Human Factor Impact Assessment of RPAS Integration into Non-segregated Airspace

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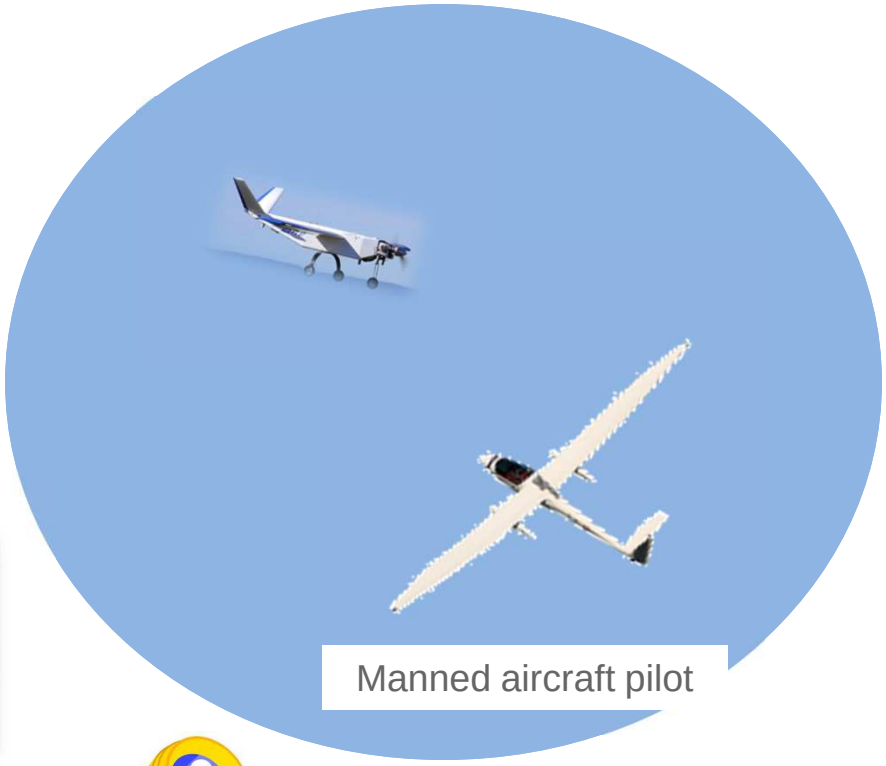
Demonstration Projects

DEMORPAS aims at assessing the feasibility of the RPAS integration in non-segregated airspace, in a mixed environment where RPAS and manned aircraft coexist during different flight phases.

ARIADNA aims at assessing the feasibility of using a ground-based situation awareness system based on ADS-B and ATC radar data to increase the remote pilot situational awareness of the surrounding traffic in the airport environment.

Actors



Manned aircraft pilot

ACC controller

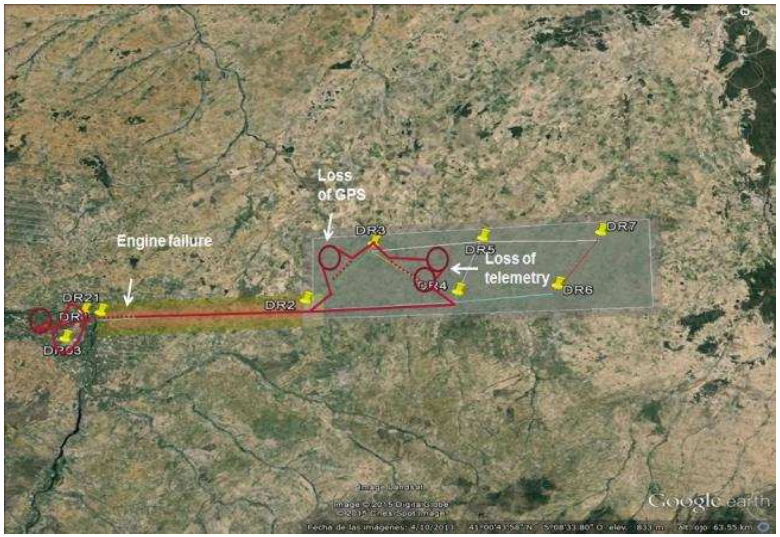
External pilot

Tower controller

Remote pilot &
SINA position / GND system

Scenarios

- RPAS nominal operations:
  - Modifications in the flight plan to allow executing the RPAS mission.
- RPAS emergency procedures:
  - Loss of data link.
  - Loss of GPS.

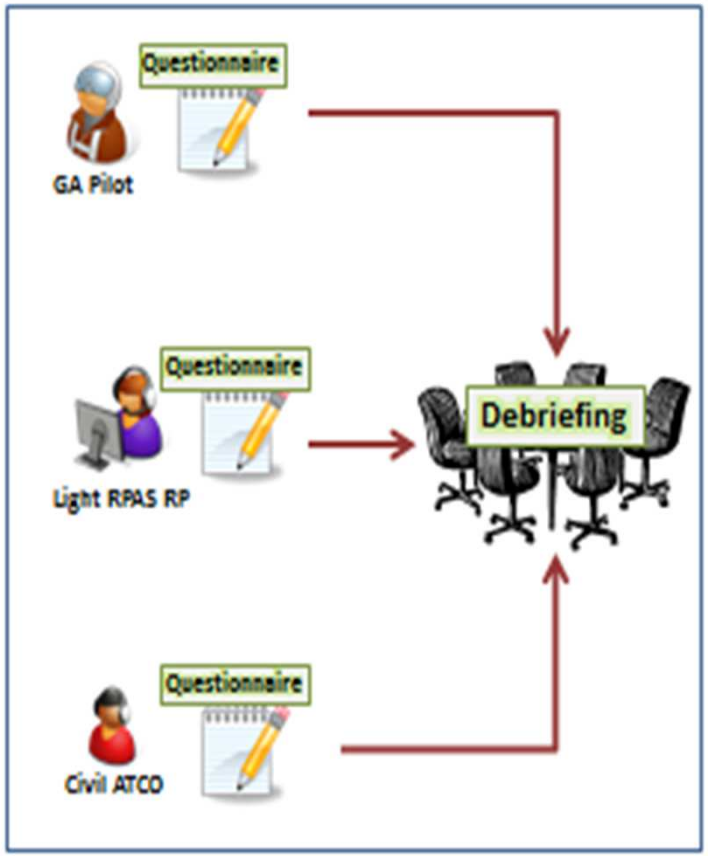


- RPAS separation procedure when flying simultaneously with others:
  - Loss of data link and potential separation infringement with other aircraft.
  - Separation infringement with manned aircraft in the vicinity of the airport.
  - Runway incursion with two RPAS.

Metrics

Consistent with the SESAR Performance Framework:

- **Human error** –adherence to ATC standards.
- **Task balance within the team** – distribution of workload among RPAS crew members with the new tasks to interact with ATC.
- **Communication** – quality and quantity of the communication between controllers and remote pilots.
- **Situational awareness –** capacity of the different actors to predict the evolution of the traffic.
- **Technology acceptance** – controllers´ perception about the feasibility of specific aspects (performance, procedures, etc.) of the RPAS.



Results Summary

	Actors involved		
Human factors	***TWR ATCO***	***ACC ATCO***	***Remote Pilot***
Human error	○	○	●
Task Balance	○	○	●
Communication	●	●	●
Situational awareness	●	○	●
Technology acceptance	●	●	●

Results for Remote Pilots

- **Situational awareness is improved.**
  - ATC radar and ADS-B in RP Station is considered useful by Remote pilots as Detect and Avoid alternative and during the execution of emergency procedures.

- **Increase of Remote Pilot's workload** due to the combination of piloting tasks with ATC interactions.
  - Deficient interaction due to the lack of remote pilots' knowledge of phraseology.
  - Errors related to collation of instructions and lack of authorization requests.

Results for Remote Pilots. An example

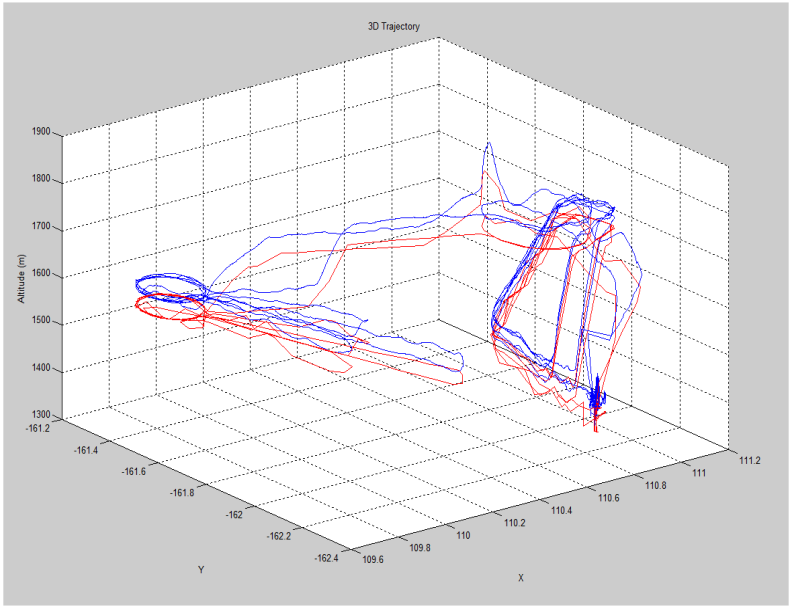
An example with RPAS pressure sensor

The RPAS crew changed the pressure reference from local to standard sea-level pressure at the wrong altitudes (in Spain the transition layer is between 6000 and 7000 feet).

Results for Controllers

- TWR and ACC **controllers maintained their task balance's perceptions**.
  - They had more difficulties and time to operate in the frequency.
  - They didn´t consider that errors in exercises were impacting safety.

- Controllers' **situational awareness was maintained** although risks were identified with:
  - RPAS abrupt manoeuvres showed in radar could distract the controllers from other tasks.
  - In case of emergency procedures, ATC and other pilots are not able to foresee the evolution of the RPAS unless they had been established before the flight.



Conclusions

- Ground-based systems based on different technologies are effective to provide remote pilots with surrounding traffic information.
  - **Essential when operating RPAS close to other aircraft** and during RPAS emergency procedures.
- **Communications as one of the most demanding tasks** for pilots and controllers
  - Remote pilots´ lack of knowledge of the standard procedures and phraseology.
- **Management of RPAS emergency procedures** not known in manned aviation was considered as a potential risk for safety of the operations.
  - *Definition of RPAS types operating in each environment?*

Thank you for your attention