UAS Air Traffic Insertion Starts Now - Real-time simulation of UAS in ATC

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AT-One EEIG

AT-One combines the strength of NLR and DLR in ATM Research
Need for UAS to operate in non-segregated airspace

There is an enormous variety in UAS type

The range of applications for UAS is expected to grow
SINUE: Satellites enabling the Integration of UAS in non-segregated airspace in Europe
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
- relay C³ link
- Comm delay

Avionics System
- (NAV / FMS / AFCS / FTS)
- C-UAS
- VHF COM
- SSR transponder
- strobe lights
- TCAS II
- sense & avoid

C-UAS
- direct C³ link

UAS Control Station
- telephone

Other aircraft
- 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

AT-One
the ATM Research Alliance

Pseudo Pilots

R/T

R/T Radar

R/T C2

UAS

Satellite

R/T C2

Ground Control Station

NARSIM

Back up telephone

SINUE communication overview
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

Pseudo Pilots

UAS Pilot

UAS Pilot ATC

ATC
Validation Scenarios

Evaluation of the UAS integration concept:

• Normal operations
  – Avoidance of severe weather

• Emergency Operations:
  – Standard emergency procedures:
    • Comm Loss
    • Thrust Loss

• Loss of separation
The mission
• 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
• 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
Workload:

• Workload increased slightly
• Due to unkown behaviour
• Later on workload got to normal
Results (4)

• Sense & Avoid

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