UAS integration into airspace is a challenge by its numbers, by its risks, and its technology.

- IFR Aircraft: Ca. 1,000 German Int. Flights: 10,000/Day
- VFR Aircraft: Ca. 12,000 Single-engine, Rotorcraft, Motor gliders
- VFR Aircraft: Ca. 12,000 Gliders, Ultralights, Balloons

Uncontrolled Airspace

Controlled Airspace

Reported encounters of aircraft with drones in DFS for Germany:

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>14</td>
<td>64</td>
<td>88</td>
</tr>
</tbody>
</table>

Ca. 600,000 mainly private and <10% commercial UAS
UAS = Disruptive challenge for existing air traffic due to risk, growth, and new technologies

New paradigms in UTM

- Accelerated automation and robotics in aircraft
- Self-service of operations / operators
- Exploding multiplity of data and data sources
- Heterogeneous user groups
- Intuitive and user-friendly HMIs
- Low price of applications
- Easy accounting modalities
- New forms of funding

Growth, risks and new paradigms ->

- Tactical challenge for CAAs and ANSPs
- Strategic challenge for CAAs and ANSPs
„Pro-active“ 4-fold strategy paradigm in DFS: Safe and fair integration of UAS into air traffic system

- **Regulation**
  - National registration, pilot qualification, insurance, and UAS identification for surveillance required (-> EASA, U-Space)

- **Operations**
  - Risk and performance based, operation centric, proportional measures (-> EASA, SORA)
  - Affect both ATM and UTM

- **Systems**
  - ATM systems have to be adapted/enhanced
  - UTM systems have to be built, UTM as „a system of systems“ (-> GUTMA) cloud-based architectures to be expected

- **Economics**
  - Existing fee regimes will not work
    Self-service, SaaS and UPP expected
DFS and Deutsche Telekom AG started an explorative UTM project „U:CON“

- Provide evidence that efficient connectivity, surveillance and tracking as well as command and control of UAV in very low level airspace via the mobile communications network is possible
- Define operational and technical requirements for systems and infrastructure (incl. system architecture)
- Identify the relevant elements for a Concept of Operations (ConOps)
- Develop a business case for establishment and operation of an UTM System

More use cases in 2018:
- Blood transport between hospitals
- Gas infrastructure inspection
- SAR missions on rivers and over sea
- UAS in food production
- Airport construction progress monitoring
System components of U:CON: HODs & MF (DTAG), Tracker & UTMF (DFS)

Users
- Fleet Operator
- BOS
- LLB
- Manufacturer
- Pilot

Cloud services
- UTM- AWP
- CWP
- ATM

Core System
- UTM Framework
- PHOENIX

Analysis Tools
- Web Clients
- Profess. App

Data services
- Hook-on/ Hook-in Devices
- COCs

UTM System
- U:CON
- Hook-on/ Hook-in Devices (UTM Box)

Data flows
- Mobile telecom connections

Services
- Weather
- MapData

Protocols
- DDS
- IEEE802.11P
- MAVLINK
- Transponder
- ADS-B
- FLARM

UTM at DFS
AWC, Madrid 6.-8.3.2018
Technical feasibility of drone tracking using mobile telecom & HOD was proven 2017
The U:CON tracking tests also showed possible fusion of UAS with manned aviation.
Unifly UTM framework consists of 2 types of web applications (PRO, SENTRY) and one mobile app.

Users of UTM PRO web clients

Users of UTM SENTRY web clients

Users of UTM PRO mobile app clients (UAS and A/C pilots)
Configuration of working positions and work share may be designed for cooperative usage

Users of UTM PRO web clients

Users of UTM SENTRY web clients

Users of UTM PRO app clients (UAS and A/C pilots)
Work sequences in UTM

Typical sequence in UTM PRO

1. Register, create profiles and fill database
   - Definition of companies or operators
   - Definition of pilots
   - Definition of drones to be used
   - Definition of documents for means of compliance

2. Planning of mission
   - Planning of mission
   - Validation against rules, NFZ, other missions
   - Adaptation of planning
   - Publication and submission for approval
   - Evtl. modification on request

3. Mission execution
   - Activation with mobile app (TakeOff)
   - Activation by flight, detection, and tracking
   - Execution of flight, use of situation display
   - Validation against NFZs, changes, and evtl. temp. NFZs
   - Check of collision risk

4. Mission termination
   - Report
   - Logbook maintenance
   - Battery management
   - Incident management

Typical sequence in UTM SENTRY

1. Permissions
   - Process permission requests
   - Manage permissions

2. NFZ Workflow
   - No Fly Zone creation
   - No Fly Zone deletion
   - No Fly Zone editing
   - No Fly Zone management

3. Situation display
   - Supervision
   - Zoom / Decenter / Layer selection
UTM framework: example screens mission planning, flight view
Mobile apps close the „control loop“ with the pilot in the field
**What ANSPs can do for UTM**

**Knowhow Supply**
- Traffic management (operational and technical)
- Efficient workflow and HMI components and conventions
- Proven safety culture (QA, qualification, training, supervision, auditing, ...)
- Mediation between existing ATM stakeholders and new participants

**Data Supply**
- Relevant A/C track data
- Airspace usage / booking
- Airspace map data
- Weather data

**Service Supply**
- Provision of MSDF tracking systems
- Geofencing and collision warnings and alerts
- Weather warnings and alerts
- UTM ASP
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