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