



UAV Detect And Avoid (DAA): State-of-the-art and latest trends

UAV integration in Air Traffic
Workshop and Demo
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UAVs Evolution : Autonomy !



Real Estate



Inspection



Crops Control

Remotely
Piloted

Autonomous

**Key Enabler : Integration of UAS
into Non-Segregated Airspaces !**



Parcels Delivery



Emergency Medical
Equipment Delivery



Search And Rescue at
Sea

Close Encounter : The drone & The Rafale



Sources : Defense Aero, CentreFrance

Detect-And-Avoid (Sense-And-Avoid)

- Improves/transposes See-And-Avoid (VFR)
- Detect-And-Avoid (DAA) covers 2 Functions:
 - **Traffic Avoidance** : Allows keeping a safe distance from other aircrafts
 - **Collision Avoidance** : Allows last moment manoeuvre to avoid Near Mid Air Collision (NMAC)

Detect-And-Avoid (Sense-And-Avoid)

Traffic Threshold : 'Remain Well Clear'



'Intruder'

Collision Threshold : 'Avoid Collisions'
→ 'Regain Well Clear'

Collision Volume



'Ownship'
(UAV)

Relevant Technical Committees and Standards

- RTCA SC-228: Minimum Performance Standards for UAS
 - Objective : Safe UAS integration into National Airspace System
 - Minimum Operational Performance Standards (MOPS)
 - Detect-And-Avoid (DAA)
 - Command and Control (C2) Data Link Systems
 - Key Dates
 - Established in 2013
 - Next meeting : October 2022

Relevant Technical Committees and Standards

- RTCA SC-147: Traffic Alert and Collision Avoidance System
 - Objective : Define and update TCAS/TCAS II Standards
 - Minimum Operational Performance Standards (MOPS)
 - Airborne Collision Avoidance System - ACAS X
 - ACAS Xa is the replacement of TCAS II
 - ACAS Xu is dedicated to UAS (current working on small UAS)
 - Key Dates
 - Established in 1980
 - Next meeting : November 2022

Relevant Technical Committees and Standards

- EUROCAE WG-75 Traffic Alert and Collision Avoidance Systems (TCAS)
 - Objective : Develop ACAS X MOPS
 - Minimum Operational Performance Standards (MOPS)
 - ACAS Xa
 - ACAS Xo (specific procedures)
 - ACAS Xu (UAV)

Relevant Technical Committees and Standards

- EUROCAE WG-105 SG-1 Detect And Avoid
 - Objective : UAS integration into Non-Segregated Airspaces
 - Minimum Operational Performance Standards (MOPS)
 - Detect-And-Avoid (DAA)
 - Under IFR
 - In Very Low Level Operations
 - In Class A-C Airspaces (en route and large/moderate airports)
 - Position report on SC-147 ACAS Xu

Relevant Technical Committees and Standards

- American Society for Testing and Materials – Committee F38 on UAS
 - Objective : Address issues related to design, Acceptance tests and safety monitoring for UAS

Relevant Technical Committees and Standards

- US Standards related to DAA – RTCA
 - **DO-185:** MOPS for Traffic Alert and Collision Avoidance System II (TCAS II)
 - Published on March 2013
 - Scope:
 - Improved efficiency of TCAS Surveillance Function
 - Allow TCAS to implement Mode S reception
 - Various improvements

Relevant Technical Committees and Standards

- US Standards related to DAA – RTCA
 - **DO-365:** MOPS for DAA Systems
 - Published on March 2021
 - Scope:
 - Transiting through Class B,C,D,E and G
 - Operations > 400 Feet AGL in Class D,E and G
 - Operations in Terminal Areas in Class C,D,E and G and off-airports locations

Relevant Technical Committees and Standards

- US Standards related to DAA – RTCA
 - **DO-366:** MOPS for Air-To-Air Radar (ATAR) for Traffic Surveillance
 - Published on September 2020
 - Scope:
 - Meet Non-Cooperative sensor requirements for DAA
 - Collision Avoidance Functions as described in ACAS Xu

Relevant Technical Committees and Standards

- EU Standards related to DAA – EUROCAE
 - **ED-143:** MOPS for Traffic Alert and Collision Avoidance System II
 - Published on April 2013
 - Scope:
 - Document published jointly by WG-75 and SC-147 (DO-185)

Relevant Technical Committees and Standards

- EU Standards related to DAA – EUROCAE
 - **ED-267:** Operational Service and Environment Definition (OSED) for DAA in Very Low Level Operations
 - Published on August 2020
 - Scope:
 - High Level Operational Requirements for candidate capability in line with ED-78 Process

Relevant Technical Committees and Standards

- EU Standards related to DAA – EUROCAE
 - **ED-271:** Minimum Aviation System Performance Standard (MASPS) for DAA in Class A,B,C
 - Published on May 2022
 - Scope:
 - DAA Functions to operation in in Class A,B,C under IFR

Relevant Technical Committees and Standards

- Industry Standards related to DAA – ASTM
 - **F2411-04:** Standard Specification for Design and Performance of an Airborne Sense-And-Avoid System
 - Last Update on August 2017
 - Scope:
 - Design and performance of airborne Sense-And-Avoid (S&A) systems
 - Detection of and safe separation from manned and unmanned aircrafts

ACAS Xu UAV Collision Avoidance System

