A low-angle shot of an Airbus aircraft wing soaring through a bright blue sky filled with soft, white clouds. The wing is sleek and modern, with visible wing fences. The perspective creates a sense of upward motion and flight.

Airbus implementation of Flight Tracking, Autonomous Distress Tracking, and Post Flight Localization & Recovery components

Singapore Aviation Safety Seminar (SASS)

Claude PICHAVANT
March 2019, Singapore

AIRBUS

Agenda

01

Summary of the GADSS Concept

02

Aircraft Tracking (Normal and Abnormal)

03

Autonomous Distress Tracking

04

Post Flight Localisation and Recovery



GADSS ConOps



Concept of Operations

Global
Aeronautical
Distress &
Safety
System
(GADSS)

Version 6.0

This Concept of Operations document specifies the high-level requirements and objectives for the GADSS.

Responding to the requirements and objectives, the ConOps specifies the high-level functions needed, with a description of users and usages of **aircraft position information, in all airspaces, during all phases of flight, both normal and distress flight conditions including the timely and accurate location of an aircraft accident site and recovery of flight data.**

Global Aeronautical Distress Safety System

AT

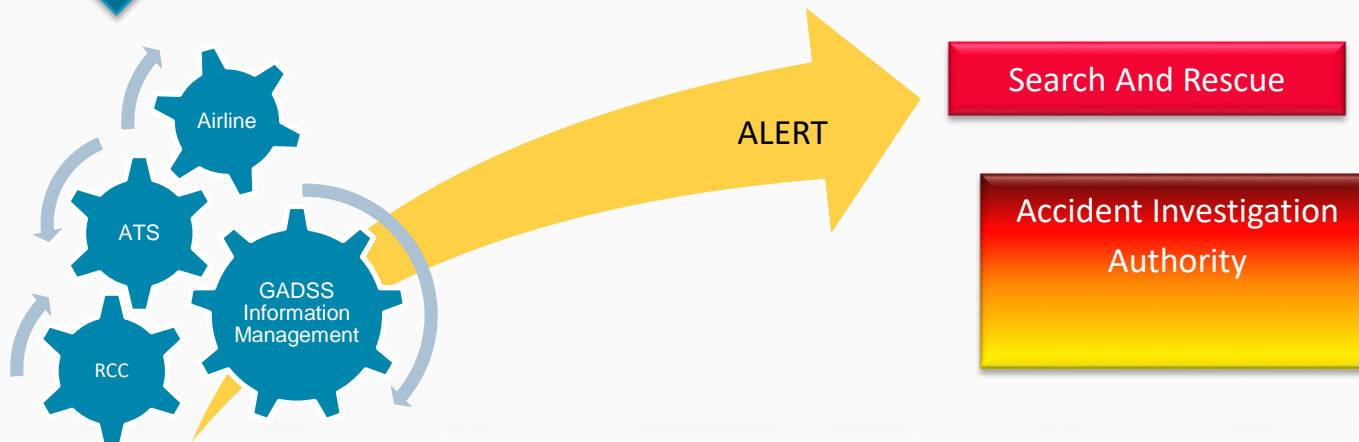
- Aircraft Tracking

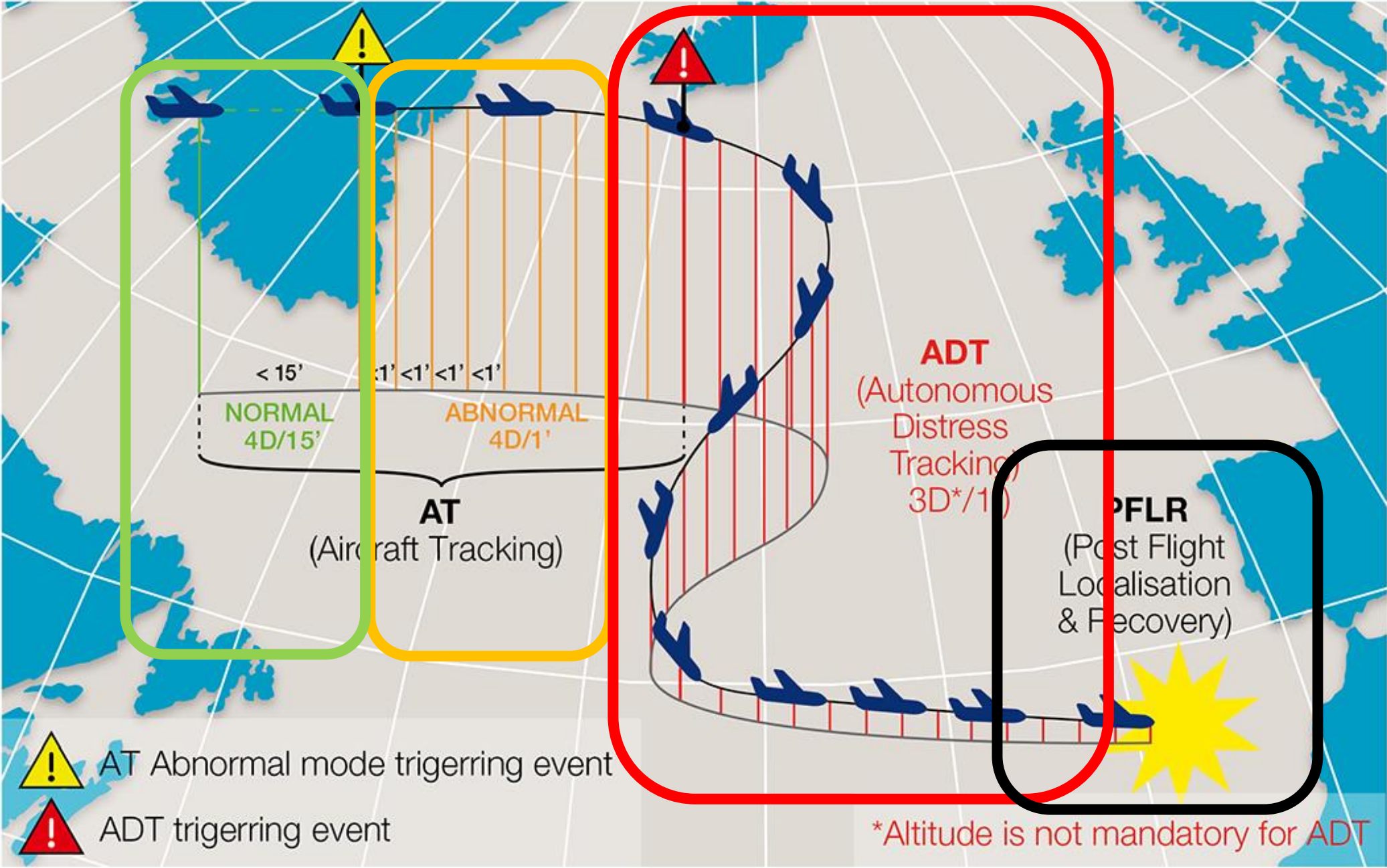
ADT

- Autonomous Distress Tracking

PFLR

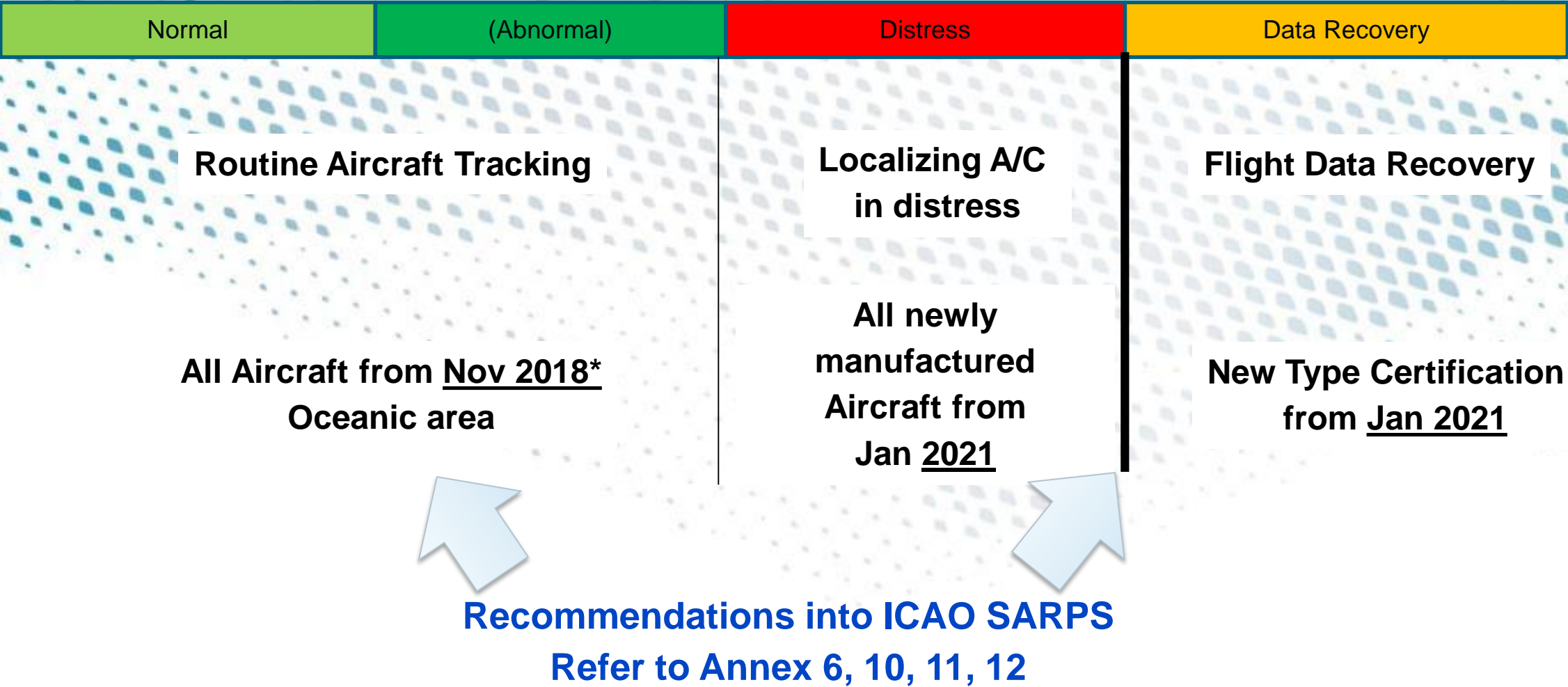
- Post Flight Localization & Recovery







Summary of the GADSS Concept



**: implementation date can be different according to regional or national regulations*

Summary of the GADSS Concept



Concept of Operations

Global
Aeronautical
Distress &
Safety
System
(GADSS)

Version 6.0

Amendment of ICAO Annex 6
SARPS



§3.5
A/C Tracking

Tracking

§6.18
Location of
A/C in distress

ADT

§6.3.5
Flight Recorder
Data Recovery

PFLR

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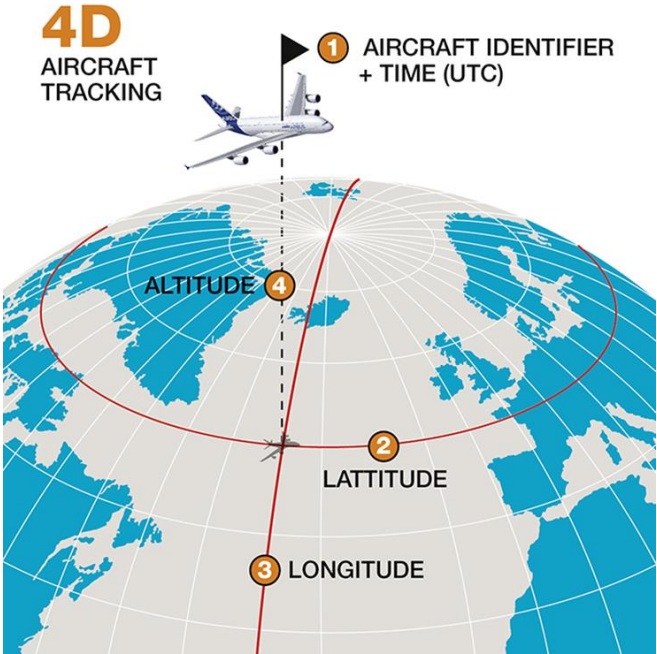
04

Post Flight Localisation and Recovery



Airbus- A/C tracking

Airbus
implementation
through AOC



Aircraft Tracking Normal Operations



Position
(Lat, Long, Alt, Time)
A/C Ident






≤15 mins

Available in Collins Aerospace
and Honeywell AOC application

Aircraft Tracking Abnormal Operations

**Report same content as
Normal Tracking**

Higher transmission rate
triggered on abnormal
event



1 min

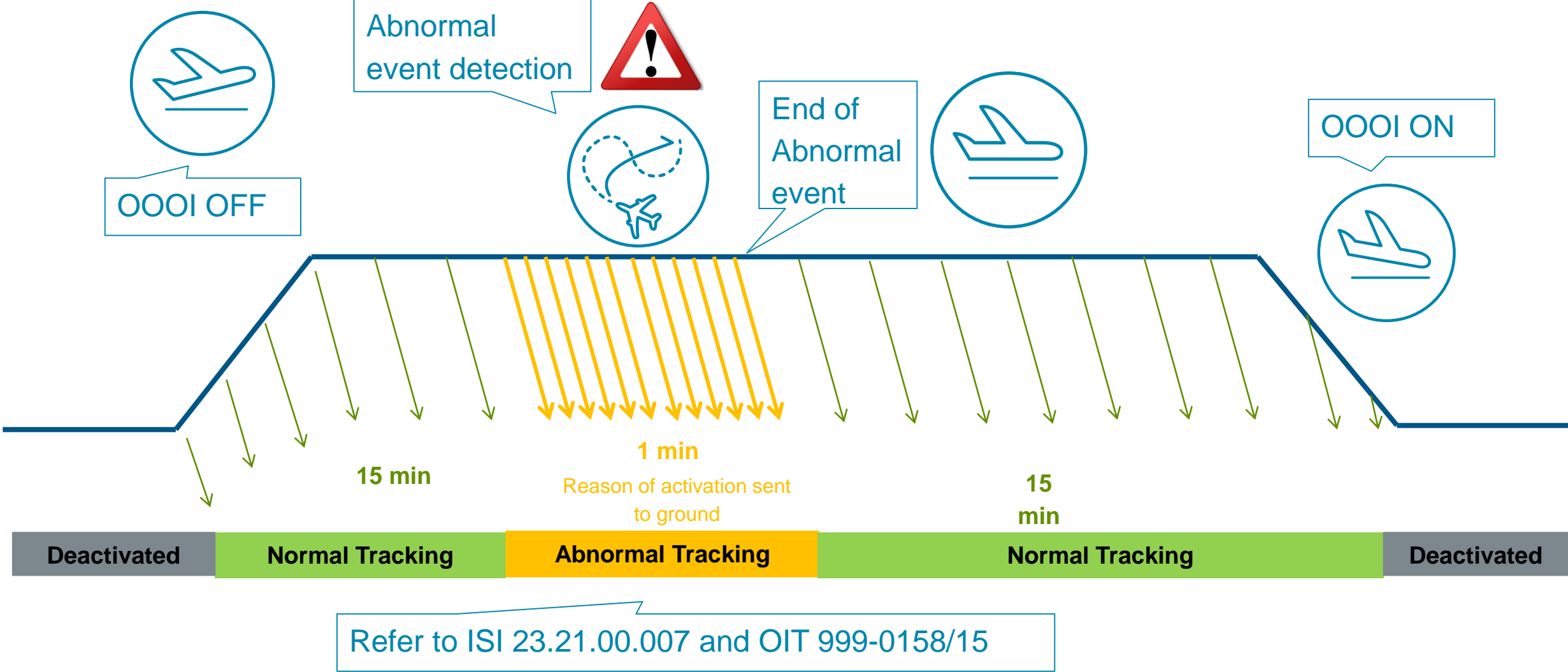
Available in Collins Aerospace
customization AOC database

Airbus recommends
Abnormal tracking :

- Higher reporting rate to
reduce uncertainty
- Improved position
accuracy



Airbus- A/C tracking



OOOI: Out, Off, On, In

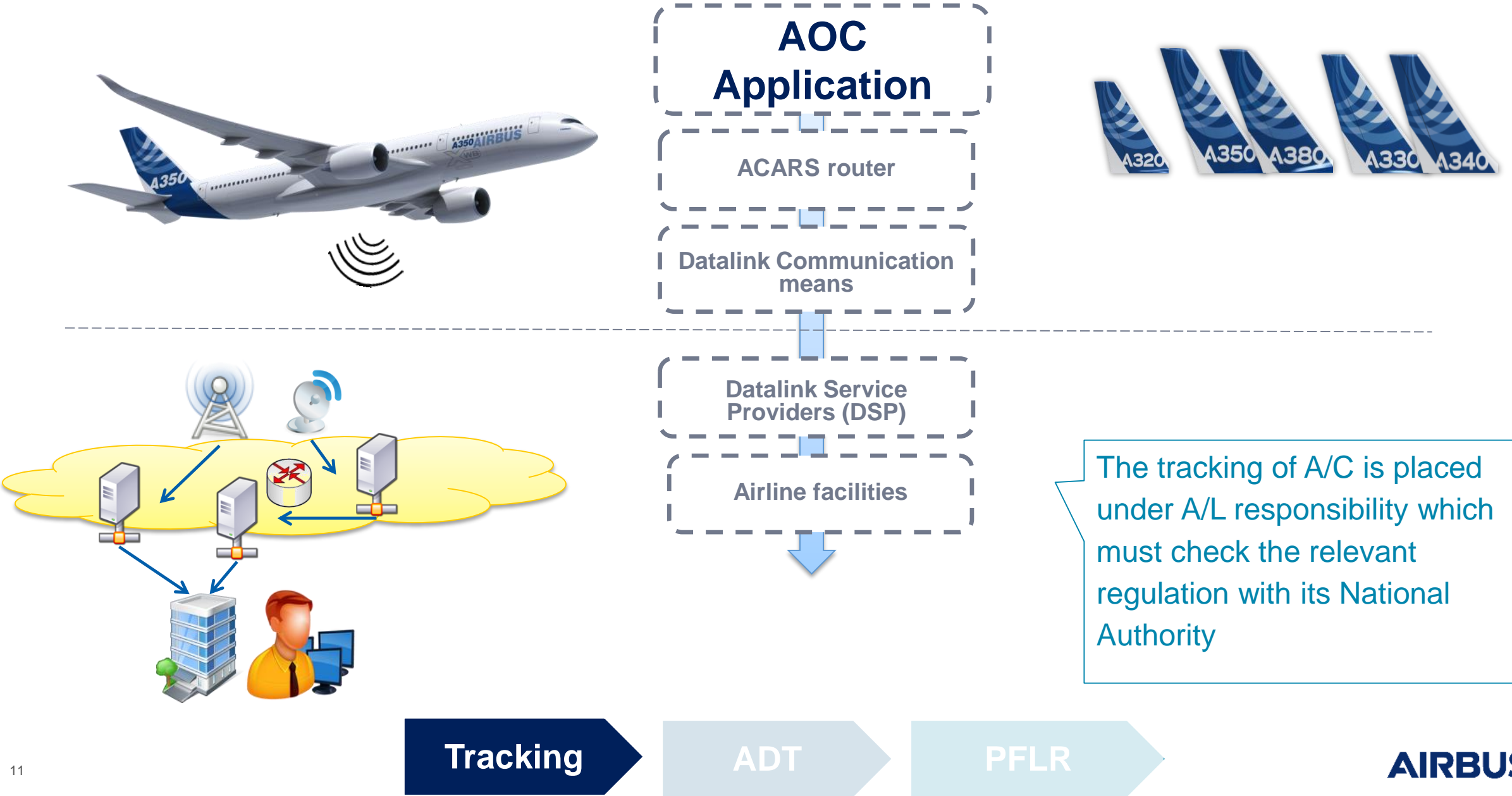
Tracking

ADT

PFLR

AIRBUS

Airbus - A/C tracking



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Autonomous Distress Tracking

Capability to detect a distress and transmit information allowing to determine the position of an aircraft every minute:

- Automatic transmission of 3D position +ID
- Activates within 5 seconds upon distress detection
- Gives accident site determination with a 6NM radius
- Uses protected distress spectrum
- Resilient to faults of A/C power, communication and navigation
- Sends signal to Search and Rescue



Note: *“Distress is a situation which, if left uncorrected, is likely to result in an accident”.*

Tracking

ADT

PFLR

AIRBUS

Standardization of Autonomous Distress Tracking



In order to specifically address expected, forthcoming ADT mandate in the most effective way (accounting for system complexity, cost, schedule, risk, etc.), the aviation industry launched a standardization activity through ARINC (APIM 17-004, ADT) .

The work is structured in 3 main phases:

- Definition of requirements and main functional block diagrams
- Proposition of candidate architectures .
- Develop detailed equipment, interfaces, and aircraft installation requirements, for selected architecture(s). Define accordingly new ARINC or updated Characteristics.

>>> ARINC Report 680 available, will be presented to the AEEC General Session

Tracking

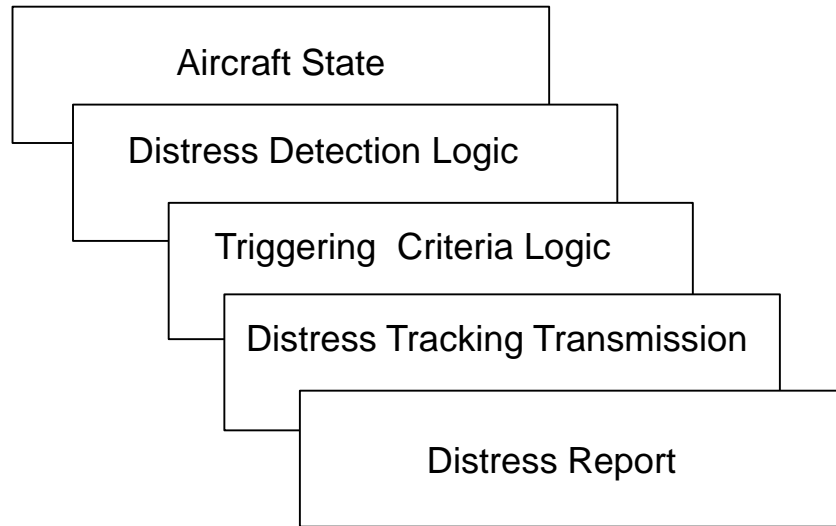
ADT

PFLR

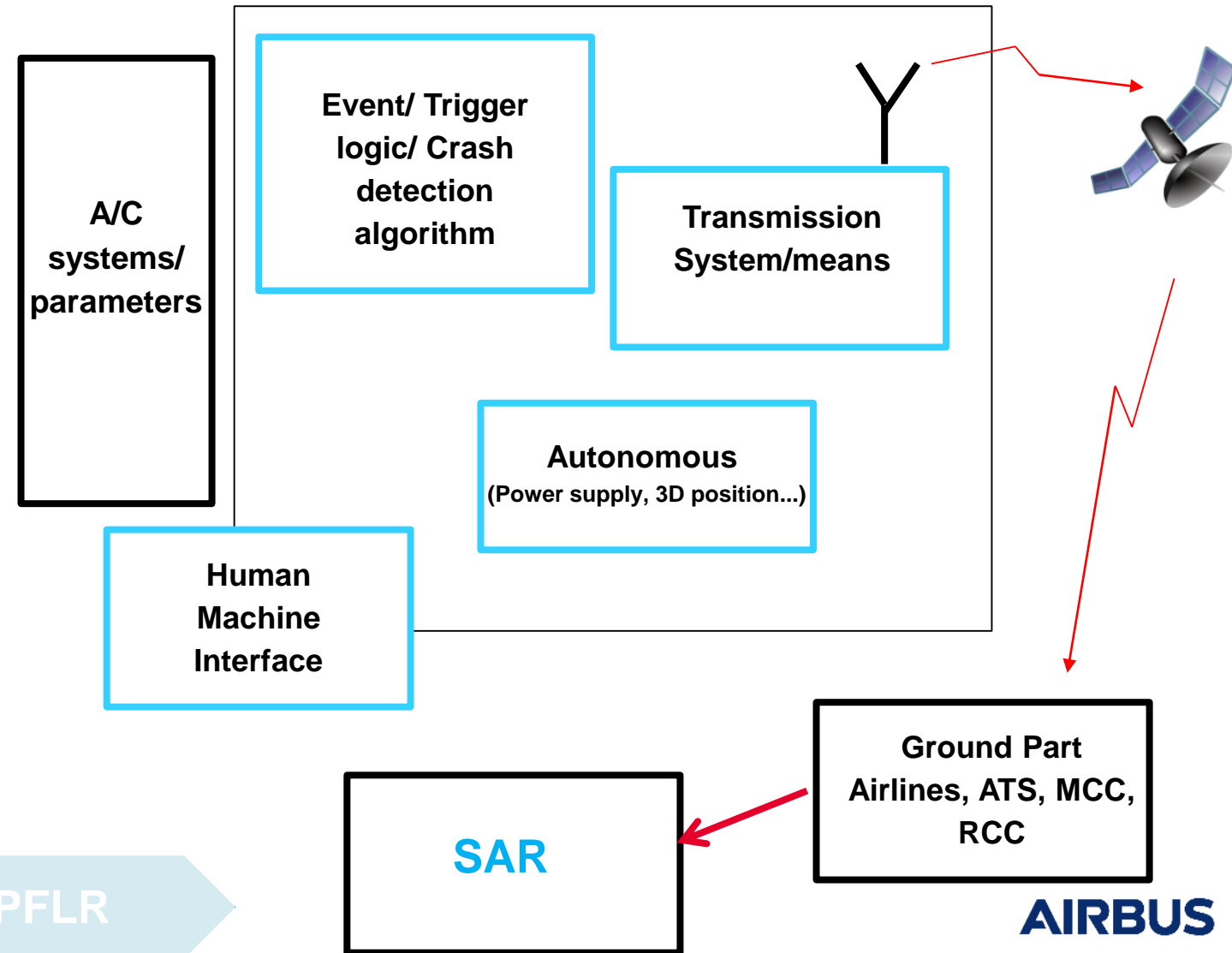
AIRBUS

Outcome of Standardization for ADT

Main ADT Function Blocks

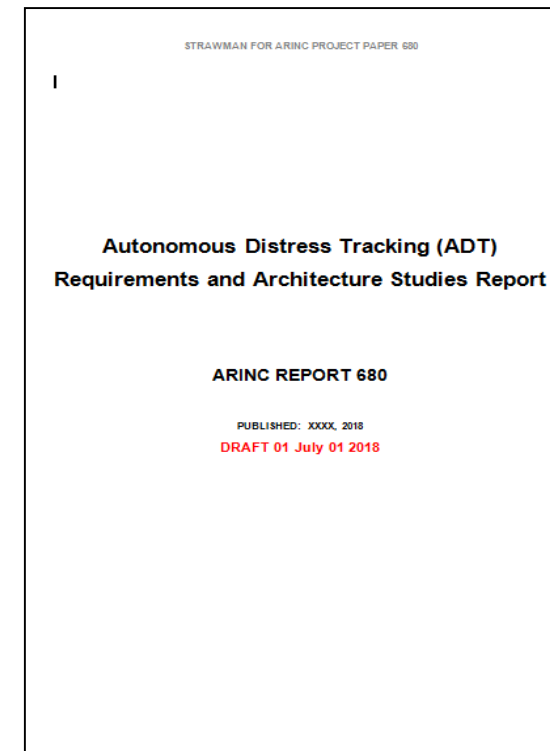


Typical ADT Block Diagram architecture whatever Com means



Outcome of Standardization for ADT

- Main Architectures:
 - ✓ Emergency Locator Transmitter – Distress Tracking (ELT-DT)
 - ✓ Spaced-Based Automatic Dependent Surveillance – Broadcast (SB ADS-B)
 - ✓ SATCOM-based Tracker (Inmarsat)
 - ✓ SATCOM-based Tracker (Iridium)
 - ✓ Other (ie Dissimilar Complimentary Architectures or stand alone solution)...
- Good support from industry: Airlines, Suppliers, Airframers, Service providers and government agencies



Tracking

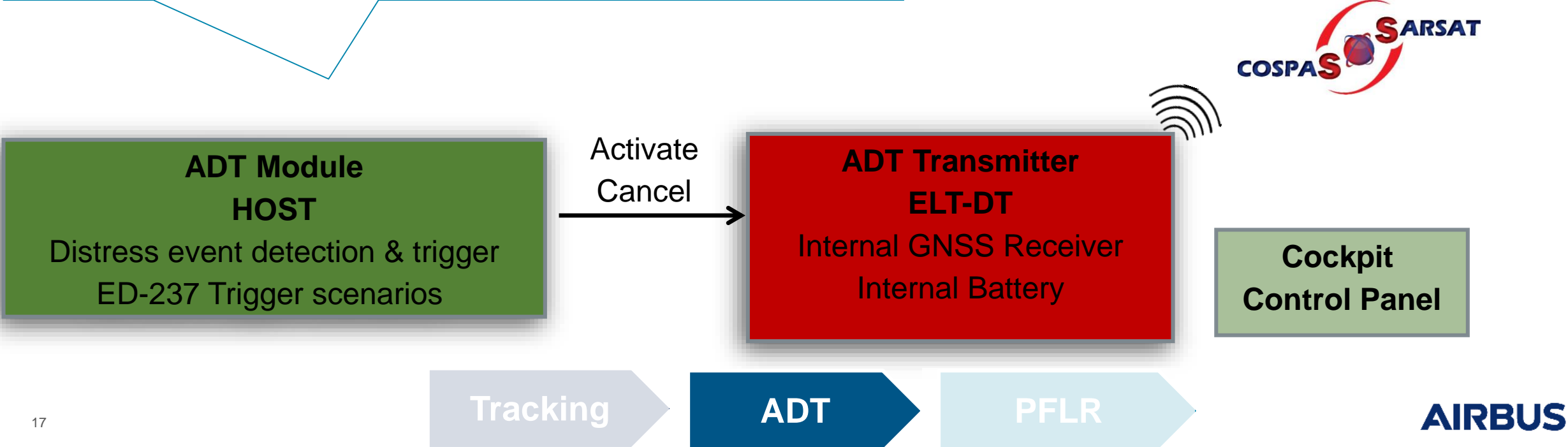
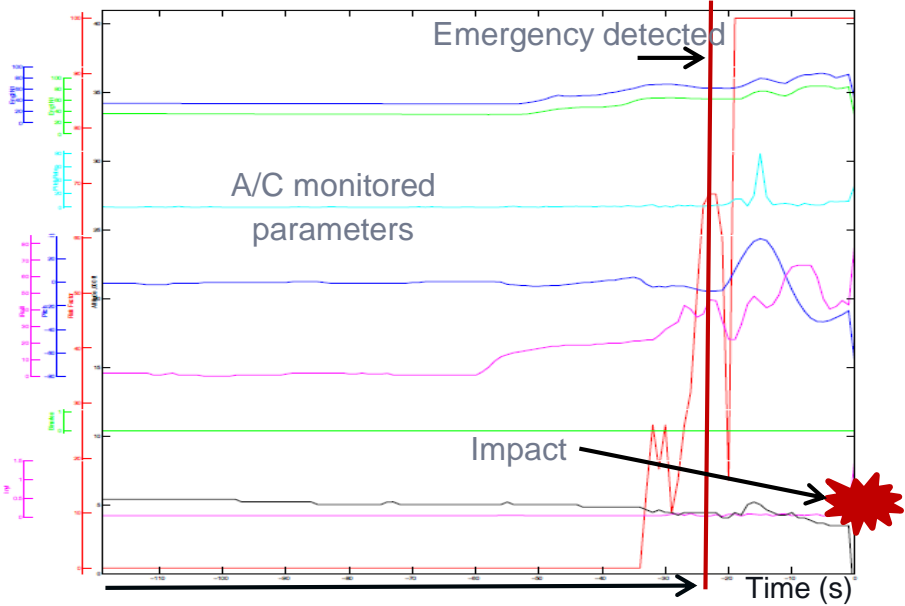
ADT

PFLR

Airbus - Autonomous Distress Tracking

Airbus ADT solution is ELT-DT based, either integrated in Deployable Recorder or Standalone

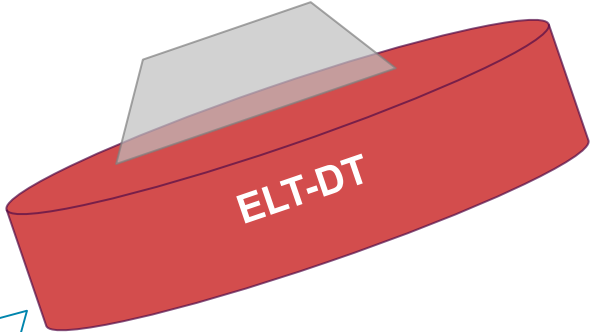
- Distress will only be able to be de-activated using the same mechanism that activated it
- Standalone autonomously powered



Airbus- Autonomous Distress Tracking

Airbus selected an ELT-DT based solution for the Autonomous Distress Tracking

Reminder:
ADT is placed under Airlines / Operators responsibility!



- ❖ To use well proven and secured (protected distress spectrum) Space and Ground segments and procedures of Cospas Sarsat, e.g. direct signal to SAR
- ❖ To minimize the impact on our different aircraft types

Required Nuisance Rate: $< 2e-5$ / FH

GPS / USA

20 → 28 (≈Early 2020s)

Galileo / Europe

10 → 16 (YE 2016)
→ 28 (YE 2019)

Glonass / Russia

1 → 8 (YE 2020)

Tracking

ADT

PFLR

AIRBUS

Airbus- Autonomous Distress Tracking

Airbus solution - Equipment overview on A320 - Non-Oceanic Short Haul



Tracking

ADT

PFLR

Airbus- Autonomous Distress Tracking

Airbus solution - Equipment overview on A350 - Oceanic Long Haul

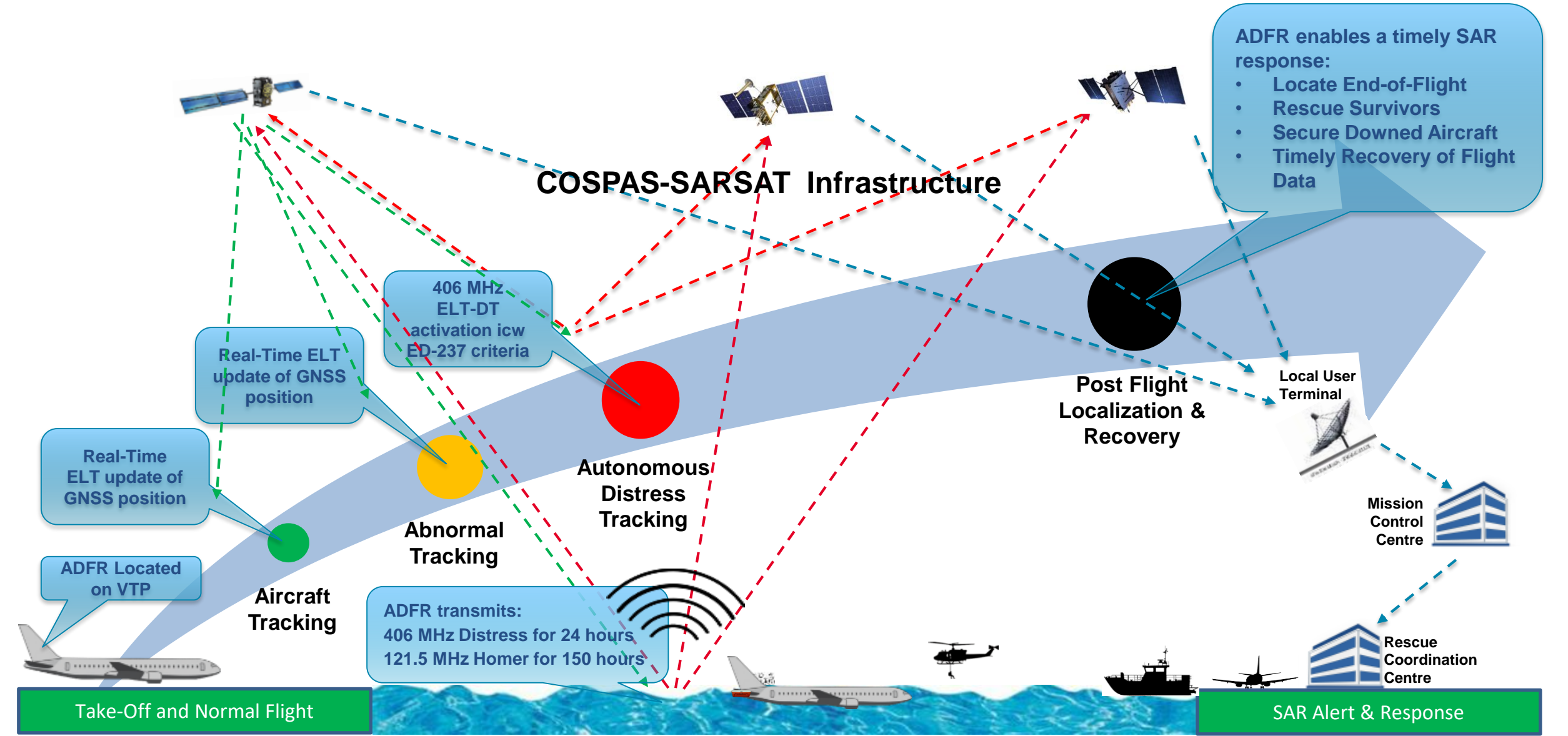


Tracking

ADT

PFLR

Airbus- Autonomous Distress Tracking within ADFR



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Post Flight Localisation and Recovery



Outcome of Standardization of Post Flight Localization and Recovery



In order to specifically address expected, forthcoming PFLR mandate in the most effective way (accounting for system complexity, cost, schedule, risk, etc.), the aviation industry launched a standardization activity through ARINC (APIM 17-005 , TRFD -Time Recovery Flight Data).

The work is structured in 3 main phases:

- Document the end to end system, Data Security and privacy requirements, develop System Functional Block Diagram (**ARINC Report 681 Draft**)
- Develop candidate architectures / choose architecture(s) (**ARINC Report 681 Draft**)
- Develop detailed equipment, interface, and aircraft installation requirements, as well for selected architecture(s). Define accordingly new ARINC or updated Characteristics

Tracking

ADT

PFLR

AIRBUS

Outcome of Standardization of Post Flight Localization and Recovery



There are two potential TRFD architectures, including (but not limited to) the following:

- Automatic Deployable Flight Recorder (ADFR) - a combination of flight recorder (Cockpit Voice Recorder (CVR)/Flight Data Recorder (FDR)), with integrated ELT, installed on the aircraft which is capable of automatically deploying from the aircraft
- Flight Data Streaming (FDS) – the ability to stream flight data from the airplane while in flight

>>> Completed work expected Q4 2020

Tracking

ADT

PFLR

AIRBUS

Airbus - Deployable Combined Recorder with integrated ELT-DT

Airbus plan: Forward-fit application of ADFR (Automatic Deployable Flight Recorder) with integrated ELT-DT (Emergency Locator Transmitter -Distress Tracking) on all long range operations aircraft: A350, A380, A330, and A321XLR



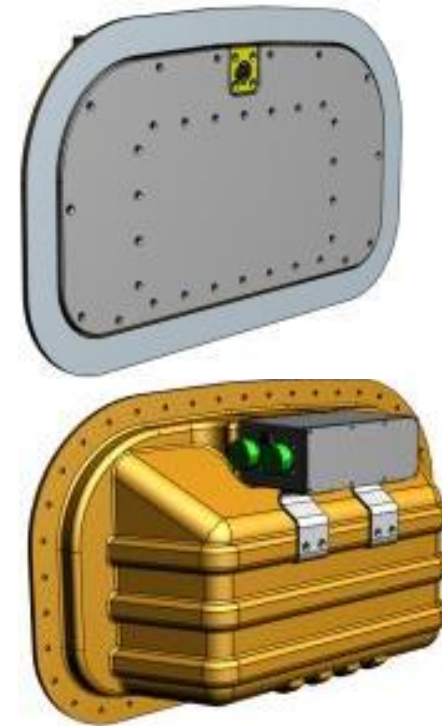
Note: No retrofit mandate existing as of today.

AIRBUS

Airbus -Deployable Combined Recorder with integrated ELT-DT

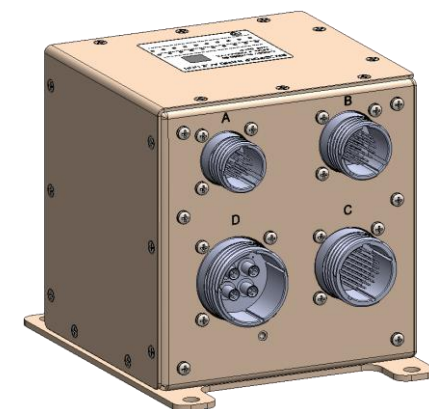
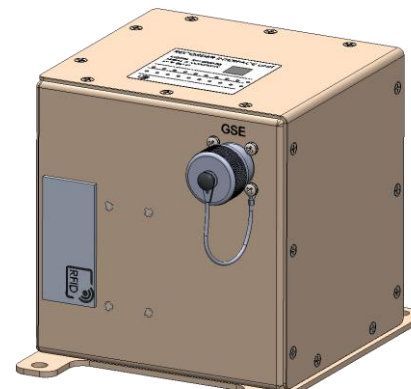
Automatic Deployable Flight Recorder (ADFR)

- Records cockpit voice, datalink and flight data
- Capable of 25 hours of Voice & Data recording
- Provisions for FCMI (Flight Crew Machine Interface)
- Located on Vertical Tail Plane (VTP)
- Ejected on crash or immersion detection
- Contains a Emergency Locator Transmitter (ELT)
- Floats on water indefinitely - No Underwater Recovery



Recorder Interface Unit (RIU)

- Data concentrator for ADFR
- Allows ADFR read-out without removing it
- Located in the fuselage of the aircraft, flange mounted



Tracking

ADT

PFLR

AIRBUS

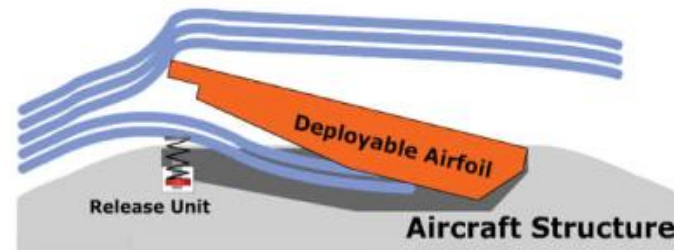
Airbus - Deployable Combined Recorder with integrated ELT-DT

- Airbus selected ADFR (Automatic Deployable Flight Recorder) solution for the Post Flight Localization and Recovery component



Source: DRS

Unintended deployment Failure Condition
shall be demonstrated as Extremely remote
i.e. 10^{-7} per Flight Hour



- » Airfoil releases from aircraft within milliseconds
- » Aerodynamic force “lifts” airfoil away from the aircraft
- » Floats on water indefinitely

Tracking

ADT

PFLR

AIRBUS

Airbus -Combined Recorders on all programs

A320, A319, A321

SA new architecture : **Dual CVDR**

Cockpit Voice and Data Recorder

Cockpit Voice and Data Recorder



A350XWB, A380, A330 and A321XLR

Long range new architecture : **ADFR and CVDR**

Automatic Deployable Flight Recorder including ELT -DT

Recorder Interface Unit

Cockpit Voice and Data Recorder



Tracking

ADT

PFLR

Summary of the GADSS Concept

AIRBUS Vision

- Full, compliant, implementation of A/C Systems enabling ICAO GADSS on board.
- Compliance with various Regulations, including CVR 25 Hrs.
- Strong participation in Regulation and Standardization bodies (ICAO, ARINC, EASA, ...) to optimize on board implementation

Tracking

ADT

PFLR

Benefits

- Retrofit impact very limited for Aircraft Tracking
- Compact solution (ADFR includes the ADT).
- Robust solution based on existing COSPAS-SARSAT satellite payloads.
- Combined and Deployable recorder for an improved dispatch reliability.
- Fleet commonality

Any questions ?



Thank you

Glossary

ACARS: Aircraft Communication Addressing and Reporting System
ACMS: Aircraft Condition Monitoring System
ACR: Avionics Communication Router
A/C: Aircraft
ADFR: Automatic Deployable Flight Recorder
ADS-B: Automatic Dependent Surveillance-Broadcast
ADS-C: Automatic Dependent Surveillance-Contract
ADT: Autonomous Distress Tracking
AEEC: Airlines Electronic Engineering Committee
A/L: Airlines
AMC: Airworthiness Means of Compliance
ANC: Air Navigation Commission
AOC: Airlines Operational Control
APC: Airlines Passenger Communications
APIM: ARINC Project Initiation/Modification
AT: Aircraft Tracking
ATC: Air Traffic Control
AtG: Air to Ground
ATM: Air Traffic Management
ATS: Air Traffic Services
ATSU :Air Traffic Service Unit
ATTF: Aircraft Tracking Task Force
BAU: Beacon Airfoil Unit
CAAS : Civil Aviation Authority of Singapore
CEPT: Conférence Européenne des administrations des Postes et Télécommunications
CoA: Certificate of Airworthiness
CONOPS: CONcept of OPerationS
CVR: Cockpit Voice Recorder

CVDR: Cockpit Voice Data Recorder
CVDR: Combined Voice Data Recorder
DAR: Digital Access Recorder
DB: Data Base
DFDR: Digital Flight Data Recorder
DLK: Data Link
DSP: Datalink Service Provider
DT: Distress Tracking
EASA: European Aviation Safety Agency
ELT: Emergency Locator Transmitter
EU: European Union
FAA: Federal Aviation Administration
FANS: Future Air Navigation System
FCMI: Flight Crew Manual Interface
FDR: Flight Data Recorder
FDS: Flight Data Streaming
FMS: Flight Management System
GADSS : Global Aeronautical Distress and Safety System
GAT: Global Aircraft Tracking
GEO: Geostationary Earth Orbit
GM: Guidance Material
GNSS: Global Navigation Satellites System
GPS: Global Positioning System
GSO: Geo Stationary Orbit
HF: High Frequency
HFDL:HF Data Link
HFDR : HF Data Radio
HLSC: High Level Safety Conference
IATA: International Air Transport Association
ICAO: International Civil Aviation Organisation

Glossary

ID: Ident

IP: Internet Protocol

ITU: International Telecommunication Union

LEO: Low Earth Orbit

LF: Low Frequency

MASPS: Minimum Aviation System Performance Specification

MCC :Mission Control Center

NAA: National Aviation Authorities

NATII: Normal Aircraft Tracking Implementation Initiative

NM: Nautical Miles

OCC = Operational Control Center

OEM: Original Equipment Manufacturer

OPS: Operations

PFLR: Post Flight Localization & Recovery

QoS: Quality of Service

RCC: Rescue Coordination Center

RIU: Recorder Interface Unit

RLS : Return Link Service

RTCA: Radio Technical Commission for Aeronautics

SAI : System Architectures and Interfaces

SAR: Search And Rescue

SARPs: Standards And Recommended Practices

SB ADS-B: Space Based Automatic Dependent Surveillance-Broadcast

SSCVR: Solid State Cockpit Voice Recorder

STC: Supplemental Type Certification

TRFD: Timely Recovery of Flight Data

TRDT: Triggered Recording Data Transmission

ULB: Underwater Locator Beacon

ULD: : Underwater Locating Device

VDR: VHF Data Radio

VDL: VHF Data Link

VHF: Very High Frequency

VTP: Vertical Tail Plane

WRC: World Radio Conference

3D: Three Dimensions

4D: Four Dimensions