we presented the outcomes of the myCopter project to relevant stakeholders, the general public and members of the press. This deliverable includes details about the event, including the presentations and demonstrations that were shown. Also, information is provided regarding the press coverage of the event.

Table of Contents

1. myCopter Project Day

The myCopter Project Day was held on 20 November 2014 at DLR in Braunschweig, Germany. During the event, we presented the outcomes of our project to relevant stakeholders, the general public and members of the press.

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 Zurich)
- 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 hoped to stimulate lively discussions between attendees during hands-on demonstrations of our findings. Furthermore, attendees of the myCopter Project Day were able to experience demo flights with unmanned aerial vehicles and in DLR's Air Vehicle Simulator (AVES).

Invitation and programme for the myCopter Project Day

Transportation

HOW TO FIND THE GERMAN AEROSPACE CENTER

DLR Braunschweig
Lilienthalplatz 7
38108 Braunschweig

Tel.: +49 531 295-0
see myCopter website for Details

Important note: Admission to DLR is only possible after registration on our website. All guests will need to present their passport at the DLR reception.

ARRIVAL BY TRAIN AND BUS

Please take bus route # 436 from the central railway station in the direction 'Flughafen' until bus stop 'DLR' (see the dashed line on the map).

Website of Braunschweig transport system: www.braunschweiger-verkehrs-ag.de

ARRIVAL BY CAR

From the A2 autobahn, take the exit 'Braunschweig-Flughafen' and follow the signs to DLR. Signposted parking space is available at DLR.

ARRIVAL BY AIR

Braunschweig airport is nearby but the nearest major airport is Hannover. From Hannover airport it takes approximately 45 minutes by car to get to DLR Braunschweig or about two hours by public transport.

Project funded by the EU's 7th framework programme

Project Day
20 November 2014

ACCOMODATION

HOTELS IN BRAUNSCHWEIG

Hotel Landhaus Seela
Messeweg 41
38104 Braunschweig
Germany
Phone: (+49) 531 370010
Fax: (+49) 531 37001193
E-Mail: info@hotel-landhaus-seela.de
www.hotel-landhaus-seela.de
Bus stop: Messeweg, bus # 413 to DLR

Hotel "An der Stadthalle"
Leonhardstraße 21
38102 Braunschweig
Germany
Phone: (+49) 531 - 73068
Telefax: (+49) 531 - 75148
E-Mail: info@hotel-an-der-stadthalle.de
www.hotel-an-der-stadthalle.de
Bus stop: Leonhardplatz (Stadthalle), bus # 436 to DLR

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European Hospitality Management GmbH
Hauptstraße 48b
38110 Braunschweig
Germany
Phone: (+49) 5307-209-0
Fax: (+49) 5307-209-400
E-Mail: braunschweig@balladins-hotels.com
www.balladins-hotels.com/?id=28
No direct bus/train connection, but short distance by taxi/car.

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38100 Braunschweig
Phone: (+49) 69 256699 300
Fax: (+49) 531 4814 100
E-Mail: info.braunschweig@pentahotels.com
www.pentahotels.com/de/hotels/bweph-braunschweig
Tram station: John-F.-Kennedy-Platz,
M1 to main station; # 436 to DLR

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Berliner Platz 3
38102 Braunschweig
Germany
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Fax. (+49)531/7008125
E-Mail: H0871@accor.com
www.accorhotels.com/gb/hotel-0871-mercure-hotel-atrium-braunschweig/index.shtml
Bus stop: Main Station (Hauptbahnhof), bus # 436 to DLR

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38100 Braunschweig
Tel. (+49) 531 48222-0
Fax (+49) 531 48222-888
de.steigenberger.com/Braunschweig/Steigenberger-Parkhotel
Tram station: John-F.-Kennedy-Platz,
M1 to main station; # 436 to DLR

Project funded by the EU's 7th framework programme

Project Day
20 November 2014

2. Workpackage presentations

The morning of the myCopter Project Day was devoted to presentations about the scientific results generated within the project. Project coordinator Prof. Dr. Heinrich Bülthoff gave an introduction into the project, after which each project partner gave an overview of their work:

- **Presentation title:** myCopter – Enabling Technologies for Personal Aerial Transportation Systems
  Presenter: Prof. Dr. Heinrich Bülthoff

- **Presentation title:** WP2: Flight simulation and training
  Authors:. Michael Jump, Mark D. White, Phillip Perfect, Linghai Lu and Michael Jones
  Presenter: Dr. Michael Jump

- **Presentation title:** WP3: Human-machine interfaces for controlling a PAV
  Authors: Frank Nieuwenhuizen, Lewis Chuang and Heinrich Bülthoff
  Presenter: Dr. ir. Frank Nieuwenhuizen

- **Presentation title:** WP4: Control and navigation of a single PAV Vision-based navigation in GPS restricted environments
  Authors: Markus Achtelik, Michael Burri, Sammy Omari, Pascal Gohl, Simon Lynen, Stephan Weiss, Margarita Chli, Stephane Magnenat, Samir Bouabdallah and Roland Siegwart
  Presenter: Dr. Markus Achtelik

- **Presentation title:** WP4/5: Vision-guided automated landing and relative positioning
  Authors: Raphael Sznitman, Mario Christoudias, Xiaolu Sun, Artem Rozantsev, Vincent Lepetit and Pascal Fua
  Presenter: Dr. Raphael Sznitman

- **Presentation title:** WP5: Navigation in the air and interaction with other traffic
  Authors: Nicolas Dousse, Felix Schill, Jean-Christophe Zufferey and Dario Floreano
  Presenter: Nicolas Dousse

- **Presentation title:** WP6: PAV operational concepts PAV Technologies in ground-based and in-flight simulation
  Authors: Bianca I. Schuchardt, Joachim Götz and Marc Höfinger
  Presenter: Bianca Schuchardt

- **Presentation title:** WP7: Exploring the socio-technical environment of PAVs
  Authors: Torsten Fleischer, Sarah Meyer-Soylu, Jens Schippl and Michael Decker
  Presenter: Torsten Fleischer

These presentations can be downloaded as PDF files from the myCopter website: http://mycopter.eu/home/results/project-day-presentations.html.

3. Demonstrations

The afternoon of the myCopter Project Day was devoted to demonstrations concerning the scientific work performed in the project. These demonstrations featured various simulators highlighting PAV Handling Qualities and human-machine interfaces, Unmanned Aerial vehicles demonstrating vision-based navigation and collision avoidance, videos regarding automatic landing place assessment, and a world café where attendees could discuss their visions for personal aerial transportation systems with project partners

The demonstrations were scheduled for the entire afternoon (see the time schedule below). Attendees were first guided along all demonstrations in groups and could explore the entire exhibit at will at the end of the day.

Overview of the demos at the myCopter Project Day

Demo name	Short description	Responsible partner
Flight Simulation (AVES)	The helicopter simulator of the AVES simulator center is used for ground-based simulation and preparation of FHS flight tests. Like in the real helicopter the cockpit has been equipped with steering wheel and highway-in-the-sky display. The flight dynamics of a future PAV are simulated and the guests can take a flight.	DLR
UAVs (vision-based navigation)	Automation of take-off and landing relies on accurate knowledge of variables, such as the position, velocity and orientation of the vehicle. While GPS is a popular sensor choice in open spaces, it suffers from accuracy issues in urban environments. We therefore use cameras to estimate both the state of the vehicle and its surrounding obstacles. The demo shows a Micro Aerial Vehicle (MAV) that solely uses a camera system for stabilization and navigation. It can be steered by an untrained pilot with a joystick, while it avoids crashing into obstacles.	ETHZ
FHS - Flying Helicopter Simulator	DLR's Flying Helicopter Simulator (ACT/FHS) is a modified EC135 helicopter that can simulate other aircraft in real flight. In myCopter it is used to investigate the flight dynamics and human-machine interface of a future PAV. The cockpit has been equipped with a highway-in-the-sky display and a steering wheel for intuitive car-like control. This is the first helicopter to be flown with steering wheel. (Due to a technical failure the FHS is currently grounded. Flight tests will start as soon as possible.)	DLR
Landing Place Assessment	We use high level image features to characterize appropriate landing places, by evaluating weather constellations of these features coherently depict viable landing places. Our features take advantage of constant image regions that for continuous and compact regions that are ideal landing locations.	EPFL-CVLAB

Haptic Simulator	We combine a Highway-in-the-sky displays with a haptic shared control framework to assist a non-expert pilot with force guidance cues during a flight through a tunnel trajectory. We will show that this combination provides an easy-to-use control interface for flying a PAV.	MPI
PAV Desktop Simulation	We will demonstrate the conventional rotorcraft response types and the practical flying route used for designing the training requirements. The demonstration aims to show the response type requirements for likely PAV pilots with varying levels of flying skill in order to ensure safe and precise flight and also the evaluation methodology used for assessing the developed training syllabus.	UoL
Swarm demo (collision avoidance)	We will perform a multi-MAV collision avoidance experiment. After takeoff, all MAV will be placed on a colliding course. We show the effect of our strategy where every MAV computes a collision-free trajectory by itself based only on locally available information.	EPFL-LIS
Word Café	Join our world-cafe and see what others think about PAV traffic in their backyard or on their daily commute route. Imagine your personal use of PAVs and discuss it with us and other guests while enjoying a cup of coffee	KIT

Time schedule of the demonstrations at the myCopter Project Day

<table>
<tr><td rowspan="3">13:45

14:15</td><td rowspan="3">30 min</td><td colspan="2" rowspan="3">Flight Simulation (AVES)</td><td colspan="2">UAVs</td><td>10 min</td></tr>
<tr><td>FHS / Landing</td><td>Haptic (MPI) / UoL Sim.</td><td>10 min</td></tr>
<tr><td>Haptic (MPI) / UoL Sim.</td><td>FHS / Landing</td><td>10 min</td></tr>
<tr><td></td><td>15 min</td><td colspan="4">turnover</td><td></td></tr>
<tr><td rowspan="3">14:30

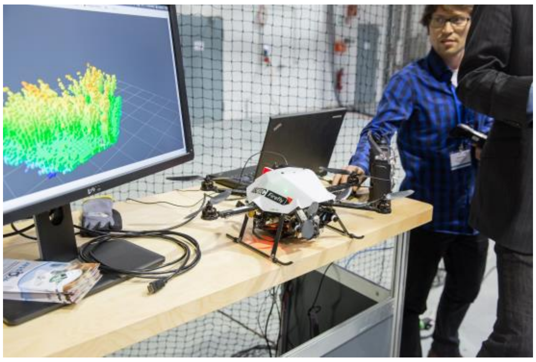
15:00</td><td>10 min</td><td colspan="2">UAVs</td><td colspan="2" rowspan="3">Flight Simulation (AVES)</td><td rowspan="3">30 min</td></tr>
<tr><td>10 min</td><td>FHS / Landing</td><td>Haptic (MPI) / UoL Sim.</td></tr>
<tr><td>10 min</td><td>Haptic (MPI) / UoL Sim.</td><td>FHS / Landing</td></tr>
<tr><td></td><td>15 min</td><td colspan="4">turnover and tower buffer time</td><td></td></tr>
<tr><td>15:15</td><td>10 - 15 min</td><td colspan="4">Swarm Demo</td><td></td></tr>
<tr><td>15:30</td><td>60 min</td><td colspan="4">Exhibition + World Café</td><td></td></tr>
<tr><td>16:30</td><td></td><td colspan="4">END</td><td></td></tr>
</table>

DLR Flying Helicopter Simulator

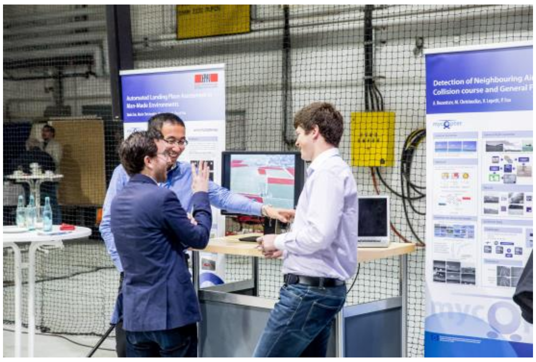
DLR Air Vehicle Simulator

MPI Haptic simulator

UoL PAV desktop simulation

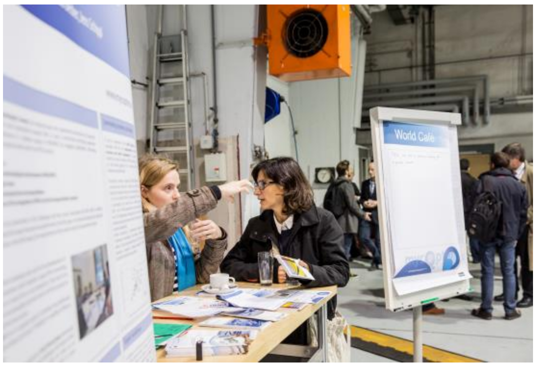


ETHZ vision-based navigation



EPFL-CVLAB landing place assessment

EPFL-LIS swarm demo (collision avoidance)



KIT World Café

Photos of the demonstration at the myCopter Project Day (Copyright: myCopter.eu/Marek Kruszewski)

4. Posters

After the presentations in the morning, the scientific results were elaborated in various poster prepared by the project partners (see below for an overview of all posters). During the lunch break, attendees could walk around and discuss the outcomes with the project partners. In-depth posters were presented in the afternoon at each of the demonstrations stands in the exhibition hangar.

All poster can be downloaded from the website http://mycopter.eu/home/results/project-day-posters.html.

Overview of all posters presented at the myCopter Project Day

Workpackage	Title	Responsible partner
WP2	Development of Handling Qualities and Training Requirements for Future Personal Aerial Vehicles (PAVs)	UoL
WP2	Development of Handling Qualities and Training Requirements for Future Personal Aerial Vehicles	UoL
WP2	Development of Handling Qualities and Training Requirements for Future Personal Aerial Vehicles	UoL
WP3	Haptics and Human Factors research for Personal Aerial Vehicles	MPI
WP3	Haptics research for PAVs	MPI
WP3	Human Factors research for PAVs	MPI
WP4	Automated Landing Place Assessment in Man-Made Environments	EPFL-CVLAB
WP4	Visual-Inertial Based Navigation in GPS - Restricted Environments	ETHZ
WP5	Detection of Neighbouring Aircrafts in Collision course and General Flight Scenarios	EPFL-CVLAB
WP5	LE (LIS-EPFL) quad. A quad for multi-robots experiments	EPFL-LIS
WP5	Comfortable collision-free navigation in dense environment	EPFL-LIS
WP6	PAV Technologies in Ground-Based and In-Flight Simulation	DLR
WP6	In-Flight Simulation of PAV Technologies	DLR
WP6	Ground-Based Simulation of PAV Technologies	DLR
WP7	PAVs – Dream or Nightmare? Further discussion of WP7 insights	KIT
WP7	Exploring the socio-technological environment of PAVs	KIT

5. myCopter flyers

During the course of the project two flyers were produced. At the start of the project, our flyer focused on the objectives and goals of the project, the flyer that was produced for the myCopter Project Day focused on results and findings.

Both flyers can be downloaded from the website http://mycopter.eu/home/downloads.html.

5.1. Objectives flyer

The flyer can be downloaded here


Consortium

© lis.epfl.ch

Max-Planck-Institut für biologische Kybernetik
http://www.kyb.mpg.de
Project coordination and management, development of novel human-machine interfaces for steering and navigation of PAVs.

The University of Liverpool
http://www.flightlab.liv.ac.uk
Modelling of PAV concepts, exploring and defining flying qualities, and development of an efficient paradigm to train people for flying PAVs.

École Polytechnique Fédérale de Lausanne
http://www.epfl.ch
Development of control strategies for collision avoidance, formation flying, automation algorithms for determining landing spots, and automatic take-off and landing.

Eidgenössische Technische Hochschule Zürich
http://www.asl.ethz.ch
Development of control strategies for automatic take-off, navigation and landing of PAVs.

Karlsruher Institut für Technologie
http://www.itas.fzk.de
Investigation of the socio-technological context, the infrastructural environment, the potential impact on society and social expectations towards PAVs via reflexive analysis.

Deutsches Zentrum für Luft- und Raumfahrt
http://www.dlr.de/flugsystemtechnik
Evaluation of newly developed technologies using the Flying Helicopter Simulator, and support on the development of dynamic models and Highway-in-the-Sky displays.

Project data

myCopter
Enabling Technologies for Personal Aerial Transportation Systems
Collaborative project, nr. 266470
EU Programme FP7-AAT-2010-RTD-1
1 January 2011 – 31 December 2014

Contact

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mycopter
http://www.mycopter.eu
Project funded by the European Union under the 7th Framework Programme

* Photo by Buck Engineering and Consulting GmbH

SEVENTH FRAMEWORK PROGRAMME

mycopter
http://www.mycopter.eu

An envisioned personal aerial vehicle © Flight Stability and Control

Introduction

© MPI

myCopter
Enabling Technologies for Personal Aerial Transportation Systems
Prevailing congestion problems with ground-based transportation and the anticipated growth of traffic present a major challenge in developing solutions that combine the best of ground-based and air-based transportation. The optimal solution could include the creation of a personal aerial transportation system (PATS) that can overcome the problems associated with current modes of transport.

We propose an **integrated approach to enable a viable PATS** based on Personal Aerial Vehicles (PAVs) envisioned for daily work and leisure commutes, flying at low altitudes in urban environments. Such PAVs are likely to be autonomous to a high degree without requiring conventional air traffic control.

Our consortium consists of expert partners that will address the development of advanced technologies necessary for a viable PATS, as well as perform socio-technological evaluations to assess the impact of a PATS on society. To this end, dynamic models for potential PAVs will be designed and implemented on motion simulators and a manned helicopter. An investigation into the required flight competencies of PAV users will be conducted, which will guide a user-centric design of suitable human-machine interfaces. Furthermore, the project will introduce new automation technologies for obstacle avoidance, path planning and formation flying. This project is a **unique integration of social investigations and technological advancements** that are necessary to move personal transportation into the third dimension.

© Flight Stability and Control © DLR
An envisioned human-machine interface

Objectives

© DLR

Simulation of a swarm of vehicles © lis.epfl.ch
© cvlab.epfl.ch
Computer vision algorithms for terrain detection

Goals

- **Human-aircraft interaction, including training issues:** PAVs are expected to shift the role of users from traditional flight control to flight management. Therefore, it is essential for human-machine interfaces to incorporate perceptual sensitivities and motor capabilities of users for comprehensive situational awareness. Furthermore, the flight interfaces must allow for fast and efficient pilot training.
- **Automation of aerial systems in cluttered environments:** PAVs will likely be autonomous for safety-critical phases of the flight, such as obstacle avoidance and landing spot selection for safe arrival and departure. Research will address collision avoidance with other traffic and swarming of vehicles along established routes such as highways to minimise the impact on urban areas.
- **Exploring the socio-technological environment:** PAVs will have a large impact on society, raising numerous questions concerning user expectations and interactions with new aerial transportation systems. It is important to engage in dialogue with experts, like regulators and stakeholders, and potential users of a PATS.

Group interviews for socio-technological evaluations © KIT

Strategy

© UoL

Research facilities

Within the project, state-of-the-art research facilities will be used. Unmanned aerial vehicles will serve as testbeds for the development of automation algorithms. Two ground-based simulators, the **CyberMotion Simulator** and the **HELIFLIGHT-R Flight Simulator**, will be used in experimental evaluations with humans in the loop.

In addition, we aim to implement aspects of our automation technologies and human-machine interface designs into the **Flying Helicopter Simulator**, a fly-by-wire / fly-by-light research helicopter operated by DLR.

Participants in simulators of the consortium © DLR © UoL © MPI *

Project milestones

The project has been broken down into distinct phases. In the **first year**, we will identify key socio-technological issues, experimental paradigms and automation requirements, thus laying a coherent foundation for subsequent research.

In the **second year**, initial tests will be performed with automation algorithms and evaluations with humans in the loop will be conducted on the experimental paradigms.

The **third year** will entail experiments on the human-machine interface and training issues, and will include simulations and tests that will be performed with automation in flight.

In the **final year**, results from exploration of the socio-technological environment will be summarised for public dissemination. In addition, part of the technological advancements will be implemented on the Flying Helicopter Simulator.

5.2. Results flyer

The flyer can be downloaded here

6. Press releases

During the myCopter Project Day also members of the press were given the opportunity to be informed about the outcomes of the project. A press conference was held where the project coordinator Prof. Dr. Heinrich Bülthoff was accompanied by Prof. Stefan Levedag from DLR Braunschweig and representatives from all project partners. English and German press releases were made available. The event was attended by approximately 20 members of the press.

6.1. English press release

Presse-Information

Deutsches Zentrum
für Luft- und Raumfahrt

The myCopter project points the way towards Personal Aerial Vehicles

Nummer

Datum
20.11.2014

Sperrfrist
20.11.2014, 12:30 Uhr

Seite
1

Road congestion is a fact of everyday life for many people. A possible solution for the future is expanding personal transport to include aviation. High above the roads, the routes become much more flexible, and travellers can reach their destinations faster. Researchers at the of the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) Braunschweig site recently presented the results of the EU research project myCopter. The DLR-developed myCopter steering wheel system, which allows users to operate tomorrow's aerial vehicles almost like cars, is the highlight of the development. Numerous other questions such as collision prevention, swarm flight or pilot training were analysed within the framework of the project, conducted under the auspices of the Max Planck Institute for Biological Cybernetics. The project also sought to learn more about the opportunities and challenges of an accessible personal air transport system, as well as take into consideration the expectations of the potential users. With an initial investigation of the possible social impact of the project, myCopter provides additional pioneering work in the field of future personal air transport systems.

Herausgeber

Deutsches Zentrum für Luft- und Raumfahrt e.V.

Kommunikation
51170 Köln

Telefon 02203 601-2116
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DLR.de

Presse-Information

Intuitive control system

Nummer

Datum
20.11.2014
Sperrfrist
20.11.2014, 12:30 Uhr
Seite
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The researchers focused on fundamental technologies and concepts. In future, the plan is that special aircraft, known as Personal Aerial Vehicles (PAVs), will enable people to go where they need to go by air. But for this to happen, the pilots will need a more efficient and intuitively designed control system. "One of the greatest challenges is engineering a control system that enables anyone to fly future PAVs. At the moment, the control systems found in modern helicopters are complex and using them requires a great deal of training," says Stefan Levedag, Head of the DLR Institute of Flight Systems. "But we have now managed to develop a steering wheel based control system – with automatic control technology behind it – that makes flying far simpler. The range of possible applications extends way beyond PAVs, bringing clear benefits to other airborne vehicles as well." Special control technology assists pilots while manoeuvring the aircraft.

Drivers are perfectly familiar with how to steer a car. The plan is to use this wealth of experience to create a more intuitive system for aircraft control with the aim of substantially simplifying the training required for future PAV pilots. "Personal Aerial Vehicles have the potential for playing an important role in future transport systems," emphasises Heinrich H. Bülthoff, the Project Manager from the Max Planck Institute for Biological Cybernetics. "myCopter has made a substantial contribution to

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DLR.de

developing crucial technologies that will be needed in future to make the dream of PAVs come true."

Steering wheel in the helicopter simulator

'Take four and make three' was the underlying concept behind the new steering wheel for helicopters. "Until now, helicopter pilots have been required to monitor all four control axes," explains Bianca Schuchardt from the DLR Institute of Flight Systems. "This takes absolute concentration, especially when hovering, as a pilot must operate both sticks and pedals at the same time to maintain a stable position in the air." The cyclic stick – responsible for movements about the longitudinal axis (roll) and the transverse axis (pitch) – is missing from the myCopter steering wheel system. "Instead, the pilot simply turns the steering wheel as required to fly the helicopter in the intended direction," Schuchardt continues. One stick remains, exclusively responsible for altitude. Alternatively, this aspect could be controlled using a paddle fitted to the steering wheel. Just as with the accelerator and brake in a car, the pedals control speed and can even cause the vehicle to hover. An eight-way switch on the myCopter steering wheel controls reverse and lateral flight. The steering wheel has already completed its maiden flight in the virtual environment of the Air Vehicle Simulator (AVES) operated by DLR in Braunschweig. The next stage will involve actual flight-

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Presse-Information

Deutsches Zentrum für Luft- und Raumfahrt

testing of the system using the DLR ACT/FHS research helicopter, which is based on a Eurocopter EC 135.

Out of the tailback and into swarm flight

"The key to simplifying helicopter flight for everyday purposes and – in addition to the controls themselves – to introduce suitable sensors and screen content that make piloting the aircraft as intuitive as possible for the user," says Bülthoff, who conducts research into these questions at the Max Planck Institute for Biological Cybernetics. Other project partners are involved in questions of how the numerous individual pilots could be coordinated and what specific PAV training they would require. The aerodynamic PAV model and the curriculum for training future pilots was also a topic at the University of Liverpool. Meanwhile, students at École Polytechnique Fédérale de Lausanne (EFPL) used unmanned aerial vehicles to conduct research into collision prevention, swarm flight and automatic landing site detection, while the Swiss Federal Institute of Technology in Zurich (Eidgenössische Technische Hochschule Zürich; ETH Zurich) investigated control strategies for personal aircraft and also used unmanned aerial vehicles to test take-off, landing and navigation. The Karlsruhe Institute of Technology (KIT) analysed the socio-technological aspects of the project and how the introduction of PAVs would affect society.

Nummer

Datum
20.11.2014
Sperrfrist
20.11.2014, 12:30 Uhr
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Presse-Information

Deutsches Zentrum für Luft- und Raumfahrt DLR

Nummer

Datum
20.11.2014
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Flight path shown on cockpit display

DLR has also used its EC 135 ACT/FHS research helicopter to conduct demonstrations of selected technologies developed within the framework of the project. "We are supporting the development of aerodynamic models and producing a 'Highway-In-The-Sky display' for PAVs – a kind of intuitive navigational tool for the pilots," explains Schuchardt. A tunnel display in the cockpit shows lines indicating the optimal flight path to the pilot.
The myCopter project – Enabling Technologies for Personal Aerial Transportation Systems – is scheduled to last four years, running from the start of 2011 to the end of 2014. It receives funding from the European Commission within the 7th Research Framework Programme. Partners include the Max Planck Institute for Biological Cybernetics (project management), the University of Liverpool, EFPL, ETH Zurich, KIT and DLR.

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6.2. German press release

Presse-Information

Deutsches Zentrum für Luft- und Raumfahrt

Projekt myCopter zeigt Wege zum individuellen Luftverkehr

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Stau auf den Straßen ist Alltag für viele. Ein zukünftiger Ausweg: Den Individualverkehr auf die Luft ausdehnen. Hoch über den Straßen sind die Wege flexibel und Reisende kommen schneller ans Ziel. Am Standort Braunschweig des Deutschen Zentrums für Luft- und Raumfahrt (DLR) haben Wissenschaftler nun die Ergebnisse des EU-Forschungsprojekts myCopter vorgestellt. Ein Highlight ist die im DLR entwickelte myCopter-Lenkradsteuerung, mit der sich Drehflügler von morgen nahezu wie ein heutiger PKW steuern lassen. Zahlreiche weitere Fragen wie Kollisionsvermeidung, Schwarmflug oder Pilotenausbildung wurden im Rahmen des vom Max-Planck-Institut für biologische Kybernetik geleiteten Projekts untersucht, um mehr über die Möglichkeiten und Herausforderungen des individuellen Luftverkehrs für jedermann zu lernen. Dabei galt es auch die Erwartungen potentieller Nutzer zu betrachten. Mit einer ersten Untersuchung möglicher gesellschaftlicher Auswirkungen leistet das myCopter-Projekt zusätzliche Pionierarbeit auf dem Gebiet des zukünftigen Individualverkehrs.

Steuerung soll intuitiver werden

Im Fokus der Forscher standen grundlegende Technologien und Konzepte. Mit speziellen Fluggeräten, sogenannten Personal Aerial Vehicles (PAV), soll es in ferner Zukunft jedermann möglich sein, seine täglichen Wege durch die Luft zurückzulegen. Dafür muss die Steuerung für die Piloten effizienter und intuitiver gestaltet werden. „Die Handhabung zukünftiger PAVs für jedermann möglich zu machen, ist eine große Herausforderung, denn das Hubschrauberfliegen mit der heutigen komplexen Steuerung erfordert nach wie vor viel

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Training“, sagt Prof. Stefan Levedag, Leiter des DLR-Instituts für Flugsystemtechnik. „Nun ist es uns gelungen, eine Lenkradsteuerung mit dahinterliegender automatischer Steuerungstechnik zu entwickeln, die das Fliegen deutlich vereinfacht. Wir können das nicht nur für ein PAV nutzen, sondern auch andere Luftfahrzeuge damit verbessern.“ Eine spezielle Regelungstechnik unterstützt den Piloten bei der Steuerung des Fluggerätes. Das Erfahrungswissen des Autofahrers soll genutzt werden, um die Steuerung von Fluggeräten intuitiver zu gestalten. Das Ziel ist, die Ausbildung zukünftiger PAV-Piloten deutlich zu vereinfachen. „Der individuelle Luftverkehr hat das Potential eine wichtige Rolle im zukünftigen Verkehrssystem einzunehmen, unterstreicht Projektleiter Prof. Dr. Heinrich H. Bülthoff vom Max-Planck-Institut für biologische Kybernetik. „myCopter hat dazu beigetragen, entscheidende Technologien zu entwickeln, um PAVs in der Zukunft Wirklichkeit werden zu lassen.“

Lenkrad im Hubschraubersimulator

„Aus vier mach drei“ lautet die Idee des neuen Lenkrads für Hubschrauber. „Bisher muss ein Hubschrauberpilot alle vier Steuerachsen gleichzeitig im Blick behalten“, erklärt Bianca Schuchardt vom DLR-Institut für Flugsystemtechnik. „Besonders im Schwebeflug erfordert das höchste Konzentration, wenn der Pilot beide Hebel und Pedale gleichzeitig bedienen muss, um stabil in der Luft zu bleiben.“ Mit dem myCopter-Lenkrad fällt das zyklische Steuer weg, das für die Bewegung um die Längsachse (Rollen) und um die Querachse (Nicken) verantwortlich ist. „Stattdessen kann der Pilot mit der entsprechenden Drehbewegung des Lenkrads den Hubschrauber in die gewünschte Richtung fliegen“, so Schuchardt weiter. Ein Hebel verbleibt ausschließlich für die Flughöhe. Alternativ kann diese auch über

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Schaltwippen am Lenkrad kontrolliert werden. Die Pedale kontrollieren wie beim Auto mit Gas und Bremse die Geschwindigkeit bis hin zum Verweilen im Schwebeflug. Zudem ermöglicht ein Acht-Wege-Schalter am myCopter-Lenkrad den Rückwärtsflug sowie den Seitwärtsflug. Im AVES-Simulatorzentrum des DLR in Braunschweig hat das Lenkrad bereits seinen virtuellen Erstflug im Hubschrauber gemeistert. Im nächsten Schritt wird es auf dem DLR-Forschungshubschrauber EC135 ACT/FHS im realen Flug getestet.

Vom Stau in den Schwarmflug

„Entscheidend ist es, das Hubschrauberfliegen für den Alltag umfassend zu vereinfachen und neben der Steuerung mit passenden Sensoren und Bildschirminhalten möglichst intuitiv für jedermann zu gestalten", sagt Projektleiter Bülthoff, der am Max-Planck-Institut für biologische Kybernetik zu diesen Fragen forschte. Weitere Projektpartner beschäftigten sich mit Fragen etwa nach der Koordinierung der zahlreichen Privatflieger oder nach der konkreten Ausbildung zukünftiger PAV-Piloten. Das flugdynamische Modell der PAVs und die Struktur des Trainings für die zukünftigen Privatpiloten war Thema der University of Liverpool. Wissenschaftler der École Polytechnique Féderale de Lausanne indessen erforschten mit Hilfe unbemannter Fluggeräte die Themen Kollisionsvermeidung, Schwarmflug sowie automatische Landeplatzerkennung, während sich die Eidgenössische Technische Hochschule Zürich mit Kontrollstrategien für einzelne Fluggeräte und ebenfalls mit Starts, Landungen und der Navigation bei unbemannten Fluggeräten befasste. Das Karlsruher Institut für Technologie untersuchte die soziotechnologischen Aspekte des Projekts und damit, welchen Einfluss die Einführung von PAVs auf unsere Gesellschaft hätte.

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Flugweg im Tunneldisplay

Das DLR führt zudem Demonstrationen von ausgewählten, im Projekt entwickelten Technologien auf dem Forschungshubschrauber EC135 ACT/FHS durch. „Wir unterstützen die Entwicklung von flugdynamischen Modellen und entwickeln ein Highway-in-the-Sky-Display für individuelle Flugvehikel; eine Art intuitive Navigationshilfe für PAV-Piloten", erklärt Bianca Schuchardt. In einem Tunneldisplay werden dem Piloten visuelle Wegelinien eingeblendet, die den optimalen Flugweg vorgeben.
Das Projekt myCopter - Enabling Technologies for Personal Aerial Transportation Systems ist auf vier Jahre im Zeitraum von Anfang 2011 bis Ende 2014 ausgelegt und wird von der Europäischen Kommission im Rahmen des 7. Forschungsrahmenprogramms gefördert. Zu den Partnern gehören das Max-Planck-Institut für biologische Kybernetik (Projektleitung), die University of Liverpool, die École Polytechnique Féderale de Lausanne, die Eidgenössische Technische Hochschule Zürich, das Karlsruher Institut für Technologie und das Deutsche Zentrum für Luft- und Raumfahrt (DLR).

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7. Press coverage

An overview of the articles that appeared in the press after the myCopter Project Day is given below.

Autorevue, December 2014
Mit dem Lenkrad in die dritte Dimension
NDR Info, November 30, 2014

Privates Flugauto ist und bleibt eine Zukunftsvision
Source: http://www.ndr.de

DGLR Luft- und Raumfahrt, January - February 2015
DLR stellt myCopter vor
Source: http://aviatic.de/luft-und-raumfahrt/

Süddeutsche Zeitung, November 28, 2014
Wann es fliegende Autos geben wird, Thomas Harloff
Source: http://www.sueddeutsche.de

Sächsische Zeitung, November 25, 2014
Fliegende Autos für jedermann vor großen Hürden, Valentin Frimmer
Source: http://www.sz-online.de

Baublatt, November 24, 2014
Schweizer Forscher tüfteln am Heli für jedermann
Source: http://www.baublatt.ch

Sat1 Regional, November 24, 2014
Projekt „myCopter": Mit dem Hubschrauber-Auto von A nach B
Source: http://www.hannover.sat1regional.de/

Handelszeitung, November 24, 2014
Schweizer Spitzenforscher bauen Hubschrauber für alle, Gerhard Hegmann
Source: http://www.handelszeitung.ch

Braunschweig Heute, November 23, 2014
Projekt myCopter zeigt Wege zum individuellen Luftverkehr, Thorsten Raedlein
Source: http://braunschweigheute.de

Deutsche Welle, November 23, 2014
Das Auto ist kurz vorm Abheben, Laura Postma / Brigitte Osterath
Source: http://www.dw.de

SWR3 Landesschau Aktuell Baden-Württemberg, November 21, 2014
Der Helikopter für jedermann
Source: http://swrmediathek.de

European Pilot, November 21, 2014
EU project myCopter looks to simplify helicopter flying
Source: http://www.europeanpilot.com

Reutlinger General Anzeiger, November 21, 2014
Mit dem Lenkrad in die dritte Dimension, Franz Pfluger

Braunschweiger Zeitung, November 21, 2014
Ein weiterer Schritt zum fliegenden Auto, Daniel Freudenreich

Aircraft Owners and Pilots Association (AOPA), November 21, 2014
Flight made simple, Jim Moore
Source: http://www.aopa.org

Stuttgarter Zeitung, November 21, 2014
Das fliegende Auto für alle bleibt ein Traum – vorerst, dpa
Source: http://www.stuttgarter-zeitung.de

Aerokurier, November 21, 2014
Forschungsprojekt myCopter für ein neues Transportsystem
Source: http://www.aerokurier.de

Ingenieur.de, November 21, 2014
DLR entwickelt Lenkrad für Helikopter, Wolfgang Kempkens
Source: http://www.ingenieur.de

Autobild, November 21, 2014
Hubschrauber mit Lenkrad, Stephan Bähnisch
Source: http://www.autobild.de

ZDF heute.de, November 21, 2014
Forscher tüfteln am Heli für jedermann, dpa
Source: http://www.heute.de

Airportzentrale.de, November 20, 2014
Statt PKW das eigene Mini-Flugzeug – Fortbewegung der Zukunft entwickelt
Source: http://www.airportzentrale.de

Heilbronner Stimme, November 20, 2014
Fliegende Autos für Jedermann vor großen Hürden, dpa
Source: http://www.stimme.de

Engineering and Technology Magazine, November 20, 2014
Steering wheel for helicopters to change future of transportation, Tereza Pultarova
Source: http://eandt.theiet.org

Der Tagesspiegel, November 20, 2014
Das fliegende Auto, Markus Mechnich
Source: http://www.tagesspiegel.de

Handelsblatt, November 20, 2014
Der Traum vom fliegenden Auto, dpa
Source: http://www.handelsblatt.com

Focus, November 20, 2014
Fliegende Autos für Jedermann vor großen Hürden, dpa
Source: http://www.focus.de

Die Welt, November 20, 2014
Forscher wollen Hubschrauber für jedermann bauen, Gerhard Hegmann
Source: http://www.welt.de

n-tv, November 20, 2014
Erste Schritte Richtung Zukunft - Forscher tüfteln am Heli für jedermann
Source: http://www.n-tv.de

DLR News, November 20, 2014
myCopter points the way towards Personal Aerial Vehicles
Source: http://www.dlr.de

DLR Nachrichten, November 20, 2014
Projekt myCopter zeigt Wege zum individuellen Luftverkehr, Falk Dambowsky
Source: http://www.dlr.de

NDR Hallo Niedersachsen, November 20, 2014
DLR Braunschweig forscht an "Jedermann-Heli", Bernd Reiser
Source: http://www.ndr.de

Die Welt, November 20, 2014
MYCOPTER - Dieses Auto hebt bei Stau einfach ab
Source: http://www.welt.de