Security aspects of Urban Air Mobility

Are we prepared?

CIVITAS FORUM 2019
Session 27
RESEARCH FOR SECURE AVIATION

As an independent non-profit research association in the field of air safety and security, we are advancing the topics of secure and sustainable aviation by development and testing of innovative security concepts and solutions, preparation of training guidelines and dissemination of knowledge to establish confidence across Europe.
Since established in 2008, EASC REINFORCES SECURE AVIATION by

› set-up and management of research, development and innovation projects concerning secure aviation,
› performs risk analysis and elaborates concepts of operation,
› develops training concepts for security personnel,
› provides a neutral communication platform,
› operates a test and validation center at Schönhagen Airport (near Berlin)
<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
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<tbody>
<tr>
<td>BagTrack</td>
<td>RFID based synchronisation of passenger and luggage</td>
</tr>
<tr>
<td>APFEL</td>
<td>multi-camera system for human tracking at airports</td>
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<tr>
<td>Fly-Bag 2</td>
<td>advanced technologies for bomb-proof cargo containers and blast containment units for the retrofitting of passenger airplanes, FP7</td>
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<tr>
<td>FLYSEC</td>
<td>optimizing time-to-FLY and enhancing airport SECurity, H2020</td>
</tr>
<tr>
<td>EngEL</td>
<td>real-time detection of explosives traces in air-cargo</td>
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<tr>
<td>KIFER</td>
<td>strategies for low-emission operations at general aviation airports</td>
</tr>
<tr>
<td>MIDRAS</td>
<td>system for detection and repelling of micro-drones</td>
</tr>
<tr>
<td>ArGUS</td>
<td>situational hazard response to unauthorized UAS movements</td>
</tr>
</tbody>
</table>
common use-cases

- tourism & leisure activities
- farming & forestry
- monitoring of industrial plants
- border control
- urban air taxi
- salvage and rescue
- courier & parcel logistics
- open-cast mining
- monitoring & inspection of infrastructure

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regulatory framework

- EASA New Basic Regulation EU 2018/1139
- Commission Implementing Regulation EU 2019/947
- national law
- Aeronautical Information Publication (AIP)
- Aeronautical Information Circle (AIC)
- NOTAM Notices to Airmen
- ICAO-map / GAFOR (General Aviation Forecast)
- SORA (Specific Aviation Risk Assessment for operation of UAS)
- other requirements: Drone Pilot Licence, liability insurance and EU-harmonised national registration system for drones
EASA New Basic Regulations (EU 2018/1139)

Source: http://dronerules.eu/assets/images/DroneRules_v2.jpg
operational safety

TODAY’s SOLUTIONS

• acoustic and optical signals in case of system trouble
• parachute / airbag
• redundant control units
• autonomous modules for power supply
• Return-to-Home function
• auto-off of engines
• geofencing (authorization zones + verified account, enhanced warning zones)
• sonar based obstacle avoid
• collision warning systems (ADS-B, FLARM, SSR) of manned aircrafts
The upcoming registration requirement is an important step into the right direction. Hopefully, the offenders also know that they have to register their drone flight ...
• The **unintentional abuse** is an act of the drone pilot, which is based on ignorance and precludes the case law. This action can lead to personal, material, financial or ideological damage.

• **Intentional misuse** includes the threat and performance of a willfully damaging or enriching act by the drone pilot (and possibly its principal). Perpetrators are individuals with a personal motive, organized criminals and terrorists or terrorist networks. This action shall lead to personal, material, financial or ideological damage.

classes of abuse

attack
(swarm of) UAS for collision / crash down or utilization of toxin or explosives

spionage
use of sensing systems (also privacy related)

sabotage
„dirty“ load to achieve unserviceability of items

intrusion
smuggling of prohibited items

Lit.: “Abusive Operation of Drones – A New Challenge for Safety and Security”
J. Gonschorek (EASC), R. Kelz (EASC), AGIT – Journal für Angewandte Geoinformatik · 4-2018
## air taxi related threats

<table>
<thead>
<tr>
<th></th>
<th>Threat Description</th>
<th>Likelihood</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Shooting Icon]</td>
<td>Shooting mainly small sports or hunting arms</td>
<td>L=h</td>
<td>i=h</td>
</tr>
<tr>
<td>![Dirty Load Icon]</td>
<td>„Dirty“ load explosives, toxic material, drugs</td>
<td>L=h</td>
<td>i=h</td>
</tr>
<tr>
<td>![Jamming Icon]</td>
<td>Jamming disturbance of downlink to <em>interrupt</em> flight control</td>
<td>L=m</td>
<td>i=h</td>
</tr>
<tr>
<td>![Spoofing Icon]</td>
<td>Spoofing disturbance of downlink to <em>take over</em> flight control</td>
<td>L=l</td>
<td>i=h</td>
</tr>
<tr>
<td>![Overheating Icon]</td>
<td>Overheating thermal runaway of battery cells e.g. electromagnetic pulse weapon</td>
<td>L=m</td>
<td>i=h</td>
</tr>
<tr>
<td>![Kamikaze Icon]</td>
<td>Kamikaze remotely piloted or programmed flight to target</td>
<td>L=h</td>
<td>i=h</td>
</tr>
</tbody>
</table>

**Legend:**
- **L**: Likelihood of appearance
- **I**: Impact in case of appearance
- **h**: high
- **m**: medium
- **l**: low

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security measures

passive, preventive structural measures, privacy measures

active, preventive access control, modulation of signal strength and data transfer rate

active, destroying electromagnetic pulse weapon, laser gun, glue gun, high-pressure water cannon
towards sustainable urban air mobility

H2020-MG-3-6-2020

• **Challenge:**
  Urban air mobility (UAM) is a field of disruptive innovation. ... Research activities are not only aeronautical, but also cross-disciplinary to enable aerial traffic in the urban environment.

• **Scope:**

  A) **Safety and security:** particularly when operating over populated areas including several aspects such as
  • adverse weather and airflow conditions at low altitudes;
  • human factors and automation, collision and avoidance;
  • electro-magnetic compatibility;
  • *detection and surveillance* of physical and cyber threats, *prevention, preparedness, response and recovery* from threats, including *intentional interference and misuse* of urban air mobility;
  • other relevant hazards and threats in a operation centric and risk-based approach.

EASC is ready to contribute!
Thank you for your attention!

#FlySafe

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