REMOTELY PILOTED AIRCRAFT SYSTEMS SYMPOSIUM
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Detect and Avoid

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Overview

- **Definition of DAA**

  DAA is defined in Annex 2 as

  – "the capability to **see, sense or detect** conflicting traffic or other hazards and take the **appropriate action**"

  – This capability aims to **ensure the safe execution** of an RPA flight and to **enable full integration** in **all airspace classes** with **all airspace users**.

Hazard mitigation

- **DAA capabilities or other mitigations (e.g. operational procedures) are required for RPA to limit the risk from the following hazards:**
  - conflicting traffic
  - terrain and obstacles
  - hazardous meteorological conditions
  - ground operations
  - other airborne hazards

Principles

- **DAA may be done by**
  - **DAA capabilities** of a technical system
  - **other mitigations** (e.g. operational procedures)

  - The aim is: to give the remote pilot **equal capabilities** as the pilot of a manned aircraft has, to mitigate the 5 hazards above

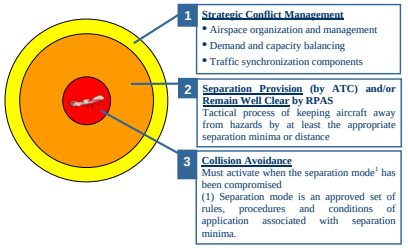
Priority

- **DAA capabilities for MAC is priority:**
  - A key enabler for RPAS integration into non-segregated airspace is mitigation of the hazard conflicting traffic (MAC).
  - RPAS may fly IFR, VFR or VLL

Contributors

- **Some factors for MAC (list not complete)**
  - Factors increasing the risk for MAC
    - Number of aircraft flying at the same time in airspace
    - Hot spots, frequently flown routes
    - Less surveillance, bad visibility
  - Factors mitigating the risk for MAC
    - See and avoid- RWC, ATC separation
    - ACAS and other systems
    - **THE DAA SYSTEM wherever needed**

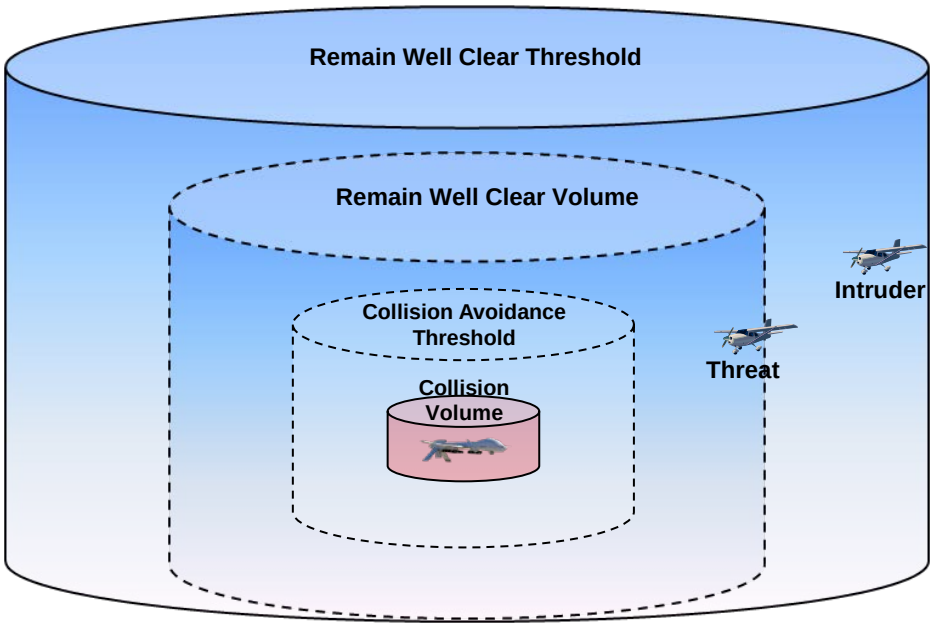
Conflict management approach



- **Three layers**
  - Strategic conflict management phase
    - Planning phase, obtain sufficient data for the flight
  - Separation provision phase
    - Actions by the participants, separation provisions applied by ATC and RWC by the pilots / remote pilots
  - Collision avoidance phase
    - Last resort action, if the provisions above fail

Conflict management approach

- **Three layers**
  - 3D situation



System certification

- **Certification issues**
  - What is necessary?
    - DAA system(s) capabilities and performance sufficient for its purpose and feasible (and not the best that can be built)
    - DAA may consist of a system of systems and may have distributed components
    - DAA configurations/performance levels tailored to different operations and types of RPAS.

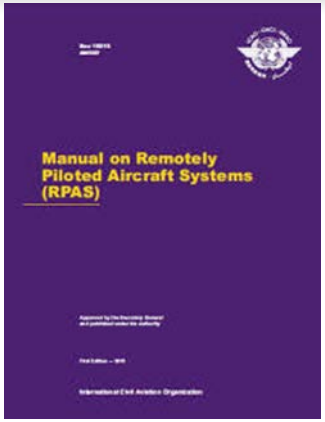
Safety considerations

- **The total aviation system**
  - Apportioning of risk
    - Participants and technical systems have an **interdependent relationship** in the total aviation system.
    - In order to reduce the risk of hazards addressed by DAA to an **acceptable level** (i.e. the safety objective), the **DAA capability and all the contributing participants**, including ATC and other aircraft, should be considered.

Safety considerations

- **The total aviation system**
  - Possible way to go:
    - If a safety objective can be met may be determined by calculating the risk with an approved method
    - Factors from above should be included in the determination
    - Tailoring of safety to different operations
    - The risk must be acceptable to the states and should be implemented in the State safety programme

Safety considerations



- **The total aviation system**
  - In addition:
    - The avoidance of MAC is dependent on the airspace class and the flight rules
    - With this parameters the availability of mitigating factors changes
    - A DAA system could be tailored to this specific needs
    - A DAA system will need **quantitative performance standards and requirements**

Way forward

- **The identification of risk level**
  - More effort is needed to identify the basic risk due to the number of aircraft in airspace
    - The risk is a function of airspace population
    - Many studies are available
    - Simulations are ongoing
    - The final identification is still pending

Way forward

- **The identification of risk level**
  - In particular, there is a need for improvement:
    - there are not many data available for low level VFR traffic population
    - for VLL the situation is even worse

Way forward

- **The identification of mitigating factors**
  - See and avoid from the cockpit:
    - there are studies available to quantify the role of the pilots visual observation quantitative performance
    - The results are varying widely
    - To quantify the contribution of the pilot of the manned
  - Pilot in the loop visual detection from the RPAS
    - Pilot cameras are not yet sufficient to replace the pilot directly
  - A decision need to be made, as best guess!

Way forward

- **The identification of mitigating factors**
  - Procedural mitigation:
    - It may be considered to define alternative flight routes for RPAS, at least in the vicinity of aerodromes
    - The quantification of this effect need to be investigated
  - Mitigation using a technical device
    - The quantification of this effect may be defined during the development of the device
    - Shall be interoperable with other existing devices

Way forward

- **The identification of mitigating factors**
  - Mitigation using a technical device (cont'd)
    - We have some devices already in operation: ACAS, GPWS, SSR, etc, etc.
    - Can we improve the functions of this devices?
  - Should we require additional installations in all aircraft? Or
  - Should we require additional installations in all aircraft using a particular airspace?

Challenges

- **Separation and remaining well clear**
  - can we agree on a standardized method to calculate the risk?
    - Independency of factors must be assured
    - Agreement on which factors to be used
    - Could enable the states to define DAA procedures and equipment requirements
  - decision is needed!

Challenges

- **Collision avoidance**
  - Should the CA maneuver be automatic?
    - PRO: this may be necessary in VFR, VLL (and) in loss of link scenarios
    - PRO: may save reaction time and improving the effectiveness of the maneuver
    - CON: In IFR controlled situation the ATC controller does not like unpredictable maneuvers
    - CON: may cause hazard in case of false alarm executed maneuver
  - decision necessary!

Challenges

- **Separation and remaining well clear**
  - dependent on the airspace and the flight rule
    - Unresolved for VLL operations (even if out of the scope of ICAO, it is an urgent question for the states)
    - Most challenging in airspaces with mixed IFR/ VFR traffic
  - should we exclude some types of RPAS from using a specific airspace?

Challenges

- **Separation and remaining well clear**
  - can we apply the right of way rules unchanged?
    - in manned aviation the application of right of way rules are not always free from contradictions
    - small RPAS with poor conspicuity may be obliged to give right of way all the time? (or be excluded from the airspace?)
  - decision is needed!

Outlook

- **The RPAS Panel DAA group outcome:**
  - ICAO Doc 10019 RPAS
    - DAA is addressed in Chapter 10 of the Manual
  - RPAS Panel work plan defined
    - Timeline agreed with ANC
  - The goal is developing the SARPS necessary for integration of RPAS

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THANK YOU