Cognitive Systems, Interaction, Robotics
Micro helicopter design, vision-based motion estimation and 3D reconstruction without GPS
In the sFLY project autonomous micro helicopters are about to play major roles in tasks like search and rescue, security surveillance and law enforcement. The ability to fly allows to avoid obstacles on the ground and to have an excellent bird’s eye view. Their navigational and hovering advantages make them the ideal platform for exploration, mapping and monitoring tasks. Fully autonomous operation in cities or other dense environments involves challenges on all levels of helicopter design, perception, actuation, control, navigation and power supply that
have yet to be solved. This project will focus on micro helicopter design, visual 3D mapping and navigation, low power communication and multi-robot control under environmental constraints. It will lead to novel micro flying robots that are: inherently safe due to very low weight; capable of vision-based fully autonomous navigation and mapping; capable of coordinated flight in small swarms in constrained and dense environments.

Autonomous micro helicopters are about to play major roles in tasks like reconnaissance for search and rescue, environment monitoring, security surveillance, inspection, law enforcement, etc. The ability to fly allows easily avoiding obstacles on the ground and to have an excellent bird’s eye view. Therefore flying robots are the logical heir of ground based mobile robots. Its navigational and hovering advantages make them the ideal platform for exploration, mapping and monitoring tasks. If they are further realized in small scale, they can also be used in narrow out- and indoor environment and they represent only a limited risk for the environment and people living in it. However, for such operations today’s systems navigating on GPS information only are not sufficient any more. Fully autonomous operation in cities or other dense environments requires the micro helicopter to fly at low altitude or indoors where GPS signals are often shadowed and to actively explore unknown environments while avoiding collisions and creating maps. This involves a number of challenges on all levels of helicopter design, perception, actuation, control, navigation and power supply that have yet to be solved. Our S and T endeavor proposed in this project will therefore focus on micro helicopter design, visual 3D mapping and navigation, low power communication including range estimation and multi-robot control under environmental constraints. It shall lead to novel micro flying robots that are:

- inherently safe due to very low weight (around 500g) and appropriate propeller design;
- capable of vision-based fully autonomous navigation and mapping;
- able to coordinated flight in small swarms in constrained and dense environments.

Field of science

/Engineering and technology/mechanical engineering/vehicle engineering/aerospace engineering/aircraft/rotorcraft

Programme(s)

Topic(s)

Call for proposal
# Funding Scheme

CP - Collaborative project (generic)

## Coordinator Contact

Davide SCARAMUZZA (Dr.)

## Coordinator

**EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH**

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[Website](#) | [Contact the organisation](#)

**Administrative Contact**

Roland Siegwart (Prof.)

## Participants (5)

**CSEM CENTRE SUISSE D'ELECTRONIQUE ET DE MICROTECHNIQUE SA - RECHERCHE ET DEVELOPPEMENT**

<table>
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<td>2000 Neuchatel</td>
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[Website](#) | [Contact the organisation](#)

**Administrative Contact**

Jean-Dominique DECOTIGNIE (Prof.)
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<td>ASCENDING TECHNOLOGIES GMBH</td>
<td>Germany</td>
<td>€ 300,800</td>
<td>Konrad Zuse Bogen 4, 82152 Karilling</td>
<td>Private for-profit entities (excluding Higher or Secondary Education Establishments)</td>
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<td>INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET AUTOMATIQUE</td>
<td>France</td>
<td>€ 320,640</td>
<td>Domaine De Voluceau, Rocquencourt, 78153 Le Chesnay Cedex</td>
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<td>ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS</td>
<td>Greece</td>
<td>€ 231,058</td>
<td>Charilaou Thermi Road 6 Km, 57001 Thermi Thessaloniki</td>
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## EU contribution

€ 189 642

### Address

**Building E4, Technical University Campus Counoupidiana**  
731 00 Chania

### Activity type

**Higher or Secondary Education Establishments**

### Administrative Contact

**Elias Kosmatopoulos (Dr.)**

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