

GADSS in depth

**Airbus views on Global Aeronautical Distress Safety System
ICAO Regional Preparatory Group / WRC-19 Workshop**

Claude PICHAVANT
September 2018, Johannesburg

AIRBUS

Emerging Issue

Global Aircraft Tracking Initiatives



SECOND HIGH-LEVEL SAFETY CONFERENCE 2015 (HLSC 2015)



“ICAO should encourage States and the International Telecommunication Union (ITU) to discuss allocation requirements at the World Radio Communication Conference in 2015 (WRC 15) to provide the necessary spectrum allocations for global air traffic services surveillance as a matter of urgency; “

WORLD RADIO CONFERENCE 2015

Resolution 425 (WRC-15)

“Use of the frequency band 1 087.7-1 092.3 MHz by the Aeronautical Mobile-Satellite (R) Service (Earth-to-space) to facilitate global flight tracking for civil aviation.”

>>> “Space ADS-B “



New Agenda Item 1.10

“To consider spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System (GADSS), in accordance with Resolution 426 (WRC15).”





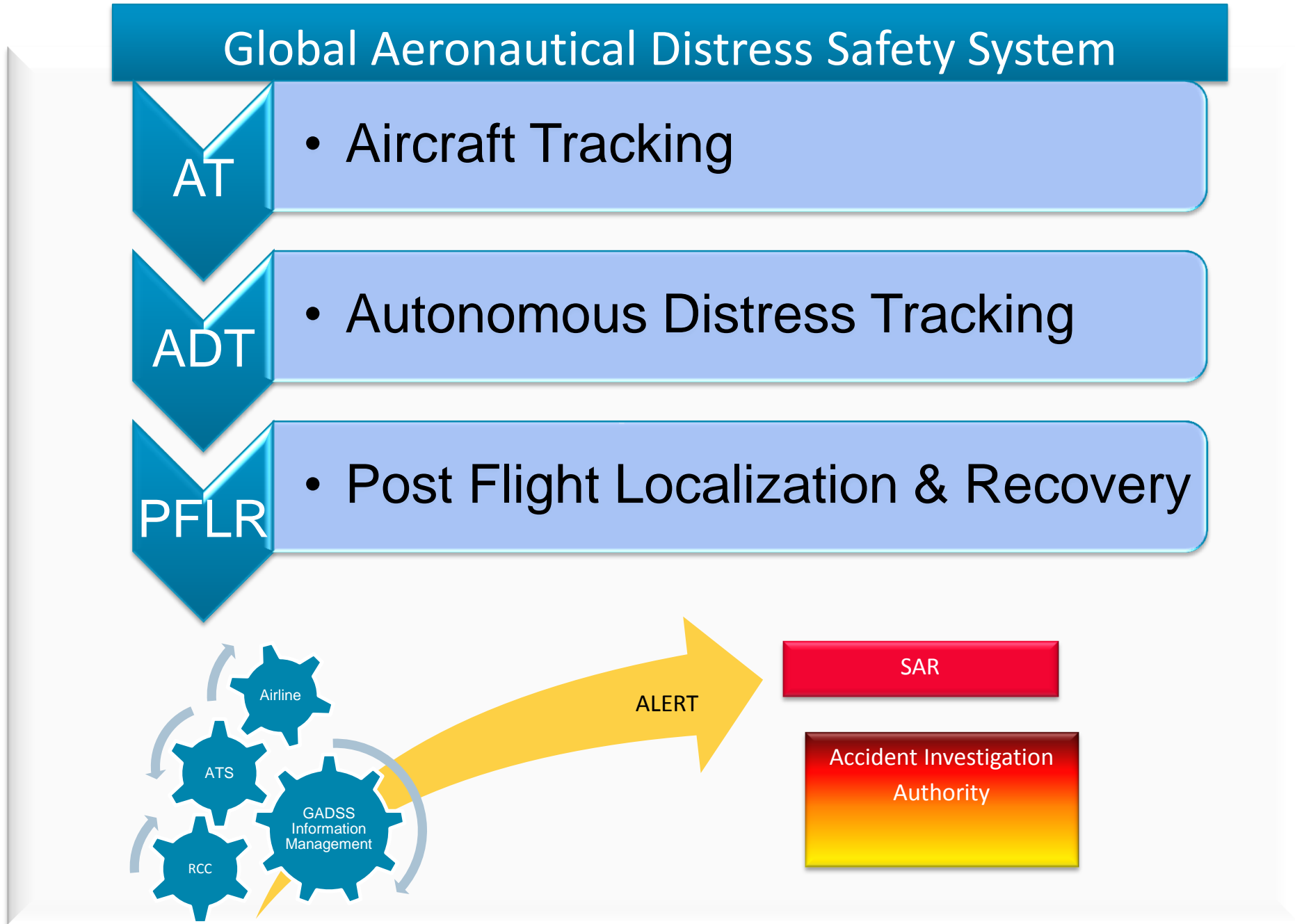
Concept of Operations

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.**



ICAO Recommendations

- 90 days ULB “Underwater Locator Beacons” (37,5Khz) attached to recorders CVR and DFDR (replacement of 30 days ULB)
 - >>>>> **January 2018 Forward fit & Retrofit**
(EASA: 16 June 2018 for retrofit)

- 90 days Low Frequency ULD “Underwater Locating Devices” (8,8Khz) attached to the aircraft for long-range over-water flights
 - >>>>> **2019 Forward fit & Retrofit**
(ICAO: Not later than 1 January 2018 ; EASA: By 1 January 2019)

- 25 hours CVR
 - >>>>> **Jan 2021 -Forward fit**

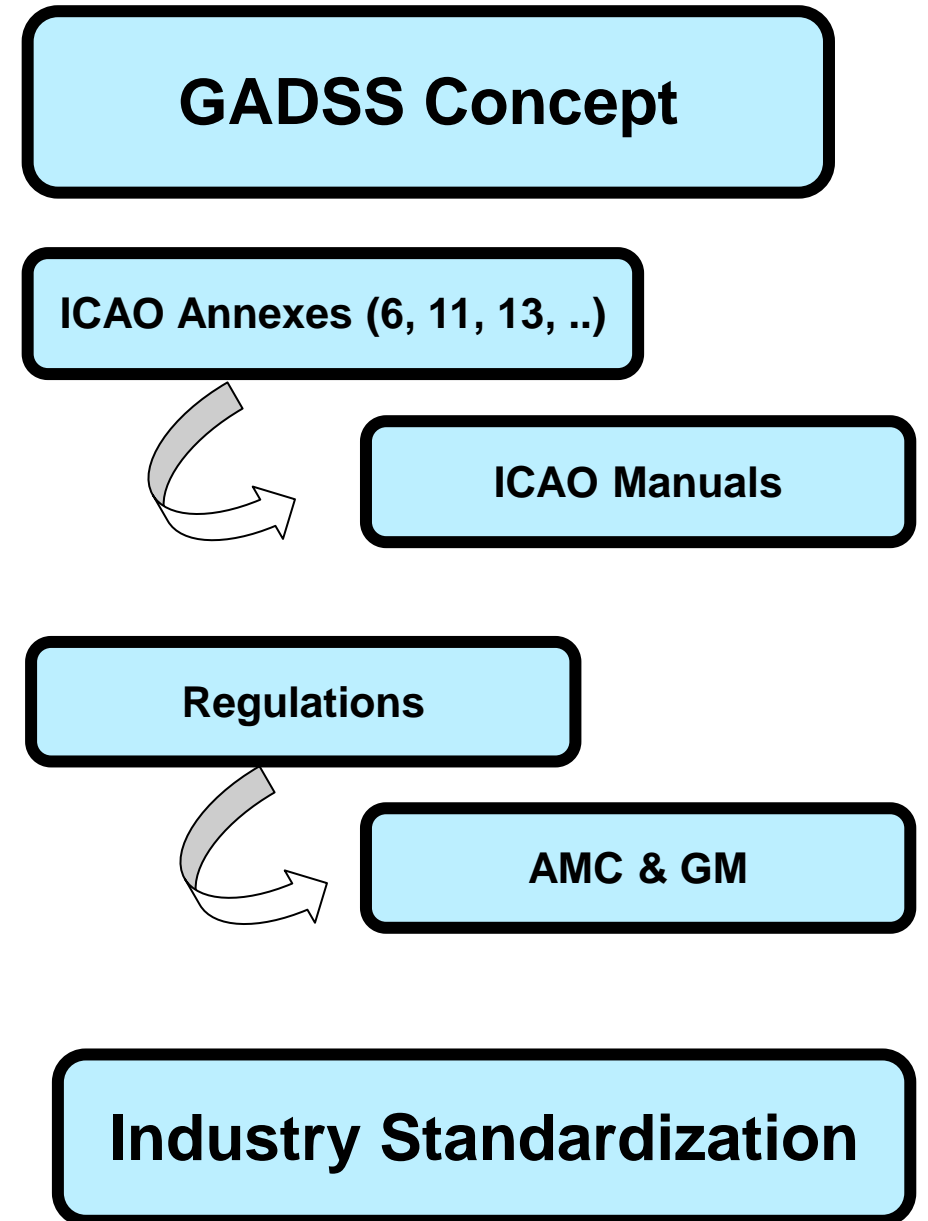
ICAO Recommendations

- Aircraft Tracking Normal (& Abnormal) Conditions
 >>>>> **Nov or Dec 2018 Forward fit & Retrofit**

- Location and tracking of an Airplane in Distress
 >>>>> **Jan 2021 - Forward-fit**

- Flight Data Recovery , two alternative means:
 - Data streaming (CVR and FDR data content)
 - or ADFR “Automatic Deployable Flight Recorders” (with integrated ELT).
 >>>>> **Jan 2021 - new Type Certificate**

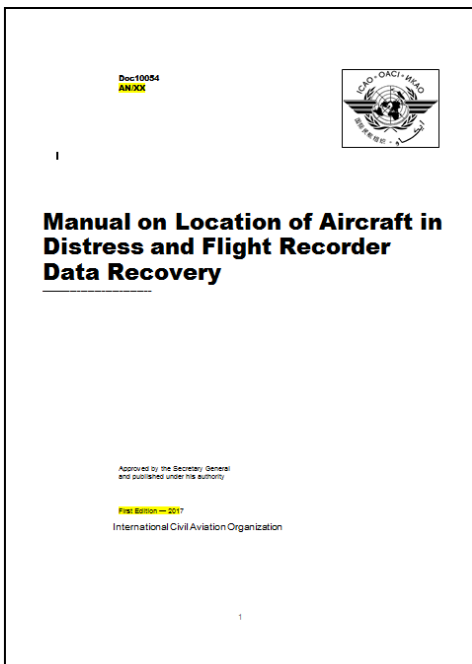
- **ICAO Conops (V6)**
- **ICAO SARPs**
 - ⇒ **Manual (Doc 10054)**
 - ⇒ **Distress Tracking Repository**
- **National Regulations**
 - ⇒ **AMC & GM**
- **Industry Requirements and Standards**
 - ⇒ **EUROCAE (ED 237, ED62B)**
 - ⇒ **ARINC (680, 681,..)**



Main ICAO activities

ICAO GADSS-Advisory Group activities are on going, a work programme has been establish related to the GADSS implementation .

ICAO has developed a Manual Doc 10054 to provide guidance in support of Standards and Recommended Practices (SARPs) introduced into Annex 6 regarding Flight Recorder Data Recovery and the Location of an Aircraft in Distress.



This document was defined by the ICAO “Flight Recorder” Working Group.

>>> ICAO Doc 10054 is expected to be released and distributed



Current ICAO Recommended Practices



Routine Aircraft Tracking

**Localizing A/C
in distress**

Flight Data Recovery

**All Aircraft from Nov 2018*
Oceanic area**

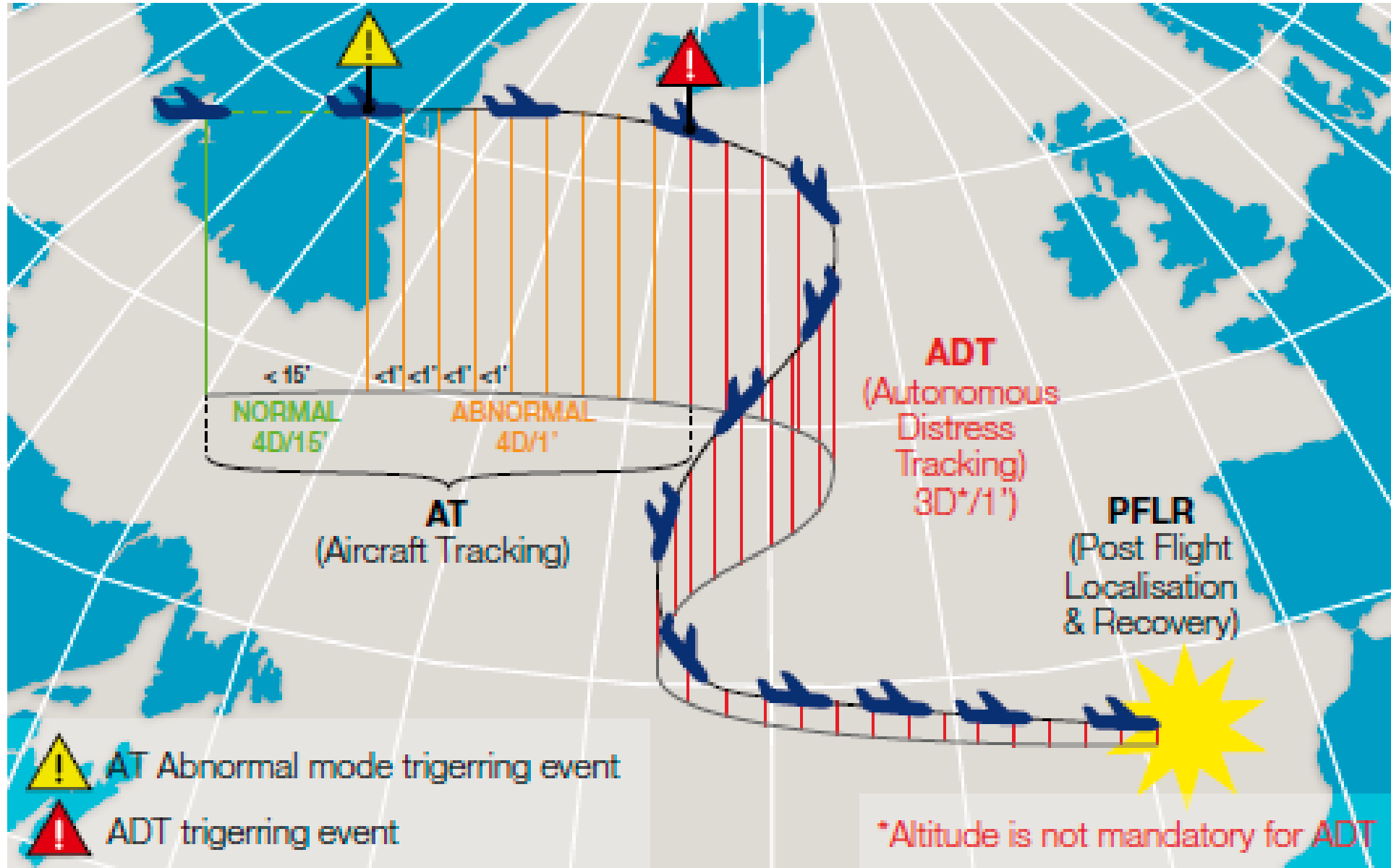
**All new manufactured
Aircraft from
Jan 2021**

**New Type Certification
from Jan 2021**



**Recommendations into ICAO SARPS
Refer to Annex 6, 10, 11, 12**

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

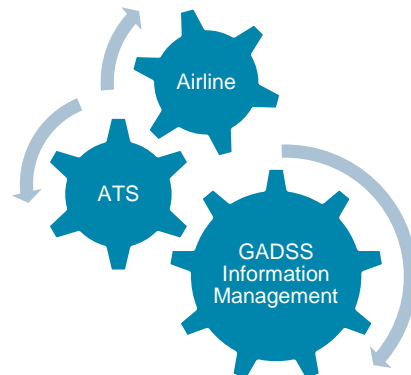


Global Aeronautical Distress Safety System

AT

• Aircraft Tracking

- Provides automatic A/C position at least once every 15 minutes
- ATS Surveillance may be utilized
- Can be isolated by Flight crew
- Multiple solutions
- May have airline defined triggers for abnormal operations with higher reporting rate



Use of any type of spectrum properly allocated, on a primary basis

Regulatory Framework – NAA status

States regulations

National Aviation Authorities (NAA) are defining their regulations according to ICAO recommendations.



Amendment to AIR-OPERATIONS (EU 965/2012) with new requirement CAT.GEN.MPA.205

Aircraft tracking from December 2018.
Abnormal mode detection required,
but no modification of transmission
rate requested (i.e: abnormal detection
from ground based on 15 min
reporting rate)



No regulation on Aircraft tracking



Amendment to "Aircraft Operator Certificate Requirements" with issue 3 revision 30

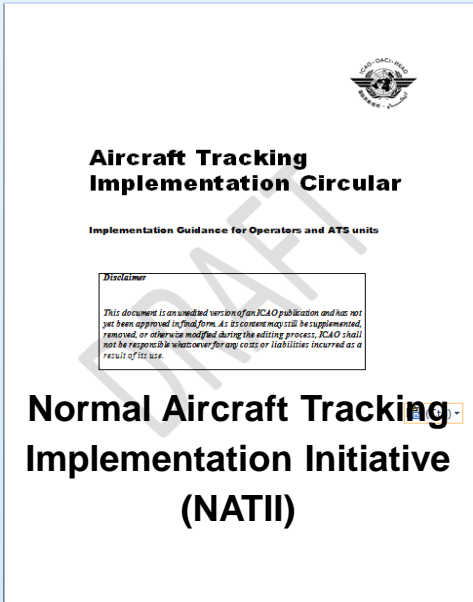
Aircraft tracking effective since July
2016 (with automated solution by
November 2018).

What is 4D (4 dimensions) ?



Aircraft tracking supported by existing technologies

Applicability November 2018 (Recommended in all areas of operations and mandatory over Oceanic areas)



Aircraft Tracking
Normal Operations

Aircraft Tracking
Abnormal Operations

4D (Lat, Long, Alt, Time) position
+ A/C Ident




≤15 mins

Same content as Normal Tracking (4D)
Higher transmission rate triggered on abnormal event

1 min

AIRCRAFT TRACKING IS PLACED UNDER OPERATORS RESPONSIBILITY

Datalink communication means on Airbus Aircraft

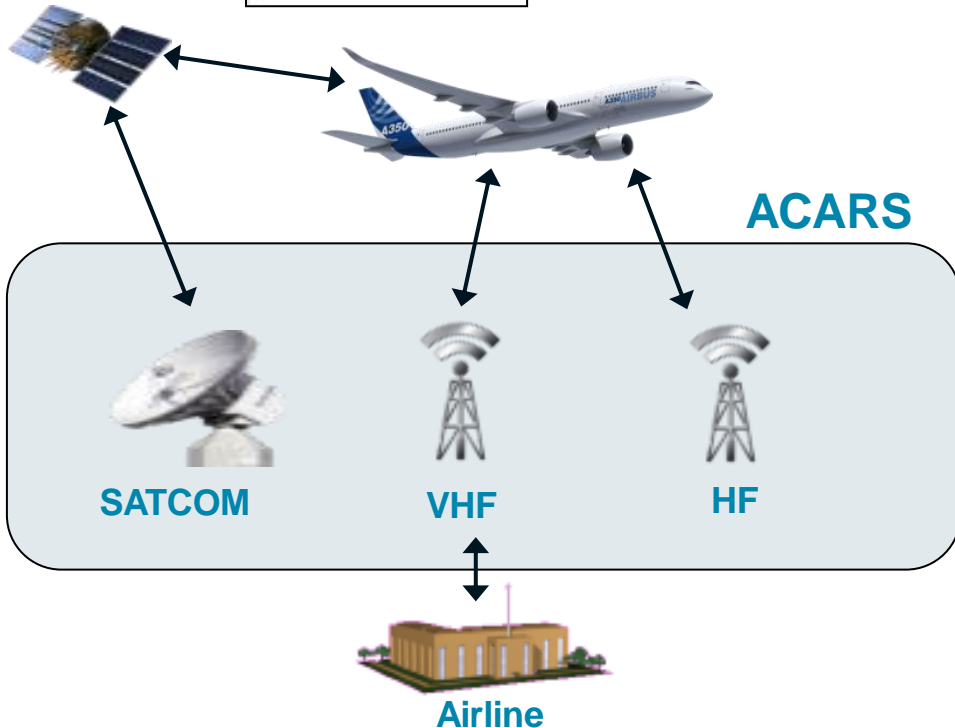
Communication systems <i>Geographical Coverage</i>			
VHF Datalink <i>Continental areas</i>	Basic	Basic	Basic
SATCOM Inmarsat <i>Worldwide except polar area</i>	Option	Basic	Basic
SATCOM Iridium <i>Worldwide</i>	Option	Option	Not yet available
HF Datalink <i>Worldwide</i>	Option	Basic	Basic
ADS-B out Continental areas and soon Worldwide	Basic	Basic	Basic

Note: Operators will need to make sure that the A/C are equipped with the proper Datalink communication means (VDL / Satcom / HF DL) with regards to their operated routes and that coverage is ensured for these routes.

Airbus way forward for implementing Aircraft Tracking function

AOC Application Airline Operational Control

Rockwell
Collins



- Airbus recommendation for A320/ A330 /A350/ A380: A/C tracking solution based on **existing** AOC datalink applications (ACARS network) and **without any additional flight crew action**
- Partnership was established between Airbus and AOC suppliers, in order to provide generic solution for normal and abnormal tracking conditions through **AOC customized database**
 - Activation/Deactivation of abnormal tracking will be done **automatically** through the monitoring of specific sets of A/C parameters that will trigger the emission of the A/C information at least every 1mn. Ground Airline center will also be able to activate abnormal mode **upon uplink request** if necessary.

Supported by existing technologies

Fast and simple solutions available in most of Airbus fleet
Already implemented by some Airlines

Reference
ISI 23.21.00007

Aircraft Tracking – Other solutions

Other existing technologies installed by Supplemental Type Certification (STC).

A wide variety of Standalone solutions using various Satcom constellations are available on the market.

spidertracks

SKYTRAC

Panasonic

FlightAware

Globalstar

N-TRACKING

NAVBLUE
AN AIRBUS COMPANY

Aireon

Blue Sky Network

Rockwell Collins

FLYHT
INSIGHT • ACTION • CONTROL

LATITUDE
Optimize every flight.

inmarsat
The mobile satellite company

Smart GADSS™

Thompson Aerospace

SITAONAIR

SATAUTH

Implementation aspects

Airbus Aircraft Tracking solution is used by a first set of customers.

As a first general feedback, the need for Airlines to check every 15 minutes « the good » reception of A/C routine tracking messages may highlight some communication delays .

Note: Transmission rate in normal mode can be modified to answer to some regulations or to anticipate some delays in ACARS network depending on Aircraft routes

Cost Aspects;

Costs of communication will depend on contracts that Airlines have negotiated with their Service Providers (Fees, Volume, Package...) .

Based on a 10 hours long range flight , the following amount of data is expected :

Routine / normal mode:	3ko
Abnormal mode:	40ko

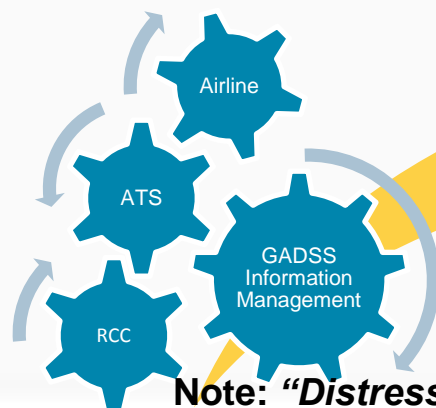
Global Aeronautical Distress Safety System

ADT

• Autonomous Distress Tracking

- Provides automatic A/C position at least once every minute
- Must be active prior to accident event
- Location of an accident site within 6 NM
- Operates autonomously of aircraft power
- Results in Distress signal to appropriate SAR FIR
- May be manually activated
- Cannot be isolated

Only protected aeronautical safety spectrum, or protected distress spectrum (e.g., 406.1 MHz), can be used

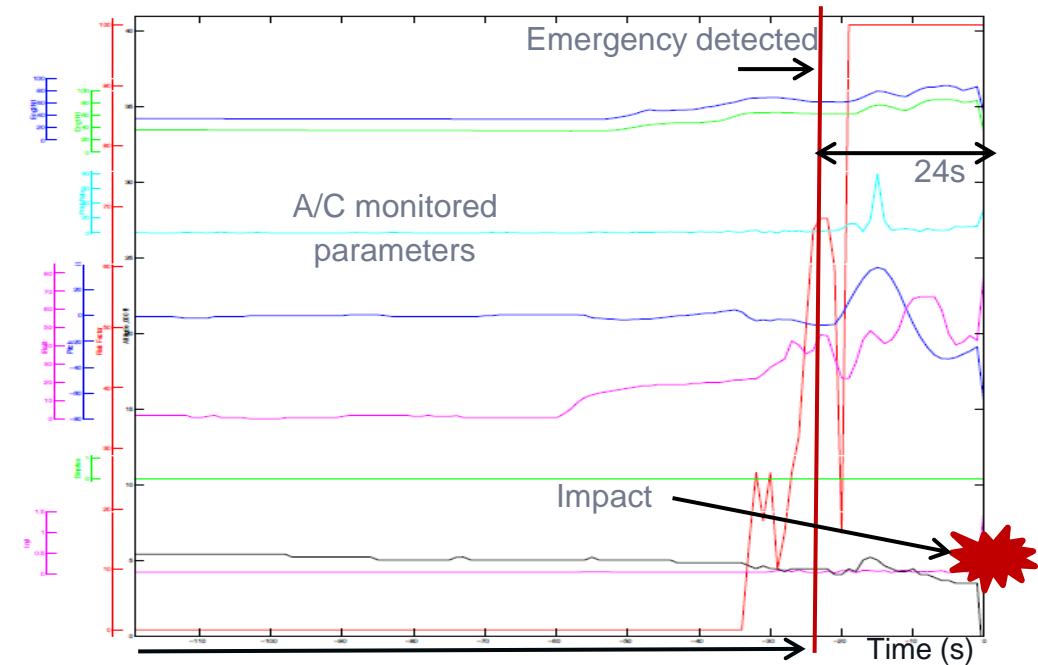
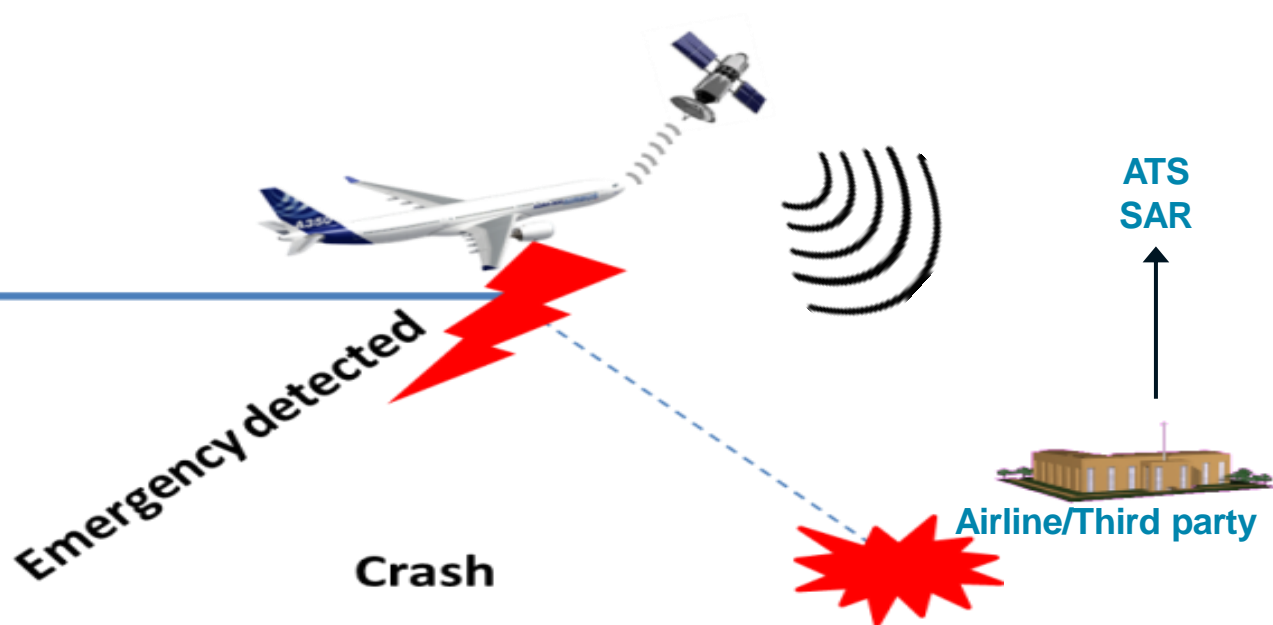


Note: *“Distress is a situation which, if left uncorrected, is likely to result in an accident”.*

ADT -Autonomous Distress Tracking

Need new equipment on board like ELT 2nd Generation (pre-crash triggered)

- Location of an accident site within a 6 NM radius,
- Automatic transmission of 3D position +ID at a rate of 1 minute
- First burst no later than 5 seconds
- Distress will only be able to be de-activated using the same mechanism that activated it
- Standalone powered and autonomous controlled
- Could be remotely activated



Triggers for Distress Tracking are defined by EUROCAE MASPS ED-237



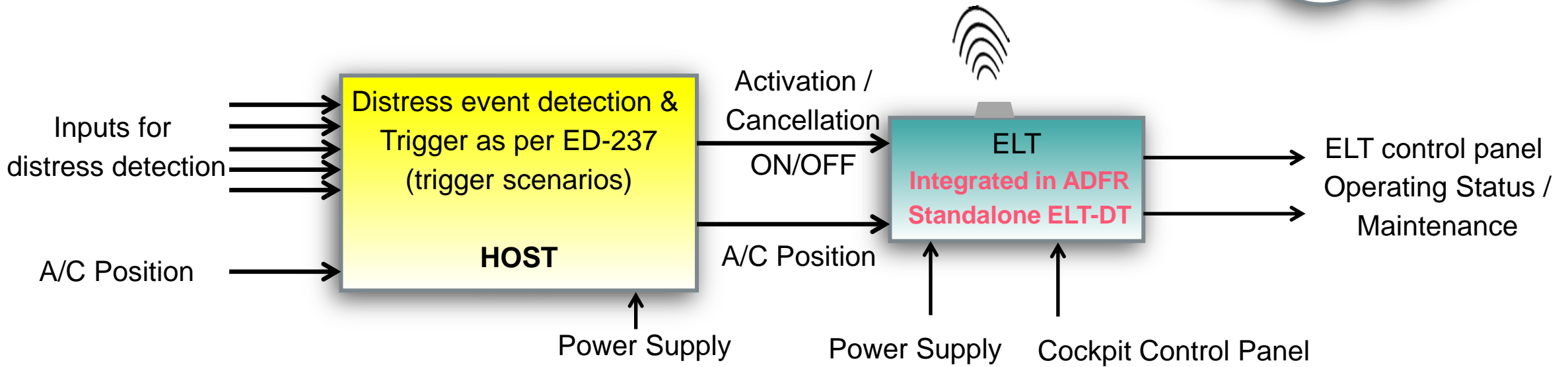
Scenario	Criteria
Unusual A/C attitude	Pitch excessive Roll excessive Pitch rate excessive Roll rate excessive Pitch marginal and Pitch rate marginal Roll marginal and Roll rate marginal
Unusual Lateral acceleration	Lateral acceleration excessive
Unusal speed/energy	Vertical speed excessive with 5s confirmation time STALL warning with 3s confirmation time
Unusal energy	Eng1N1 or Eng2N1 is high AND pitch is marginal negative with 5s confirmation time Eng1N1 and Eng2N1 is low AND pitch is marginal positive with 5s confirmation time
Collision with terrain	Radio altitude and Vertical speed in the Mode1 Pull-up envelope with 3s confirmation time
Total loss of Engine thrust	Eng1N1 and Eng2N1 failed with 5s confirmation time
Excessive cabin altitude in combination with no descent	Excessive Cabin Altitude warning and Vz>-3000 fpm with 30s confirmation time

Nuisance alerts to SAR should not exceed more than 2 per 100 000 Flight Hours

ELT Distress Tracking principle (pre-crash triggered)



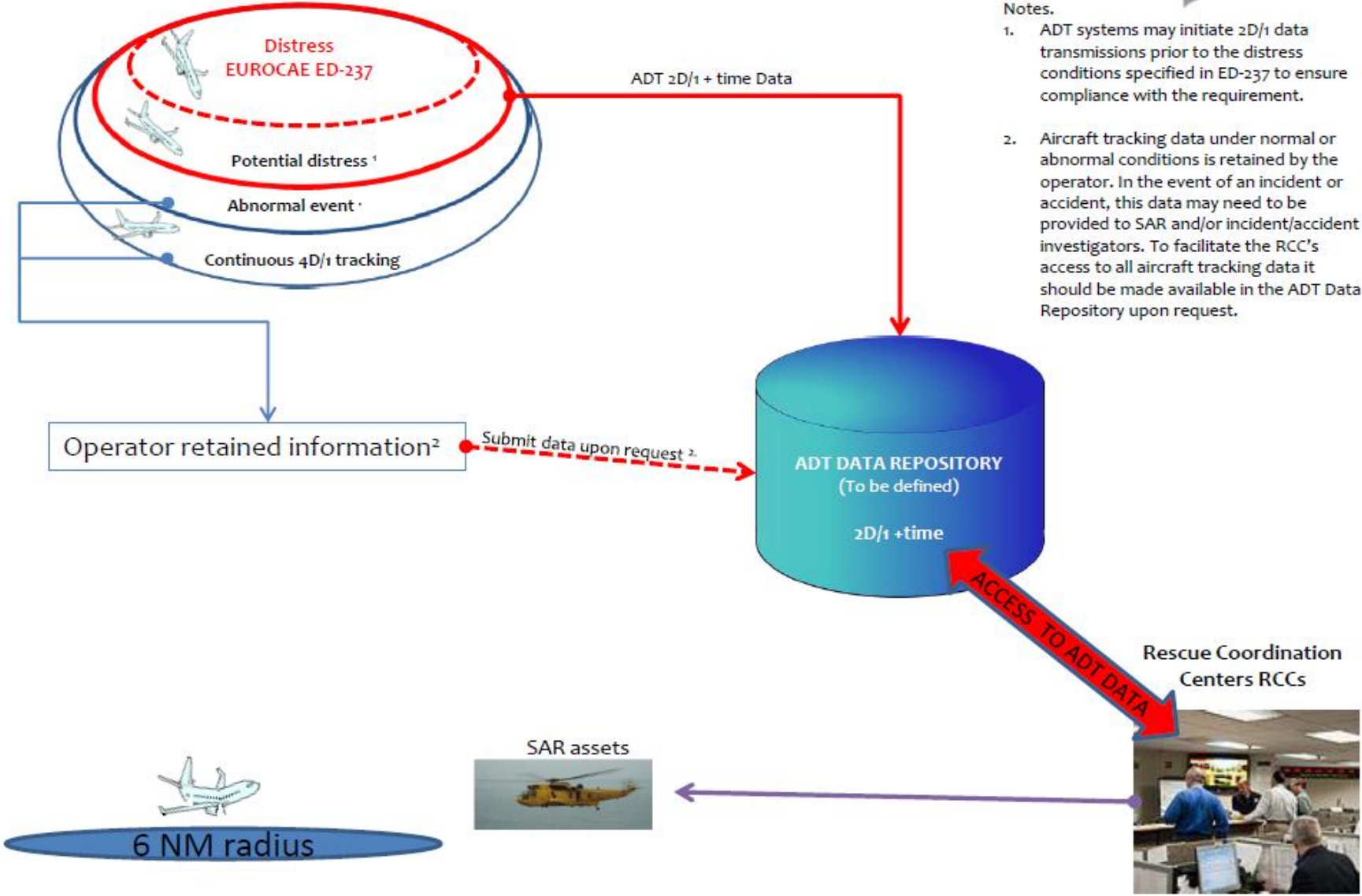
ELT includes internal GNSS receiver and Battery!



ADT –GADSS information sharing and processes for Notification of Distress Condition

ADT DATA RETENTION LOCATION AND ACCESS

Work in Progress



Notes.

1. ADT systems may initiate 2D/1 data transmissions prior to the distress conditions specified in ED-237 to ensure compliance with the requirement.
2. Aircraft tracking data under normal or abnormal conditions is retained by the operator. In the event of an incident or accident, this data may need to be provided to SAR and/or incident/accident investigators. To facilitate the RCC's access to all aircraft tracking data it should be made available in the ADT Data Repository upon request.

**GADSS
Extract**

ADT- Autonomous Distress Tracking

2nd Generation ELT- Main new features

- GPS position information **embedded** in distress signal
- Use of new COSPAS-SARSAT -MEOSAR constellation based on payloads on GPS, Glonass and Galileo satellites
- 100% worldwide coverage reached
 - **first burst will be spotted by satellite anywhere in the world, at any time**
- Potential Return Link Service
- Availability expected 2018-20



GPS / USA

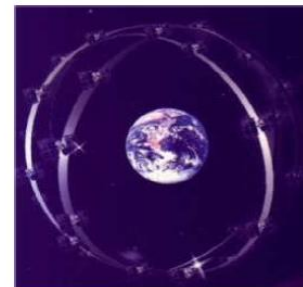


20 → 28 (≈Early 2020s)

Galileo / Europe

10 → 16 (YE 2016)
→ 28 (YE 2019)

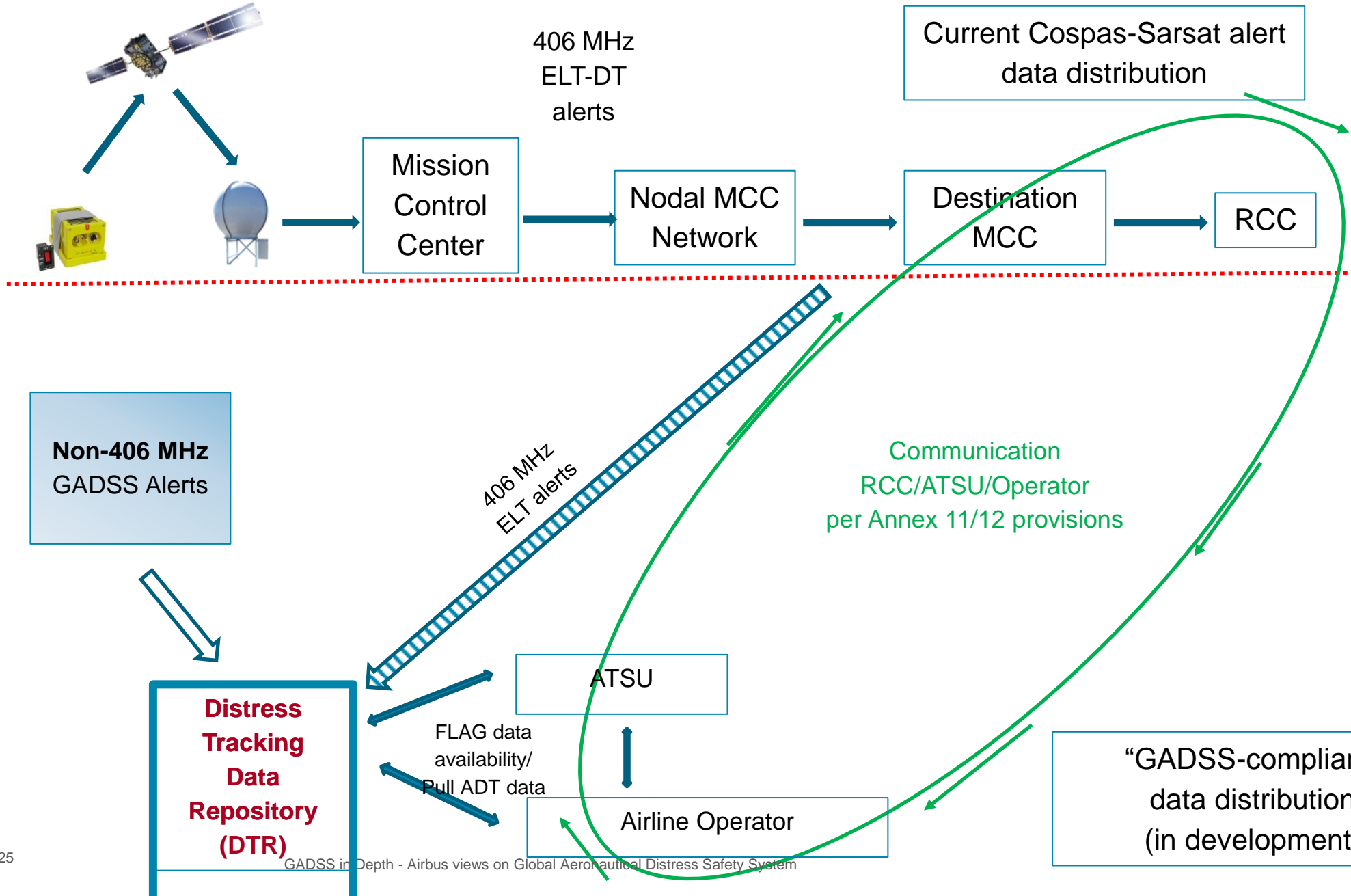
Glonass / Russia



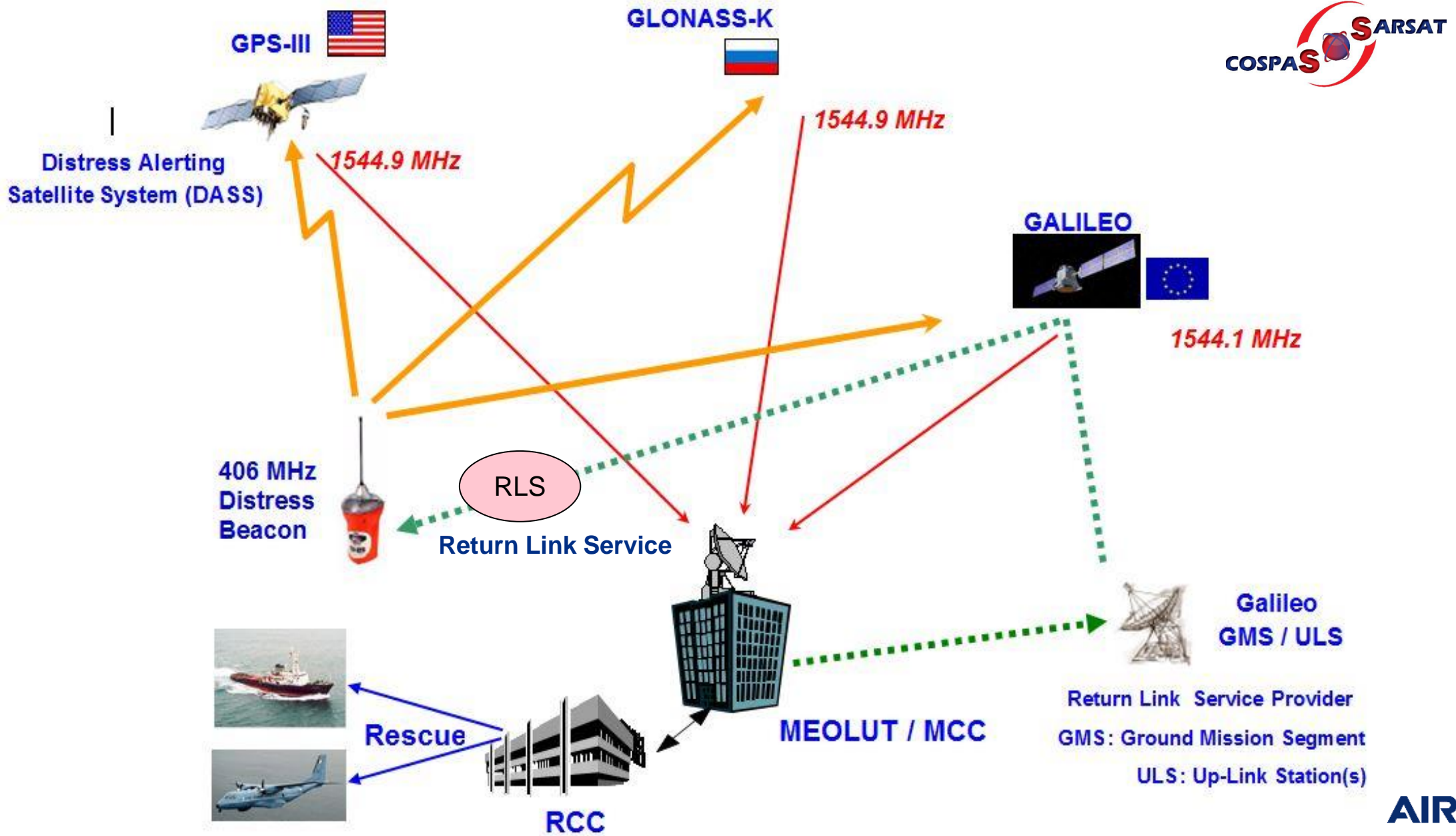
1 → 8 (YE 2020)



“GADSS-compliant” Data Distribution



Typical MEOSAR System- Configuration with RLS



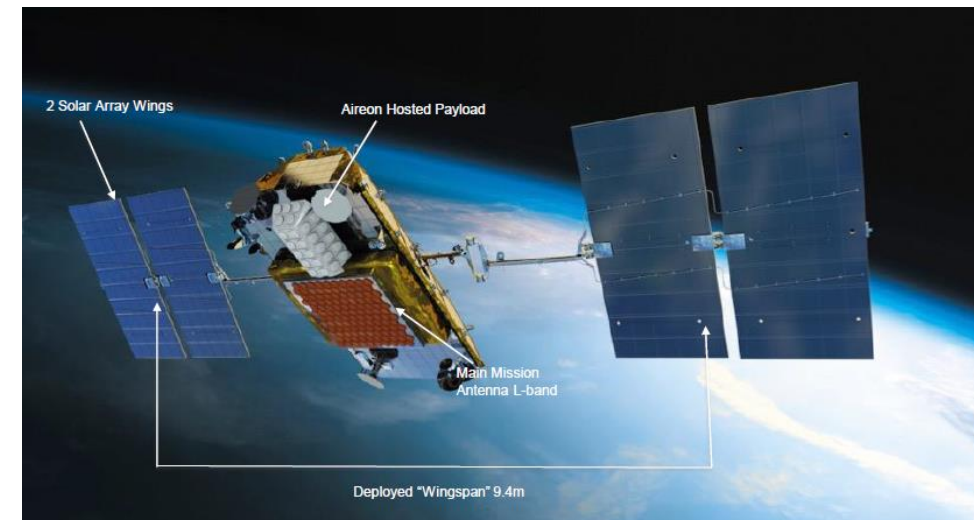
Space ADS-B based on Iridium Next constellation

- Satellites in orbit: 66
 - 11 satellites per plane
 - Plus 9 in-orbit spare satellites
 - 6 ground spare satellites
- Orbital Planes: 6
- Availability: ≥ 0.999
- Typical Lifecycle: 14 years
- Operational altitude: At only 476 miles (780 km) from the Earth

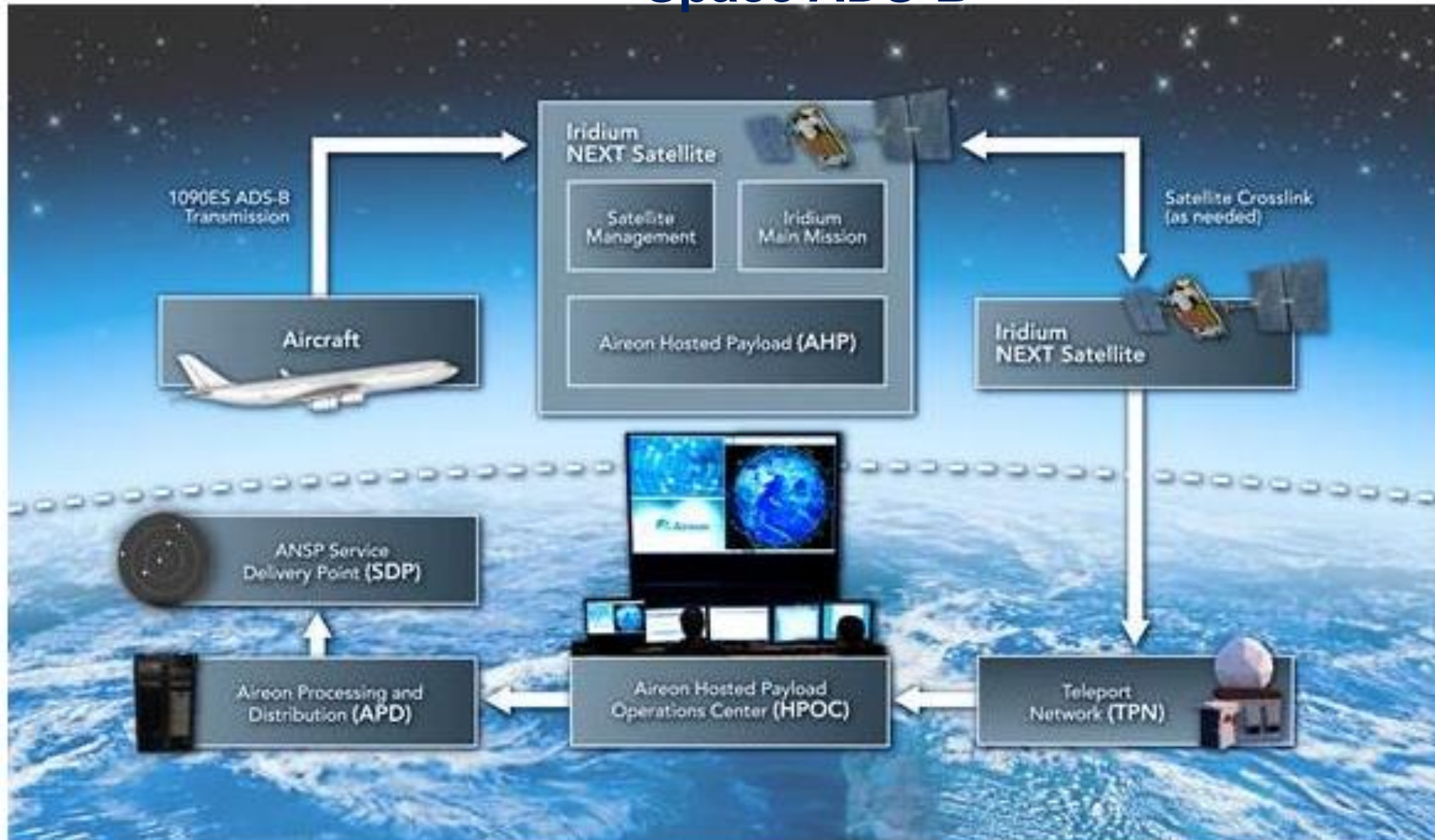


Further the last rocket launch during July 2018, 65 satellites are currently in orbit.

Intention to launch 10 additional satellites during 2018 thus completing the constellation (including Spare ones)



Autonomous Distress Tracking (ADT) - Example of other proposed solutions: Space ADS-B



Aireon ALERT solution will provide GPS location and real-time tracking data to assist rescue coordination centers in emergency situations.

Standardization of Autonomous Distress Tracking (ADT)



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 proposed to launch a standardization activity through ARINC.

The work is structured in 3 main phases:

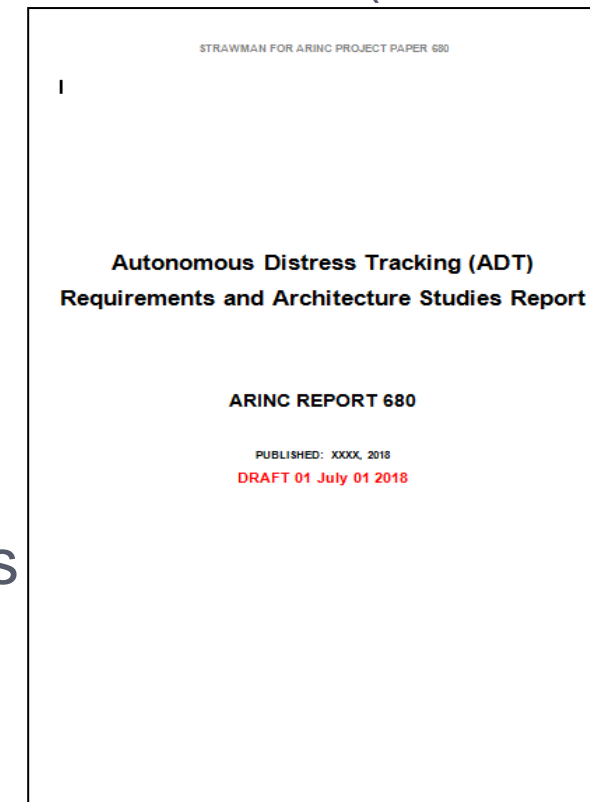
- Definition of requirements and main functional block diagrams (**ARINC Report 680 available**)
- Proposition of candidate architectures (**ARINC Report 680 available**) .
- Develop detailed equipment, interfaces, and aircraft installation requirements, for selected architecture(s). Define accordingly new ARINC or updated Characteristics.

Global Aircraft Tracking Working Group at full speed...

>>> Completed work expected Jan 2019

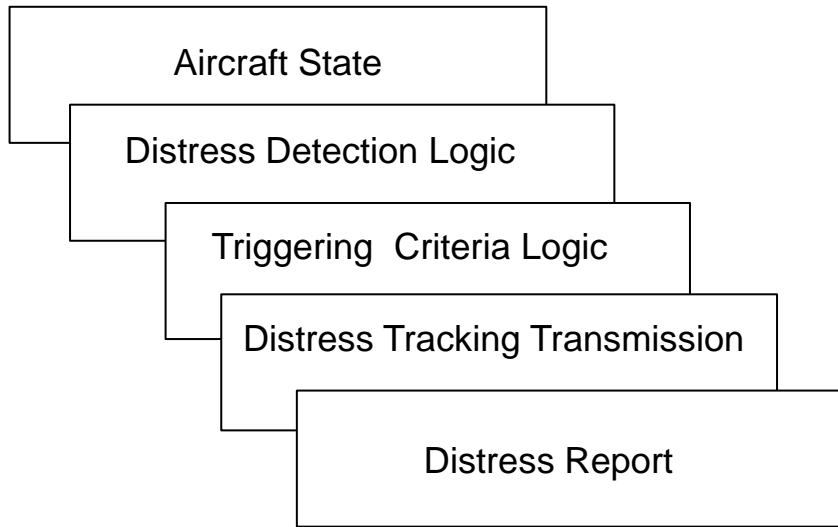
Outcome of AEEC GAT group, scope of ADT

- Phase 1: Initial Requirements - Complete
 - Phase 2: Architecture Teams developing proposed 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 stand alone solution)...
- Good support from industry: Airlines, Suppliers, Airframers, Service providers, and government agencies

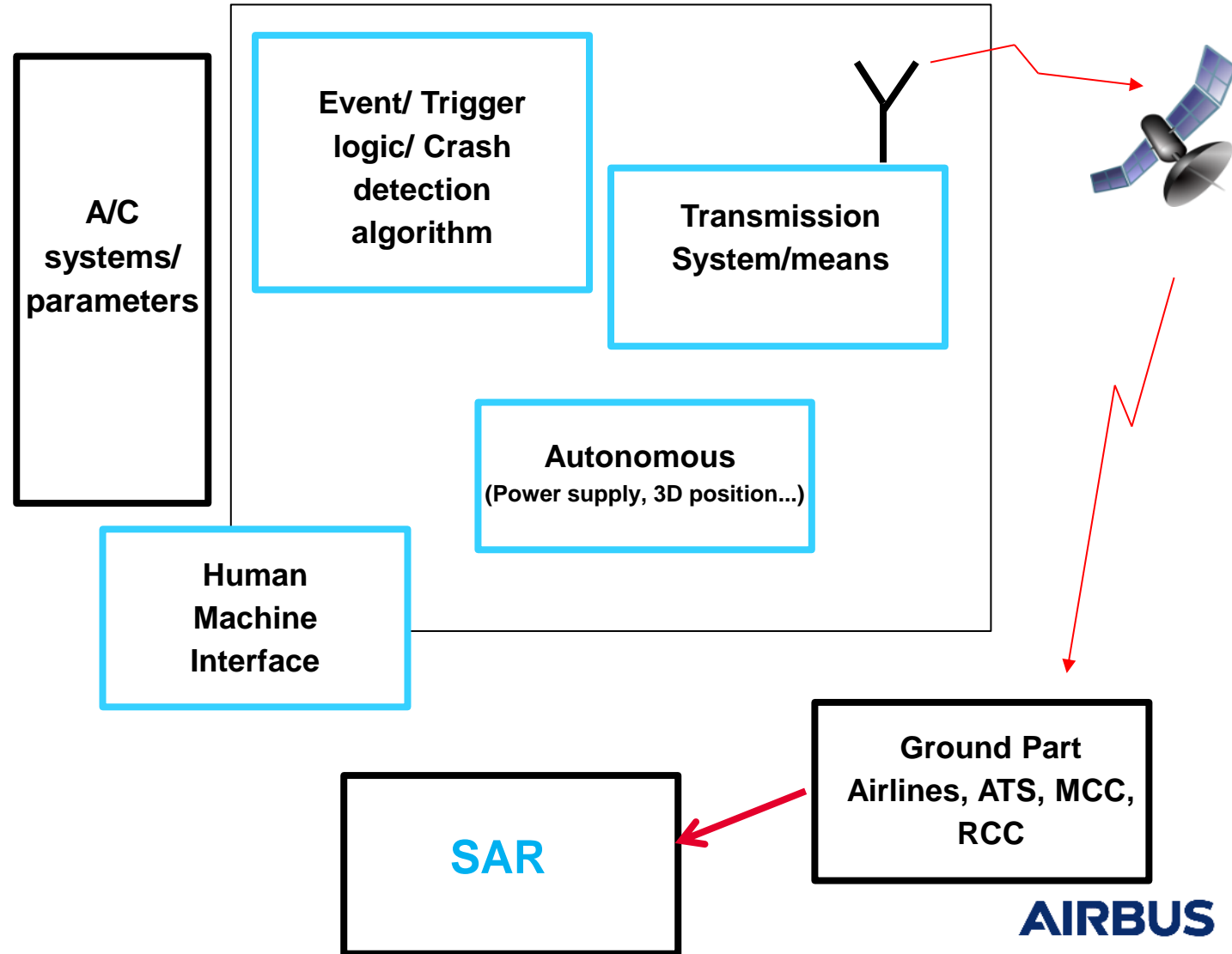


Outcome of AEEC GAT group, scope of ADT

Main ADT Function Blocks



Typical ADT Block Diagram architecture whatever Com means



Post Flight Localization and Recovery :

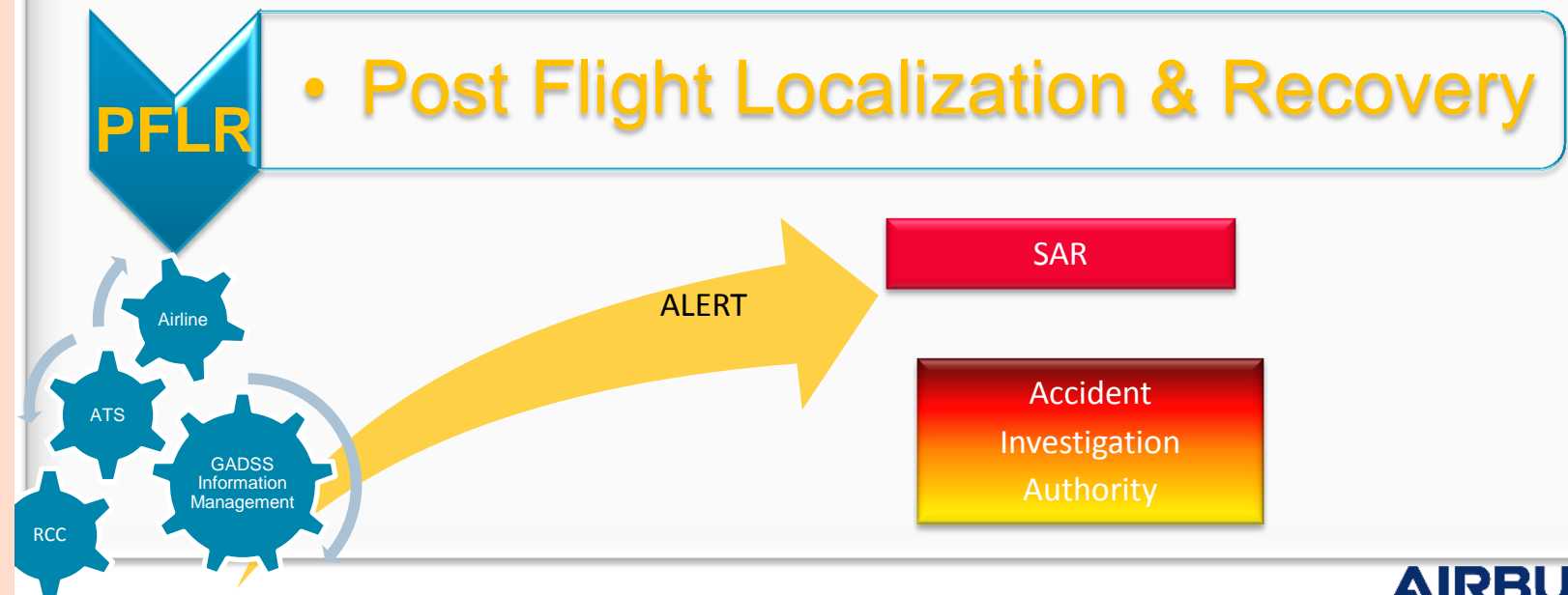
- **localization systems:** only protected aeronautical safety spectrum, or protected distress spectrum (e.g., 406.1 MHz), can be used
- **flight recorder data recovery system:** Use of any type of spectrum properly allocated, [on a primary basis], for the function being performed

To be confirmed according to ITU and ICAO on going discussions

Global Aeronautical Distress Safety System

Performance Based Solutions

- Make it available in a timely manner
- approved by the State of the Operator
 - Data Streaming
 - Ensures a minimum dataset of CVR and DFDR information
 - ADFR (Automatic Deployable Flight Recorder)
 - Floatable
 - Contains ELT to aid location



PFLR: Deployable Combined Recorder with integrated ELT

1. Sensors detect the start of a crash



2. ADFR immediately initiates the Emergency Locator Transmitter (ELT) and then releases from aircraft



3. ELT transmits aircraft ID and country of origin as well as Aircraft location via COSPAS-SARSAT satellites to SAR authorities.



4. Deployable lands safely and floats on water ensuring quick recovery.



5. ELT in the deployable recorder continues to update its position using its embedded GNSS receiver. It acts also as homing device for rescue crews..



6. SAR personnel recover survivors and Deployable Recorder to enable quickly data accident analysis



Source: DRS

Airbus Official Announcement

On June 21st 2017, during Paris Air Show, AIRBUS announced a new Recording System architecture

This new architecture is composed of:

- A combined Cockpit Voice and Data Recorder (CVDR)
- An Automatic Deployable Flight Recorder (ADFR)
- A Recorder Interface Unit (RIU)



PFLR: Deployable Combined Recorder with integrated ELT

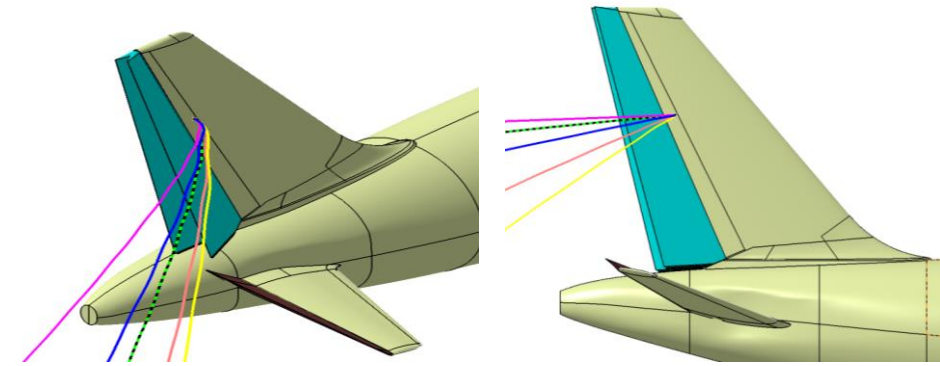
**Airbus plan: Forward-fit application of ADFR (Automatic Deployable Flight Recorder) on all long range operations aircraft:
A380, A350, A330, and A321LR**



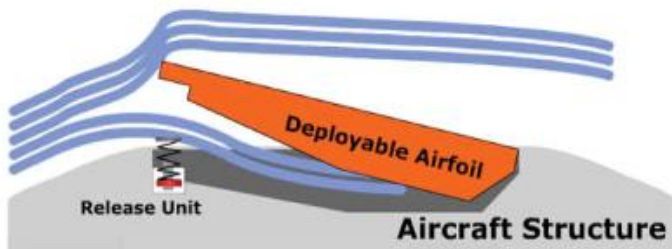
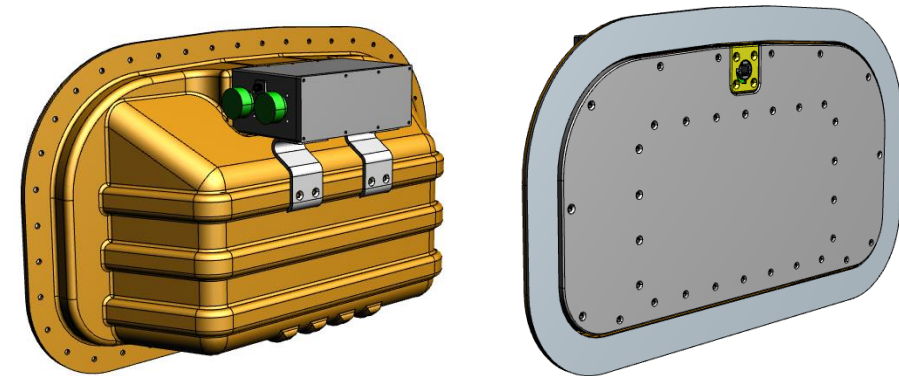
PFLR: Deployable Combined Recorder with ELT

Technology:

- Dual Combination Recording System with:
 - ADFR with integrated ELT/ADT installed in Vertical Fin
 - Crash detection circuits (significant structural deformation or water submersion)
 - CVDR installed in Avionics Bay
 - 25 hours recording
 - Common system across Airbus fleet A350, A380, A330, A321 LR
- **Entry Into Service expected before mandate date**



Ejection principle



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

PFLR: Deployable Combined Recorder with ELT



Deployable Beacon Airfoil Unit (BAU):

- Crash Survivable Memory Module
- ELT/ADT Transmitter
- GNSS Receiver
- Antenna (Combined ELT and GNSS)
- Battery Pack



BAU Tray:

- Mounts conformal to aircraft skin
- No aerodynamic impact
- Holds BAU securely on Aircraft
- Provides mounting points for Recorder Release Unit, Hydrostatic Switch(s)

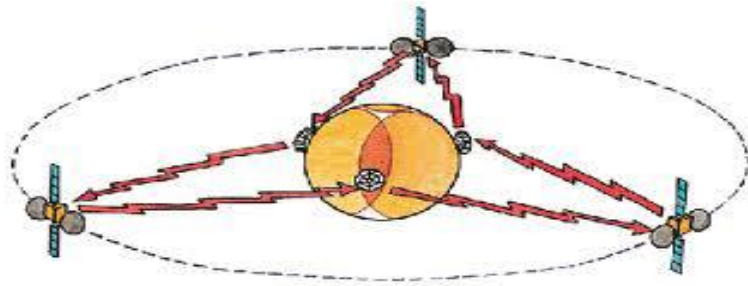
PFLR: Deployable Combined Recorder Architecture

Main Architecture/ locations



Dual combination recording with ADFR and CVDR

PFLR: Flight Data Streaming

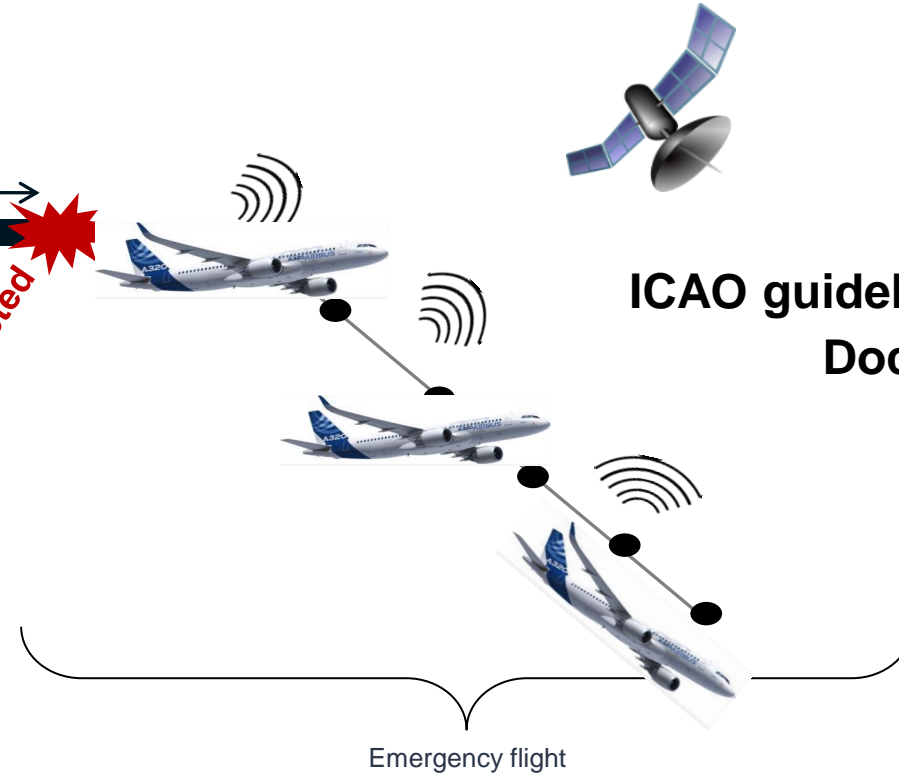


SATCOM GSO or LEO coverages
(L / Ku / Ka bands...)



← Buffer →

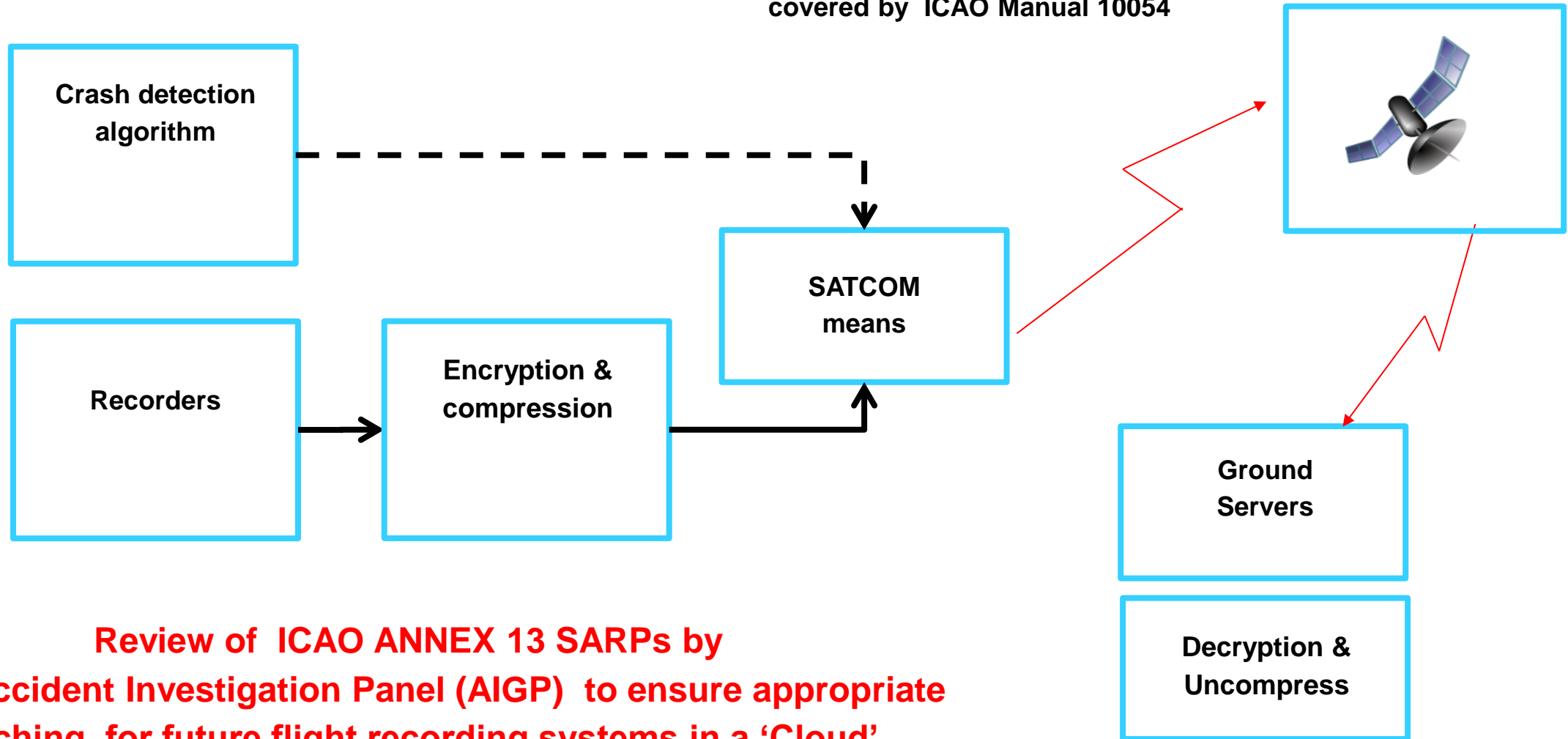
Emergency detected



ICAO guidelines defined by
Doc 10054

PFLR: Flight Data Streaming -Functional description

Performances & Requirements covered by ICAO Manual 10054



Review of ICAO ANNEX 13 SARPs by ICAO Accident Investigation Panel (AIGP) to ensure appropriate matching for future flight recording systems in a 'Cloud' environment

Standardization of Timely Recovery of Flight Data (TRFD)



In order to specifically address expected, forthcoming PLFR mandate in the most effective way (accounting for system complexity, cost, schedule, risk, etc.), the aviation industry proposed to launch a standardization activity through ARINC.

The APIM propose to structure the work 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

Standardization of Timely Recovery of Flight Data (TRFD)



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

- Automatic Deployable Flight Recorder (ADFR) - a combination 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 Sept 2020

ECC Spectrum aspects

PRELIMINARY CEPT POSITION (Issued from last PT-C April 2018)



CEPT is of the view

that systems contributing to the GADSS shall operate in accordance with ICAO requirements or recommendations contained in SARPs, manuals or guidance material;

that any changes to the Radio Regulations should be determined on the basis of the GADSS concept developed by ICAO;

that systems identified to contribute to the GADSS do not require any change to Article 5 of the Radio Regulations;

[that the list of the frequency bands and systems used by GADSS and also their technical and operational characteristics and operational parameters should be included in the corresponding ITU-R Recommendations.]

that additional regulatory actions for the introduction and use of GADSS should not place any additional constraints on the existing and planned systems.

ITU RR aspects (1/2)

Regulatory provisions

In accordance with *invites* 2 of ITU-R Resolution 426 (WRC-15), the following regulatory areas have been reviewed in order to determine if regulatory provisions were necessary to facilitate the introduction and use of GADSS.

Chapter VII - Distress and Safety Communications

Two methods are currently defined to satisfy the AI

Method A:

The modifications of RR proposed under Method A specify:

- that the details of the GADSS elements are contained in Annexes to the ICAO Convention;
- that the type of radiocommunication service used depends on the requirements of the specific GADSS function,
- that operation of GADSS elements under RR No. 4.4 is precluded.

ITU RR aspects (2/2)

Method B:

The modifications of the RR proposed under Method B specify:

- that the details of the GADSS elements are contained in Annexes to the ICAO Convention;
- that GADSS shall only operate using primary service allocations;
- that the GADSS must operate in accordance with the terms of the new Resolution [A110-GADSS] (WRC-19), resolving:
 - that systems composing the GADSS shall only operate in frequency bands that have already been provided for safety purposes;
 - that ITU-R shall develop ITU-R Recommendations detailing the system elements of the GADSS including their operating frequency bands and technical characteristics;that if constituent elements of GADSS are changed, those changes should be reflected in the relevant ITU-R Recommendation

GADSS Spectrum summary

GADSS ConOps table shows which types of frequency bands considered for the various categories of functions specified under the GADSS.

Function	Spectrum Category
Aircraft Tracking system	A
ATC Surveillance systems	B
Distress Tracking systems	C
Post Flight Localization and Recovery – <u>Localization systems</u>	C
Post Flight Localization and Recovery - <u>Flight Recorder Data Recovery system</u>	A

A: any type of spectrum properly allocated, on a primary basis, for the function being performed.

B: only protected aeronautical safety spectrum can be used.

C: only protected aeronautical safety spectrum, or protected distress spectrum (e.g. 406.1 MHz), can be used.

*This chart is not intended to imply that any new spectrum allocations are necessary to support GADSS.

Underwater Locator Devices

- Aircraft are equipped with flight recorders with Underwater Locator Beacons (ULBs) attached. The detectable acoustic range of the currently used Flight Recorder ULBs is limited due to the transmit frequency of **37.5 kHz**. Duration time has been increased to 90 days (from 30 days) .



ULB attached on CVR / DFDR

**Airbus plan: already installed
basically on all Airbus programs
Service Bulletins available for retrofit**

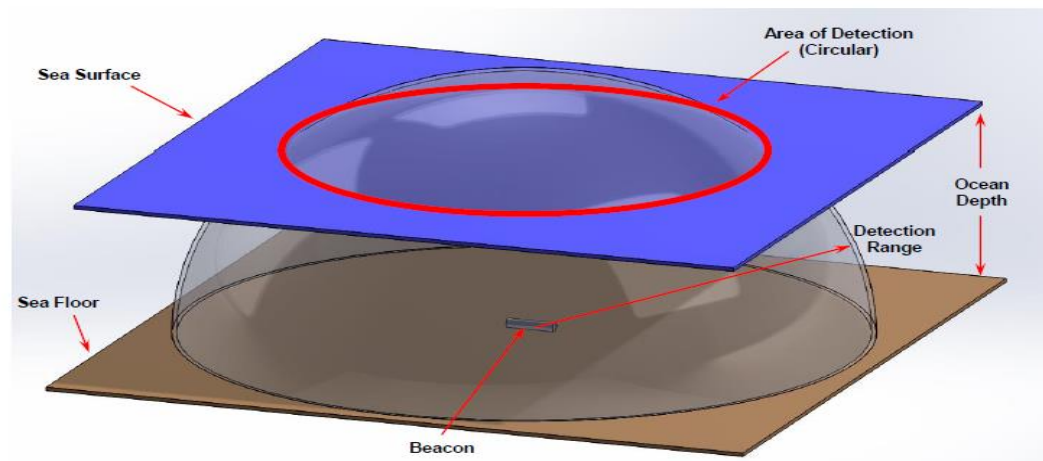
- 90 days Low Frequency ULB “Underwater Locating Beacons ” (8,8Khz) attached to the aircraft for long-range over-water flights

Transmission range is increased by a factor 4 using lower frequency.

ULB Type	Frequency	Transmission Range
Conventional ULB	37,5 kHz	5km (~2,5NM)
LF-ULB	8,8 kHz	22km (~12NM)

Underwater Locator Devices-Low Frequency Underwater Locator Beacons (LF-ULB)

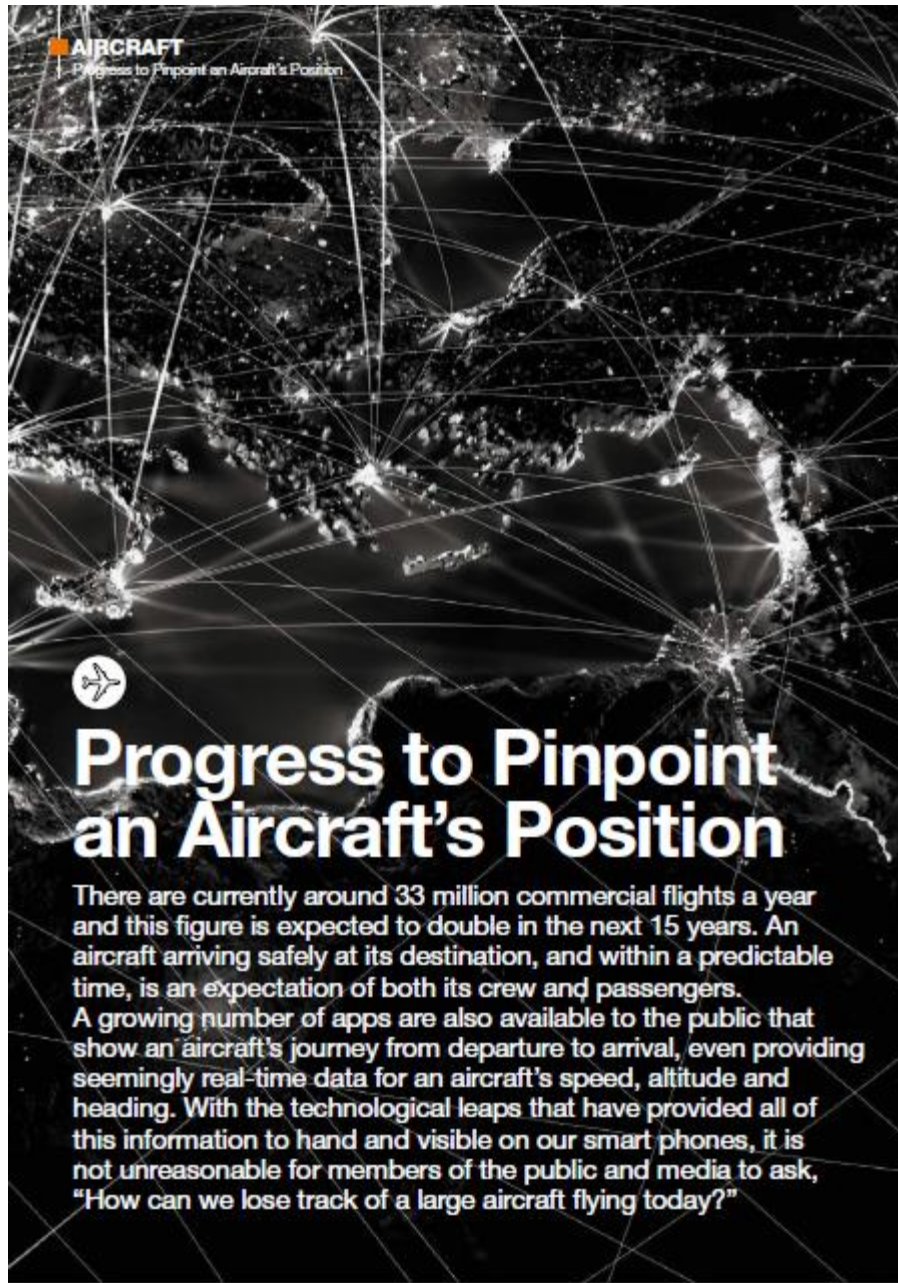
- Compliance with ARINC 677 specification to harmonize the LF-ULB footprint to aircraft interface
- Guidance manual published by EASA in December 2015:
 - Define the installation position on the fuselage (Attached to the aircraft structure)
 - Define the applicable means for fixation (aircraft bracket)
 - (E)TSO c200a qualification
 - Retrofitability (zone not modified after A/C Type Certification)



*Independent LF-ULB
on A/C structure*

**Airbus plan: Forward-fit application on all Airbus programs :
A380, A350, A330, and A320 families
Service Bulletins available for retrofit**

**Lot of Working Groups
are active, Airbus is
involved in majority of
them...**



Aircraft Tracking article in Safety First Airbus Magazine

Claude PICHAVANT
Senior Expert Communications & Surveillance
Manage Flight Systems

Geraldine VALLEE
Director of Flight Safety
Safety Enhancement

Article available on demand



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

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

CAAS : Civil Aviation Authority of Singapore

CEPT: Conférence Européenne des administrations des Postes et Télécommunications

CONOPS: CONcept of OPerationS

CVR: Cockpit Voice Recorder

CVDR: Cockpit Voice Data Recorder

DAR: Digital Access Recorder

DB: Data Base

DFDR: Digital Flight Data Recorder

DLK: Data Link

DSP: Datalink Service Provider

EASA: European Aviation Safety Agency

ELT: Emergency Locator Transmitter

EU: European Union

FAA: Federal Aviation Administration

FANS: Future Air Navigation System

FDR: Flight Data Recorder

FDS: Flight Data Streaming

FMS: Flight Management System

GADSS : Global Aeronautical Distress and Safety System

GEO: Geostationary Earth Orbit

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

ID: Ident

IP: Internet Protocol

ITU: International Telecommunication Union

LEO: Low Earth Orbit

MASPS: Minimum Aviation System Performance Specification

MCC :Mission Control Center

NAA: National Aviation Authorities

NATII: Normal Aircraft Tracking Implementation Initiative

NM: Nautical Miles

Glossary

OCC = Operational Control Center

OEM: Original Equipment Manufacturer

OPS: Operations

PFLR: Post Flight Localization & Recovery

QoS: Quality of Service

RCC: Rescue Coordination Center

RLS : Return Link Service

RTCA: Radio Technical Commission for Aeronautics

SAI : System Architectures and Interfaces

SAR: Search And Rescue

SARPs: Standards And Recommended Practices

SSCVR: Solid State Cockpit Voice Recorder

STC: Supplemental Type Certification

TRFD: Timely Recovery of Flight Data

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

Thank you

A350 XWB Sticker applied on VTP

