myCopter: Enabling Technologies for Personal Aerial Transportation Systems

Dr. ir. Joost Venrooij
Prof. dr. Heinrich H. Bülthoff

Max Planck Institute for Biological Cybernetics
Department: Human Perception, Cognition and Action
The dream of Personal Aviation

Technology exists to build aircraft for individual transport
- many concepts have already been developed

Drawbacks of current designs
- Need for a pilot license
- Need for infrastructure (e.g., landing strip)

Focus often on vehicle design instead of transport system
Challenges for Personal Aviation

“Designing the air vehicle is only a relative small part of overcoming the challenges… The other challenges remain…” [EC, 2007]

- Accessibility to large audience?
- Vehicle dynamics? Training?
- Automation? Human interaction?
- Safety, noise, … ?
- Integration?
EU-project myCopter

- Duration: Jan 2011 – Dec 2014
- Project cost: €4,287,529
- Project funding: € 3,424,534
Enabling Technologies for Personal Aviation

mycopter

Automation and autonomy
- Navigation
- Landing place assessment
- Sensor-fusion for collision avoidance

Human-machine interfaces and training
- Control interfaces and displays
- Shared control
- Multi-sensory feedback

Socio-technological environment
- Acceptance: noise, safety, fuel, cars in the sky
- Integration into current transport systems
Goal: Develop robust novel algorithms for vision-based control and navigation

Challenges

- Recognize obstacles and other traffic
- Recognize landing areas
- In all season and in adverse weather conditions
Framework for Vision-Based Navigation
Collision Avoidance Strategies

50 vehicles at the same altitude fly from a point on a circle to a point on the opposite side
Demonstration of Swarm Technology
Goal: Develop response requirements for PAVs

Challenges

• Flying a helicopter is difficult; requires lots of training
• Determine response type that is flyable by novice “flight-naïve” pilots
• Determine the training requirements for PAV pilots
Develop and assess new response types for VTOL vehicles

- Basic helicopter rate control with cyclic
  - Attitude control (pitch and roll)
  - Translation control (forward/lateral velocity)
- Turn coordination, heave augmentation
- Car-like steering
Goal: Develop human-machine interfaces that make flying as easy as driving a car

Challenges

- Current flight controls and displays are not intuitive
- Multisensory perception is not taken into account
- No reliable objective measurements of pilot workload
Intuitive Displays and Controls

- Highway-in-the-Sky display
- Haptic aid: active sidestick to “feel” the highway
Novel HMI: haptic shared control

- Combining the advantages of manual and automatic control
- The pilot remains in control and can overrule the automatic control system
Objective Measures for Workload
Exchange helicopter flight controls with a steering wheel and pedals.
HMI Demonstration in DLR Simulator
Goal: Generate knowledge on the demands and preferences of society towards PAVs

Challenges

• Identifying hurdles for introducing PAVs
• User expectations and objections
• Investigating where PAVs could have an impact
Societal Expectations and Preferences

Focus group interviews in 3 European countries to determine user perceptions and expectations

1. Discussion on mobility patterns and behaviour as well as perceived promises and actual expectations on PAV / PATS
2. Demonstration of a PAV ride in a simulator
3. Discussion on PAV-specific aspects such as design, operational environment, autonomy, usability, etc.

Liverpool
Tübingen
Zürich
Ongoing work: helicopter augmentation
Ongoing work: CableRobot Simulator

https://youtu.be/cJCsomGwdk0
myCopter: Enabling Technologies for Personal Aerial Transportation Systems

Dr. ir. Joost Venrooij
joost.venrooij@tuebingen.mpg.de

Prof. Dr. Heinrich H. Bülthoff
heinrich.buelthoff@tuebingen.mpg.de

Dr. ir. Frank M. Nieuwenhuizen

Max Planck Institute for Biological Cybernetics
Department: Human Perception, Cognition and Action

www.mycopter.eu