DLR Project City-ATM

Demonstration of Traffic Management in Urban Airspace

Stefan Kern, Dagi Geister, Niklas Peinecke, Bernd Korn
Institut für Flugführung
Research topics at DLR

- safe, resilient and reliable communication, navigation and Surveillance
- risk assessment and requirements
- vehicle technologies and certification
- information management
- airspace management
- traffic management
- social and environmental aspects
- roles, functions and responsibilities of actors
- obstacle detection and resolution
Motivation

• Various initiatives dealing with the integration of UAS and air taxis into urban airspace (below 500 ft)
• Problem:
  • no common standard
  • different application scenarios
  • several (unmanned) vehicles with differences in size, flight performance, sensors, etc.
  • safe and efficient interaction with other UAS or airspace users
  • cost efficiency vs. safety
  • Protection of privacy and critical areas, public acceptance
• Solutions:
  integration area, roles and responsibilities, requirements for vehicles
Project City-ATM
Objectives (1)

- Development and Assessment of a City-ATM-concept (density based airspace and traffic management)
  - Information and air traffic flow management for unmanned vehicles
  - Requirements analysis
  - Performance Based UAS Operations concept
  - CNS-concept
  - Concept of Operations (Definition of Reference scenarios)

- Design of an open Simulation- and Demonstration platform
  - Based on developed ATM-/CNS-CONOPS
  - Ability to integrate external UTM/UAS-System components (Stakeholder-Systems)
  - Utilization and Capacity Analysis of urban airspace (safety and efficiency)
  - Demonstration of innovative methods and technologies
Project City-ATM
Objectives (2)

- Development and Implementation of a UTM/CNS – Infrastructure for Flight trails in urban airspace (e.g. Braunschweig, Hamburg)
  - Analysis of technical and operational feasibility
  - Definition of technical specifications of urban vehicles
  - Risk assessment
  - Prototypical vehicle configuration for urban Missions
Project City-ATM Overview

- concepts, Simulations and Flight trails in different Phases with increasing complexity
- Involvement of external Stakeholder-Systems
- Early demonstration of capabilities and functionalities
Project City-ATM
Overview

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U-Space and UTM
Concept

concept for urban airspace- and air traffic management

• Problem:
  • Heterogeneous vehicles of different size, flight behavior, technical abilities, flight permission and Mission objectives
  • dynamic airspace with regions of diverse requirements

• Objective:
  • Long-term “All aircraft in all airspaces“
  • Focus on uncontrolled airspace and urban areas

• Solution approach:
  • multi-dimensional Segmentation of airspace for Modeling different requirements, specific performance (UAS) and optimization of traffic planning based on density approach

Download Blueprint: http://www.dlr.de/dlr/Portaldata/1/Resources/documents/2017/Concept_for_Urban_Airspace_Integration.pdf
More information to be presented at DASC 2018 in London
U-Space and UTM Concept

concept for air traffic management

complex requirements:
• 3D- terrain- and obstacle maps
• static and dynamic occurring, time limited no-fly and restricted areas (=Geo-fences)
• Requirements for usage of specific airspace regions depends on performance, abilities and priorities of the user
• Actual and predicted demand for strategic air traffic and airspace management

"A lot of freedom at low density and little freedom at high density"

Virtual Multi-dimensional segmentation of airspace in regions of similar characteristics:
1. 3D coordinates (x, y, z)
2. Temporal validity
3. Specific characteristics of airspace (e.g. Weather, obstacles, limited CNS-availability)
4. Access requirements (Navigational performance, communication and Detect & Avoid)
U-Space and UTM Concept

Performance Based Operations and density-based air traffic management

- Combination and Interaction of airspace users with different specifications, performance and priorities
- Concept of Modelling: "Aircraft Safety Bound"
- Access to future airspace independent of technical specifications and individual performance of airspace users
Integration of Stakeholder

- DLR has been conducting research for several years on procedures and technologies for integration of UAS to (uncontrolled/controlled) airspace
  - Detect & Avoid
  - Performance based Operations
  - Air traffic management- and surveillance
  - Acceptance studies
  - Concept of operations and feasibility study
  - communication- and surveillance technologies (Drone2Drone, Drone2Infrastructure)
  - Vehicle configuration and Risk assessment
- Various companies with very far developed concepts and components for UAS, Infrastructure and U-Space
- Idea: collaborative development of a safe, efficient and accepted concept and demonstrator for urban airspace
Cooperation in City-ATM

- Cooperation concept

  - DLR develops open UTM-Simulation- and Demonstration platform
  - DLR provides interfaces for integration of stakeholder-components
  - Stakeholder get the opportunity to validate and demonstrate their technologies and systems as part of City-ATM under good publicity
    - 4 test phases (Q3 2018, Q1 2019, Q3 2019, Q1 2020)
    - 1 final demonstration (Q3 2020)
  - NDA between partners ensures confidentiality
1st Stakeholder Workshop – Results
07.02.2018, DLR Braunschweig

• Identification of possible Use Cases
  • Bridge Inspection
  • Tissue transport
  • Fire run
• Definition of goals for Phase 1
  • BVLOS
  • Several drones operating within a zoned area
  • Redundant surveillance and communication
• U-Space-Services for Phase 1:
  • Flight planning
  • Pre-tactical geo-fencing
  • Tracking
  • Strategic de-confliction
  • Monitoring and Traffic Info
  • E-Identification and Registration
DLR Vision on City-ATM

• different Services per U-Space Level

• Link of Services with airspace users/system operators
Dichte-basiertes ATM Luftraummanagement
Separationsminima

3 s:

Cyan: alles well clear (Abstand immer >20m)
Gelb: Abstand am CPA > 5m
Magenta: Abstand am CPA > 2.5m
Orange: Abstand am CPA > 1.25m
Rot: Abstand am CPA < 1.25m

7 s:
Dichte-basiertes ATM Luftraummanagement

Use case 1
City-ATM Informationsmanagement
Use-Case 1

Strategic de-conflicting (DLR-FL)  E-Identification  eID(NXP, LHT) /Tracking (DFS, LHIS, DLR-KN)
Flight Planning (FlyNex, DLR-FL)  Tactical deconflicting (GLVI)
Pretactical Geofencing (FlyNex)  Monitoring & Traffic Info (DFS, DLR-KN)

Strategische Flugplanung  Präaktische Flugplanung  Freigabe  Flugdurchführung  Nachbereitung

t-x  t-10 min  t-1 min  t  t+20 min  t+xd

City-ATM Events

1) Planung Wegpunkte für Brückeninspektion
2) 4D-Plan-Trajektorie
3) Update 4D-Plan-Trajektorie
4) Flug freigegeben
5) Abweichung Plan- und Realtrajektorie durch Wind
6) Geplante Annäherung zweier Drohnen
7) Überwachung Payload / Missionsziel
Thank you!

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)
German Aerospace Center

Institute of Flight Guidance

Dr. Bernd Korn
Head of Department of Pilot Assistance
Phone +49 531 295-2540
bernd.korn@dlr.de