Integration of Unmanned Aircraft Systems in Air Traffic Control

Henk Hesslink, Frank Morlang, Dirk-Roger Schmitt

AT-One EEIG

AT-One combines the strength of NLR and DLR in ATM Research
UAS in non-segregated airspace
Concept validation through simulation

AT-One combines the strength of NLR and DLR in ATM Research
State of the art UAS usage

Unmanned Aerial Systems (UAS) in non-segregated airspace through real-time simulation of Beyond Line of Sight (BLOS) scenarios.
Airspace usage concept validation

The project SINUE investigates satellite aspects (BLOS operations)
Integration concept

Relay

**Comm delay**

relay C³ link

Avionics System (NAV / FMS / AFCS / FTS)

relay C³ link

C-UAS

Other aircraft

strobe lights

TCAS II

sense & avoid

VHF COM

SSR transponder

direct C³ link

UAS Control Station

telephone

Air Traffic Control
Within the simulation architecture, a satellite model is included

In the underlying scenarios, several satellite issues will be covered:

- temporary comm failure because of satellite constellation
- total comm failure
- C2 failure
- time delay
- bandwidth for real-time surveillance mission
- cost benefit study
Simulation facilities
NARSIM, MUST, GCS

Emergency procedures
ATC Interface
Separation
Architecture of communication

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Pseudo Pilots
R/T
R/T Radar
UAS
SINUE communication overview

R/T C2
Satellite

R/T C2
Ground Control Station

Back up telephone

NARSIM
Communication

- Telephone communication between controller and UAS pilot if requested

Simulated Radio Telephony

- Radio telephony for the controller / pseudo pilot voice communication
- Specially designed intercommunication device operation over wire link
- Communication delay for satellite link is implemented:
Simulation Set-up

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[Images of a simulation set-up with labels: Pseudo Pilots, UAS Pilot, ATC]
Evaluation of the UAS integration concept:

• Normal operations
  – Avoidance of severe weather
• Emergency Operations:
  – Standard emergency procedures:
    • Comm Loss
    • Thrust Loss
• Loss of separation
• UAS-pilot to ATCO interactions
• Instantaneous Self Assessment questionnaires
• NASA Task Load Index methodology
• Introduction of 1 UAS into airspace
• Introduction of 2 UAS into airspace
Workload of Controllers
(USICO project)

2 UASs

Week 1

Week 2
• General

No special problems with UAS in airspace

Integration concept allows treatment of UAS like normal aircraft
Results (2)

• Communication

Telephone comm between controller and UAS pilot could be a benefit compared to manned aircraft
Results (3)

Workload:

- Workload increased slightly
- Due to unknown behaviour
- Later on workload got to normal
• Sense & Avoid

Sense/See & Avoid is still an issue to be solved with highest priority
Missions are feasible in near future