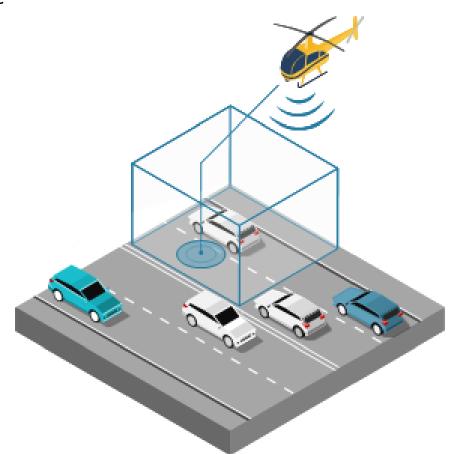


The interaction between aerial and ground-based traffic domains is a completely underrepresented topic in ITS development. In the **Air2X** project, DLR is highly focused on research activities in this sector. To identify and outline the potential difficulties of cooperative ground/air traffic, an example implementation of a particular use case is realized. The use case **Augmented Helicopter Rescue Operation with Air2X and Virtual Infrastructure** should improve a safe landing maneuver of a rescue helicopter on a highway or other dense traffic situations.

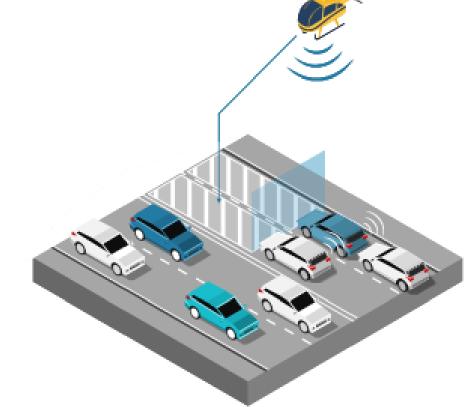
Motivation

- In case of an accident it is often necessary that a rescue helicopter is required
- If a landing on a traffic area is needed the traffic in this area has to be stopped
- Today, emergency personnel have to establish this blocked area manually
- This costs valuable time
- With communication between the helicopter and the ground vehicles a temporary establishment of a safe exclusive landing zone without ground support is possible



Concept

- The pilot defines the exact landing place due to the circumstances at the accident area
- After defining the landing place, the pilot triggers a V2X (Vehicle to everything) message and sends this message to all vehicles nearby
- A digital barrier prevents those vehicles which are capable to receive, decode and process the message from entering the desired landing site
- Thereby, they form a physical barrier for all following cars on their lane
- After the pilot confirms the successful blocking he performs a safe landing



Demonstration

Helicopter

(Drone in demonstration)

7. The drone performes a safe landing on the highway

MAVLink Protocol

Technology: 802.11p

Frequency: 5.785 GHz

1. The drone communicates with the CDCI over 802.11p in the MAVLink communication protocol

6. The pilot visually checks the desired landing place

5. Stop at the virtual barrier

DLR & NXP Solution:
Decode D2X MavLink Messages
Generate DENM
Encode X2V ITS-G5 Message

CDCI*
ETSI ITS Protocol
Technology: ETSI ITS-G5

Car

2. The CDCI filters all MAVLink messages, in case of a desired landing the CDCI transforms the information into a V2X message

3. A Decentralized Environmental Notification Message (DENM) is used to create the virtual barrier

vehicles

Due to the lack of a common communication standard for ground vehicles and aircraft, an interface, denoted here as

4. Send DENM over ETSI ITS-

G5 to all surrounding

The DENM already contains the option to encode the use case "rescue and recovery work in process - rescue helicopter landing" and can consequently be deployed for this purpose.

"Cross-Domain Communication Interface" * (CDCI), is required to allow the air-to-ground communication.

Further steps

- Gather stakeholder requirements
- Identifying further possible use casesDiscuss technical challenges:
- Δdvantages and disadva

and ADAC Luftrettung.

- Advantages and disadvantages of available communication technologies

Transportation Systems, Flight Guidance and Flight Systems. Contributors from the industry was NXP Semiconductors

- Generic protocol transformation between air and ground traffic e. g. Uspace2ITS interface
- Regulatory aspects in frequency allocation

Maik Bargmann maik.bargmann@dlr.de Dagi Geister dagi.geister@dlr.de Bernhard Fehr bernhard.fehr@dlr.de





