European Detect & Avoid (DAA)
Next Steps & Retrospect

Live Demo Day @Saab
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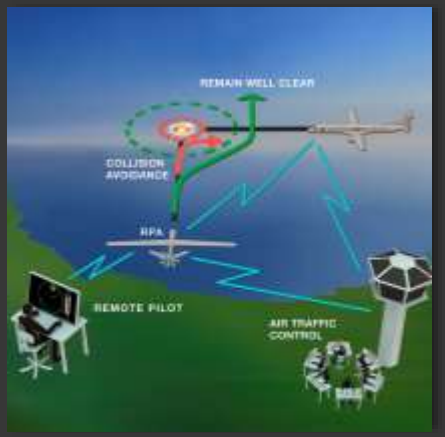
Gunnar Frisk, Saab Aeronautics

Detect & Avoid (DAA) – The door-opener…

- **Key enabler** of **safe integration** of UAS…RPAS…Drones… into non-segregated airspace

- **Are we there yet?**
  - For military, civil users
  - For large and small…
  - For airspace A-G, U-space/UTM…

- Quick-look on **Status** of RPAS integration in Europe, DAA development and **next steps** – SESAR, EUDAAS, Saab, … - military & civil, small & large, …

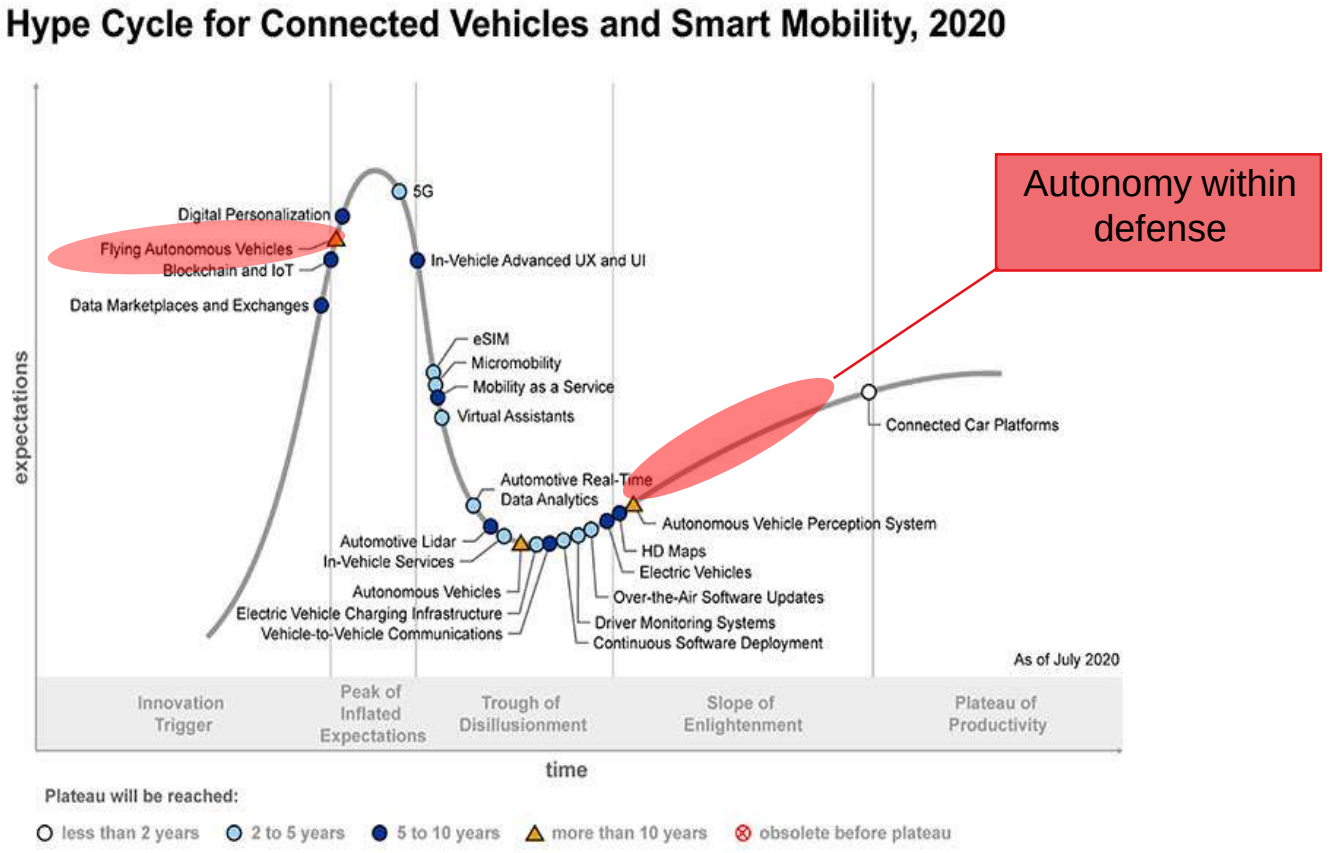


Safe integration of UAS…RPAS…Drones…

- A **priority for Military Users** seeking more flexible and safe use of their assets in non-segregated airspace (A-G) – 20 years ago (and still)
- Now a **European priority for All Users** – Civil & Military, Large & Small – RPAS, UAS, Drones in airspace A-G and U-space/UTM
- **Detect & Avoid** is the key enabler

Gartner Hype Cycle

Figure 1. Hype Cycle for Connected Vehicles and Smart Mobility, 2020



Autonomy within defense

Source: Gartner
ID: 450205

Saab Autonomy in Air Domain – Built on experience

80
Years experience

More than
5500
aircraft

Autononomy functions & Decision Support

1937

(EU) DAA evolution

National programs - Sweden

SAAB LFV VINNOVA TRAFIKVERKET

Military needs evolving

Limitations in the use of UAVs
Midair collisions incidents



Military capabilities

Automation in fighter segment
UAV demo and Dev programs
Mil. GCAS & ACAS programs
Etc.

Concept, Requirements, Prototype **DAA**
Demonstrated on RPAS in-flight

MIDCAS Sense & Avoid

EUROPEAN DEFENCE AGENCY

Initial Standardisation
DAA for non-segregated airspace

MIDCAS Sense & Avoid

EUROCAE SESAR

EUROPEAN DEFENCE AGENCY

Validation for ATC/ATM Standards
Basis for Qualification & Certification
Prototyp Product(s)

EUDAAS

EUROCAE SESAR

SAAB SAFRAN THALES indra AIRBUS DIEHL HENSOLDT

2009 2015 2020 2025+

R&D

Productification

Standardisation

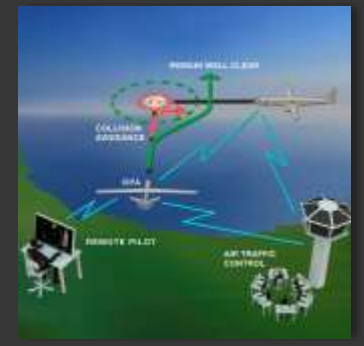
SAAB

Achievements in SESAR PJ13 ERICA project in collaboration with EDF/EDIDP EUDAAS Programme

European DAA

- **Real-Time Simulations** performed with Air Traffic Controllers and Remote pilots
  - **Validating DAA operational concept**
  - RPA integrated with LFV NARSIM Sturup simulator
- Over 341 million **Fast-time simulations** performed assessing CA and RWC using Eurocontrol Café/Cremé encounter models
  - **Validating DAA performances**
- **Live trials** on Skeldar VTOL equipped with DAA system
- Results are contributing to DAA **Standardisation** in EUROCAE and ICAO

What is EUDAAS?



EUDAAS - European Detect & Avoid (DAA) System

- Key **capability** for safe integration of RPA/UAV/Drones into the airspace
  - developed on military platforms, use in civil airspace, applicable for dual-use
- An European Defence Funds (EDF) Development collaboration **Programme**
- EUROCAE **Standard(s)**
- Building on **European investments**
  - EC, EDA, Member states, Industry
  - Military and civil programs (MIDCAS, SESAR etc.)
- **Global interoperability** and compliance
  - ICAO SARPs, Interop MASPS, …

EUDAAS Program Facts

- Awarded under the EC EDF, EDIDP 2019 call, Development/Capability window. Phase 1:
  - EC funding ~21M€
  - Total budget with national contributions ~30M€ (past investment in MIDCAS ~55M€)
- Supported by 5 MoDs: SWE (lead), GE, FR, IT, SP
- 11 main industrial partners
- Duration: 2021-2024, phase 2 2024~2026 TBC

SAAB SAFRAN indra CIRA LEONARDO THALES DLR HENSOLDT DIEHL Defence EUROCONTROL ONERA

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The EUDAAS Program Target platforms

- Tests & Demonstration on:
  - EuroDrone MALE (Dornier 228 testbed)
  - Leonardo Falco Xplorer TUAV/MALE
  - UMS Skeldar VTOL TUAV
  - Safran Patroller TUAV

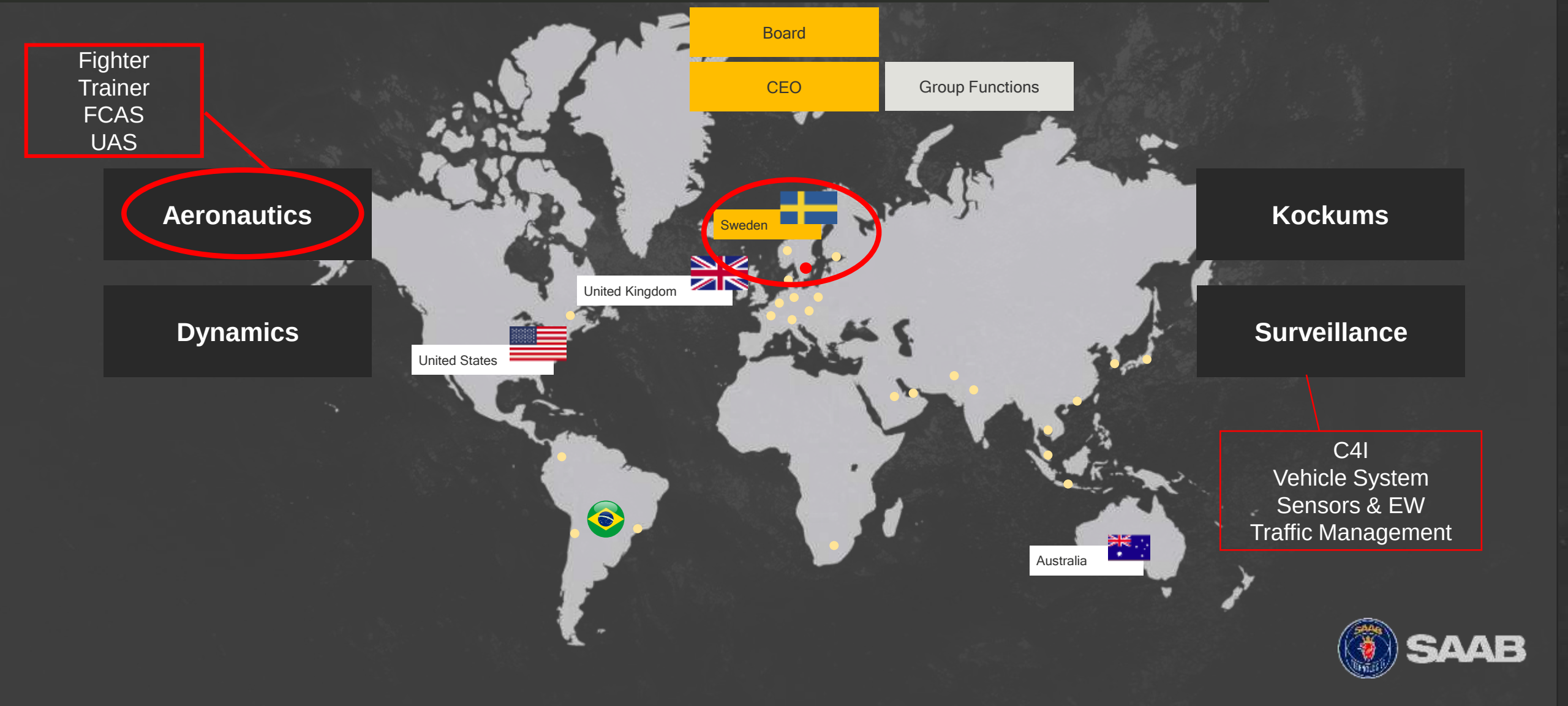
- Results will benefit and be applicable to many Drones
  - Desired, Required, Developed and Tested for ***military*** platforms – to support and meet ***civil*** requirements & environments/airspace
  - Open **standards** for EU DAA Systems, published by EUROCAE, strongly supported by EUDAAS
  - **Validation** of DAA solution in the ATM/ATC system – any entrants into A-G (jointly with SESAR PJ13)
  - Baseline for **Certification** (EASA)
  - Re-use into **UAM**, **U-space**/UTM…
  - Also relevant for **manned aviation** (e.g. SPO – Single Pilot Ops)








RPAS integration and DAA at Saab - a broad challenge requiring holistic view & broad competences

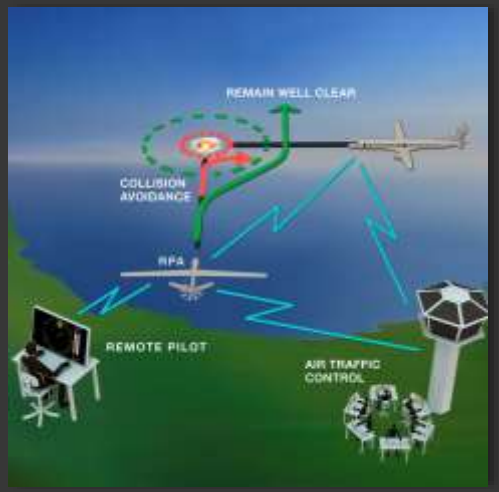


Saab DAA capabilities 1(2)

- **Pioneer & leader** in the Air Traffic Integration (ATI) domain, Leading the EU DAA work:
  - **Development** in EDF/EDIDP EUDAAS
  - **Validation** in EUDAAS and SESAR
  - **Standardisation** in EUROCAE WG-105 (and ICAO RPAS Panel)
  - Supporting **regulatory development** (EASA, NSA, Mil)

Saab DAA capabilities 2(2)

- **Saab Offers**
  - DAA equipment and algorithms, sensors, Flight Management computers, C2
  - Adaptability for different UAS & Drones (size, performance, operating environment/airspace), civil & military
  - Flight trials on several (large and small) platforms
  - Also relevant for pilot situation awareness and collision avoidance (special missions, SPO, teaming, …)
  - Test-beds & -environments
    (sim FTS & RTS, live)
- **Collaborations** will continue, is required,
  and we welcome new collaborations



Next steps?

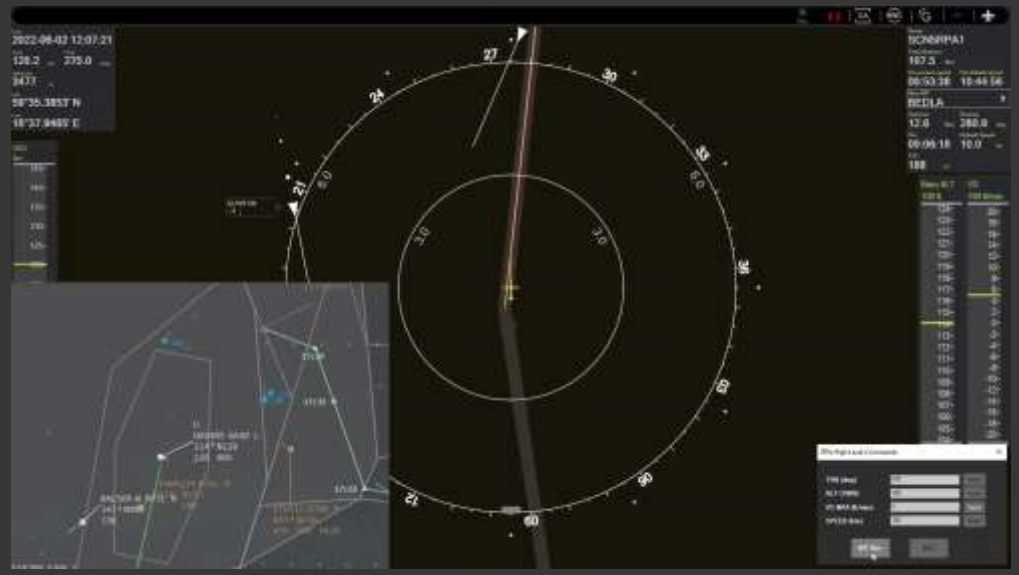
- European Standard
  - EUROCAE WG-105
- European Programs
  - SESAR PJ13 ERICA → SESAR3
  - EDF EUDAAS → EUDAAS2
- Test on more platforms
  - Military…Civil
    Smaller…Larger
    Unmanned…Manned
    ATM…UTM/U-space

- **Saab and industry developments**
  - **Refinements of existing prototypes**
  - **Product line for different categories of RPAS…UAS…Drones**

Thank you!

Welcome to our stand!

And thanks' to our partners and sponsors.



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What is DAA?

DAA **Operational Concept**

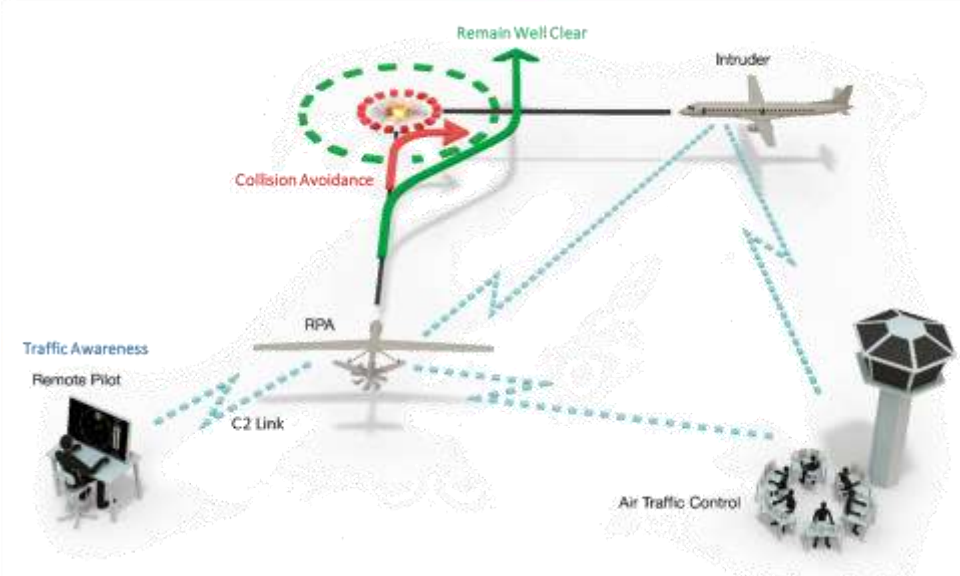
- Replicating the human ability to “see and avoid” – aviation cornerstones “rules of the air”
- Goes beyond current manned aviation, e.g. including fully automatic collision avoidance

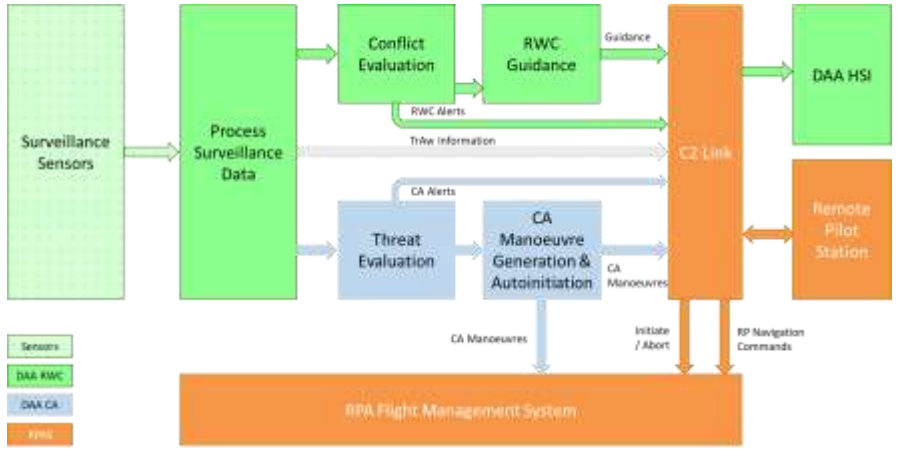
DAA is a complex **System**, including:

- Cooperative and non Cooperative Sensors
- Collision Avoidance (CA) function
  - Interoperable with existing CA Systems
  - Incl. Automatic avoidace
- Remain Well Clear (RWC) function
- Traffic Awareness (TrAw) function Human System Interface (HSI)

→ **We address the full scope**

incl. Interoperability (with safety nets, ACAS/TCAS, other DAA systems)





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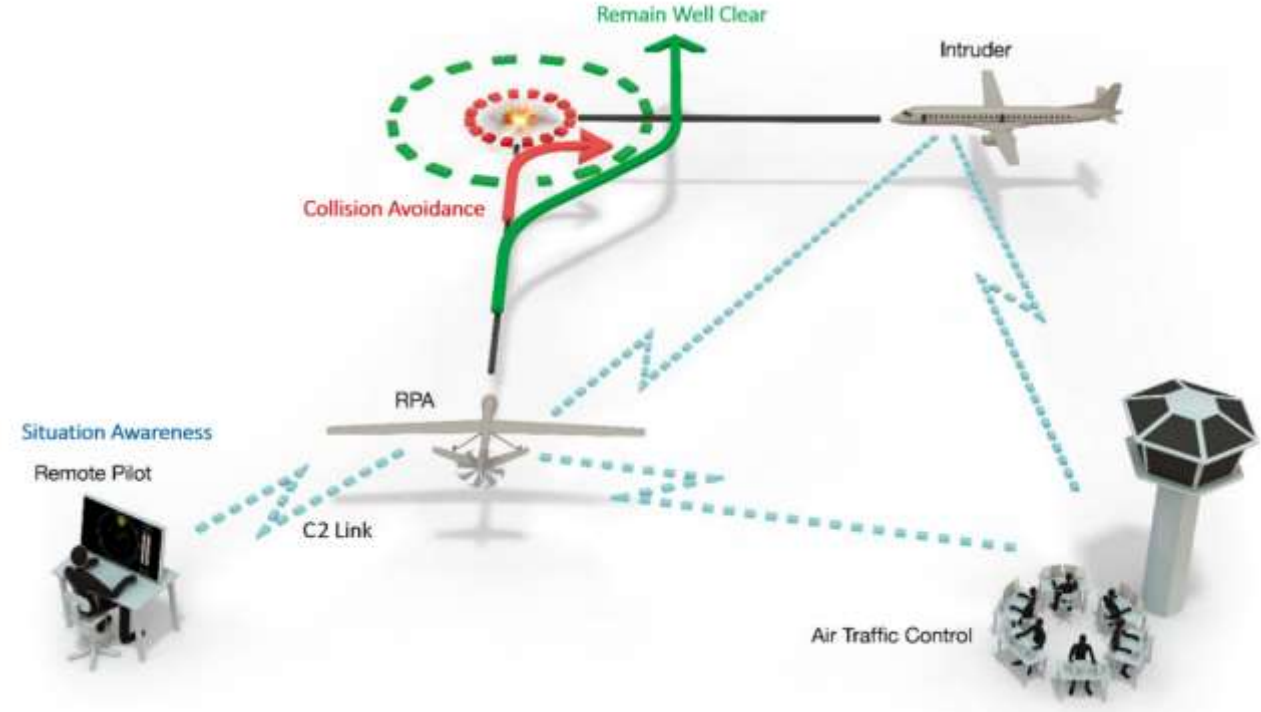
DAA/EUDAAS Operational Scope

All DAA functions:

- Situation Awareness (SA)
- Remain Well Clear (RWC)
- Collision Avoidance (CA)
  - Automatic (in EUDAAS)



EU DAA Roadmap

Past activities

Related activities

MIDCAS (R&D)

- Test & Demonstration equipment
- Concept
- Requirements analysis
- Initial architecture & design
- Draft DAA standards (OSED, MASPS)
- Test installations
- RPAS flight tests
  - Automatic CA
  - Coop & Non-coop DAA

Results:
Initial EUROCAE standards
DAA system req's & design
DAA system TRL5-6

EUDAAS + SESAR PJ13 (Dev. & Validation)

- Prototype equipment
- Representative design for MALE (EuroDrone) & TUAV
- Finalise DAA standards (OSED, MASPS, MOPS)
- Sensor MOPSs
- Regulatory framework
- ATM/ATC operational validation
- Initial integration onboard EuroDrone (testbed), TUAS

Results:
EUROCAE standards
System demo'd (TRL6-7),
limited DAA op's,
Foundation for qualification

Certification, Industrialisation, Acquisition (e.g. EDF)

- Product
- MOPS updates (if required)
- Certification at equipment & platform level (E-TSO etc.)
- Final integration
- Industrialisation
- Acquisition

Results:
System qualified (TRL 8), in operations (TRL 9).
Full DAA op's.

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