ARINC Airline Electronic Engineering Committee (AEEC)

Systems Architecture and Interfaces (SAI) Subcommittee

February 15
Coral Gables Florida

Proposed APIM 17-004, Autonomous Distress Tracker (ADT) and APIM 17-005 - Timely Recovery of Flight Data (TRFD) working session

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Agenda

1) Introductions

2) EUROCAE WG-98 / RTCA SC-229, Aircraft Emergency Locator Transmitters (ELTs) (BEA France, ACR Electronics, others)(10:30 EST)

3) Implementation of Phase 1 of ADT Standards Development (Boeing)

   A. Proposed APIMs Review and Discussion

       i.   APIM 17-004 - Autonomous Distress Tracking

       ii.   APIM 17-005 - Timely Recovery of Flight Data

   B. ADT Requirements Phase Discussion

   C. ADT Requirements Overview and Discussion

4) Concluding Discussions

Implementation of Phase 1 of ADT Standards Development

Proposed APIMs Review

International Civil Aviation Organization (ICAO Global Aeronautical Distress and Safety System (GADSS)

- *Normal Operations* - multiple means to meet normal tracking (over multiple datalinks)
  - ACARS Position Reports
  - ADS-C Reports (to AOC or ATS)

APIM 17-004 Autonomous Distress Tracker

APIM 17-005 Timely Recovery of Flight Data

Aircraft Tracking Normal Operations

- Possible Subset of ATS Surveillance
- Used for Airline Operational Functions
- Controllable by Flight Crew
- Multiple Solutions
- **Optional** Aircraft Tracking Abnormal Operations
  - Triggered by abnormal events
  - Provides higher rate flight location data

Low Frequency Underwater Locator Device (LF-ULD)

- New LRU
- Objective is to recover recorders quickly from oversea accidents by locating the underwater wreckage site faster
- Operates at 8.8 kHz
- Signal Range > 12NM

Autonomous Distress Tracking (ADT)

- A Distress Signal
- Auto Triggered by very specific events
- Should not be manually deactivated
- Should not be isolated

Timely Recovery of Flight Data

- Requirements at early stage of development
- Operational Approval Required
- Multiple Possible Options:
  - Automatically deployable flight data recorder (ADFR)
    - Automatically deployed
    - Floatable
    - Contains ELT to aid location
  - Flight Data Streaming (FDS)
    - Performance Based
    - TBD CVR/FDR dataset

ICAO GADSS Requirements Overview

Annex 6 modification for Distress Tracking and ELT requirement
ICAO Council approved SARPs March, 2016

Function	ICAO Applicability	Requirements	Notes
Normal Tracking	Nov 2018	Uses current connectivity Position reports every 15 minutes Optional abnormal event tracking capability	• Several States have introduced new requirements (e.g. India 2014, Malaysia 2015, CAAC, CAAS in 2016) • EASA 2018 applicability
Low Frequency Underwater Locator Device (LF-ULD)	2018 forward fit and retrofit	Attaches to airframe, 8.8 kHz Acoustic Beacon with 12 Nm propagation range	• Multiple Asia-Pacific Regulators have mandated for 2018 • EASA 2019 mandate has largest airline impact. • For most regulators there is no alternate means of compliance
(APIM 17-004) Autonomous Distress Tracking (ADT)	2021 forward fit	Position reports once per minute, within 6NM of crash location, independent of aircraft power, not isolatable, can be remotely activated.	• No state has adopted requirements. • Multiple potential technical solutions
(APIM 17-005) Timely Recovery of Flight Data	2021 new type designs	In work performance based requirements, TBD duration, assurance, TBD set of FDR and CVR data	• Primary options are flight data streaming or deployable flight data recorder

Draft APIMs

APIM 17-004 Autonomous Distress Tracker

Activity	Mtgs	Mtg-Days (Total)	Expected Start Date	Expected Completion Date
Phase 1: Document the end-to-end system requirements	One 2-day meeting plus teleconferences	2	May 2017*	July 2017
Phase 2: Develop candidate architectures, and select architecture(s)	Three 3-day meetings plus teleconferences	9	August 2017	Feb. 2018
Phase 3: Develop detailed equipment, interface, and aircraft installation requirements, as well as ground system requirements	Three 3 day meetings plus teleconferences	9	March 2018	Jan. 2019**

* The start date of Phase 1 (May 2017) is contingent on completion of the ICAO GADSS ConOps (and other associated documents).

** The completion date of Phase 3 (Jan. 2019) is driven by a Jan. 1, 2021 (individual Certificate of Airworthiness) forward-fit mandate (ref. ICAO Annex 6, Part I, §6.18.1). 24 months is considered the minimum time needed for system development.

Microsoft Word Document

APIM 17-005 Timely Recovery of Flight Data

| Activity	Mtgs	Mtg-Days (Total)	Expected Start Date	Expected Completion Date
Phase 1: Document the end-to-end system requirements	One 2-day meeting plus teleconferences	2	June 2018*	Dec. 2018
Phase 2: Develop candidate architectures, and select architecture(s)	Three 3-day meetings plus teleconferences	9	Jan. 2019***	Dec. 2019
Phase 3: Develop detailed equipment, interface, and aircraft installation requirements, as well as ground system requirements	Three 3 day meetings plus teleconferences	9	Jan. 2020	Sept 2020**

* The start date of Phase 1 is contingent on completion of ICAO Document(s).

** The completion date of Phase 3 is driven by a Jan. 1, 2021 application for type certification date for new aircraft type designs (ref. ICAO Annex 6, Part I, §6.3.5.1).

*** The start date of Phase 2 is to allow resources/budget to be allocated to the Autonomous Distress Tracking (ADT) development effort which has an earlier potential mandate date.
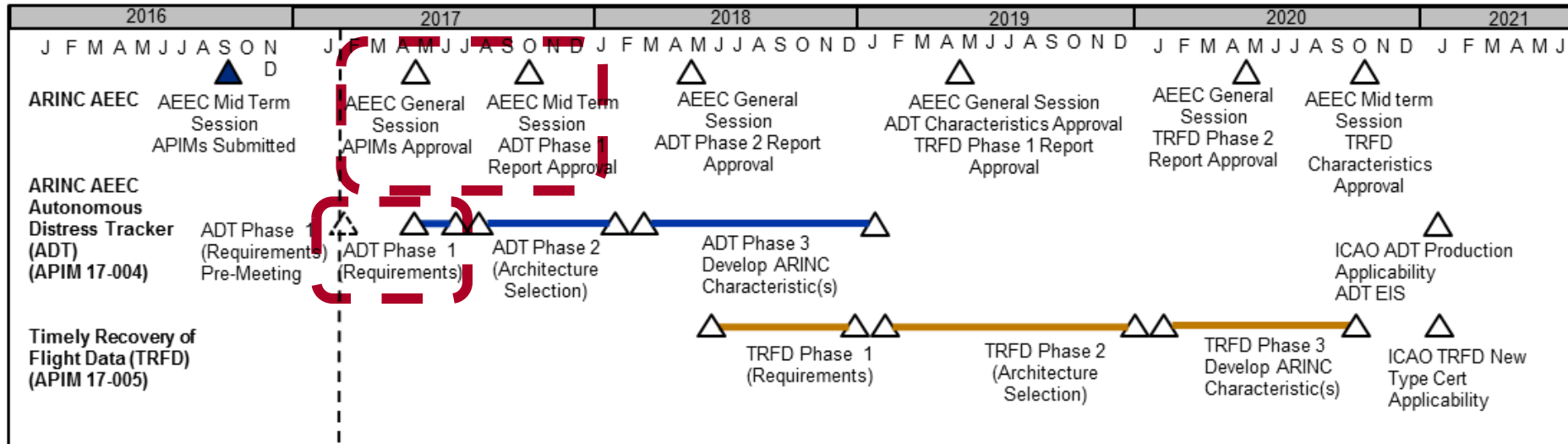
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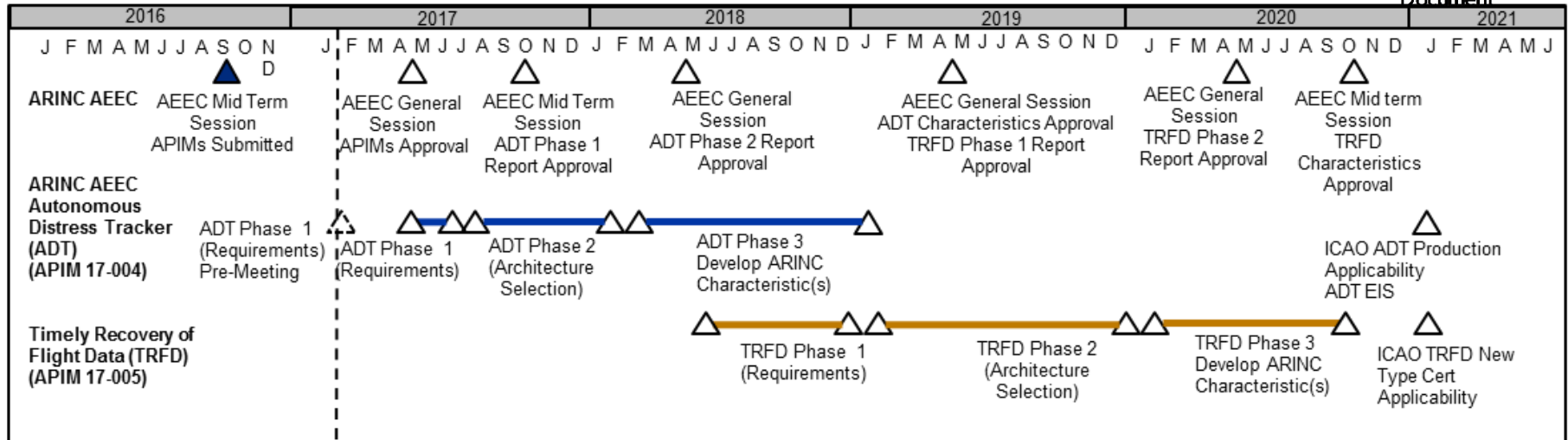
ADT Requirements Phase Discussion

ADT Requirements Phase Progression and Goals Discussion

- Preliminary Plan for Requirements Phase
- APIM Approval and formal kick-off
- Plan for Requirements Phase
- Requirements Working Meetings
  - Determine if sufficient basis to initiate (driving requirements sufficiently mature/stable vs targeted Entry Into Service)
  - Ensure applicable requirements identified and included
  - Identify industry relevant requirements not covered in requirements sources (e.g. "ilities", operational goals etc…)
  - Identify requirements that need further development/refinement
  - Develop derived or identified requirements set to use in architectural Selection Phase
  - **Other?**
- Complete phase 1 requirements report
- Report review by participants/stake-holders
- Report submission and Review in General Session

After Requirements Development – Architecture Evaluations

Key requirement areas	Architecture A	Architecture B	Architecture C	…	Architecture n
Normal Tracking	✅	✅	✅		✅
Abnormal Tracking	✅	❌	✅		✅
Autonomous Distress Tracking	✅	❌	✅		❌
Global Coverage	✅				✅
Tamper Proof	✅				✅
Notification Time	✅		✅		❌
Aircraft Integration Effort	❌	✅	✅		✅
Technical Maturity	❌	✅	✅		✅
Etc…	✅	❌	✅		❌

Notional Architecture Evaluation Matrix

After the requirements phase, an architectural evaluation will be performed to determine which architectures are suitable for moving forward into standards development. The key requirements identified in the requirements phase will provide the basis for this evaluation

ADT Requirements Phase Next Steps Discussion

- Preliminary Plan for Execution of Requirements Phase

Activity	Mtgs	Mtg-Days (Total)	Expected Start Date	Expected Completion Date
Phase 1: Document the end-to-end system requirements	One 2-day meeting plus teleconferences	2	May 2017*	July 2017
Phase 2: Develop candidate architectures, and select architecture(s)	Three 3-day meetings plus teleconferences	9	August 2017	Feb. 2018
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* The start date of Phase 1 (May 2017) is contingent on completion of the ICAO GADSS ConOps (and other associated documents).

** The completion date of Phase 3 (Jan. 2019) is driven by a Jan. 1, 2021 (individual Certificate of Airworthiness) forward-fit mandate (ref. ICAO Annex 6, Part I, §6.18.1). 24 months is considered the minimum time needed for system development.

2.0 Subcommittee Assignment and Project Support

2.1 **Suggested AEEC Group and Chairman**
Group: Systems Architecture and Interfaces (SAI) Subcommittee
Chairmen: Reinhard Andreae and Bob Semar

2.2 **Support for the activity**
Airlines: American, Delta, FedEx, Southwest, TAP, United, UPS
Airframe Manufacturers: Airbus, Boeing, Embraer
Suppliers: ACSS, Honeywell, Panasonic, Teledyne, Thales, and TBD-others
Others: TBD

2.3 **Commitment for Drafting and Meeting Participation**
Airlines: American, United
Airframe Manufacturers: Boeing, Airbus
Suppliers: ACSS, Panasonic, Thales and TBD-others
Others: TBD

2.4 **Recommended Coordination with other groups**
AEEC: Traffic Surveillance Subcommittee
EUROCAE: Working Group 98 (WG-98)
ICAO Surveillance Panel

ADT
Requirements Overview and Discussion

Sources of ADT Requirements

International Civil Aviation Organization (ICAO)

GADSS CONOPS Draft 5.11
(1 December 2016)
Normal and Distress Tracking, TRFD, ELT

Annex 6 to the Convention on International Civil Aviation, Part 1, Tenth Edition
(July 2016)
Standards and Recommended Practices (SARPs): Distress Tracking, TRFD, ELT changes

Annex 11, 14th Edition
(2016)
SARPS for Distress Reporting

Doc 10054 Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery
(not yet published)
TBD ADT and TRFD guidance material.

European Organisation for Civil Aviation Equipment (EUROCAE)

ED-237
(February 2016)
Minimum Aviation System Performance Specification (MASPS) for Criteria to Detect In-Flight Aircraft Distress Events to Trigger Transmission of Flight Information.

Executive Director (ED) Decision 2016-012
Acceptable Means of Compliance (AMC) and Guidance Material (GM) to implementing rules on flight recorders, underwater locating devices and aircraft tracking systems (second set))
(12 September 2016)
AMC and GM related to aircraft tracking systems and to location of an aircraft in distress (refer to Part CAT, CAT.GEN.MPA.205 and CAT.GEN.MPA.210) will be adopted by a Decision published at a later stage

European Aviation Safety Agency (EASA)

European Union (EU)

COMMISSION REGULATION (EU) 965/2012
5 October 2012
Technical requirements and administrative procedures related to air operations

COMMISSION REGULATION (EU) 2015/2338
11 December 2015
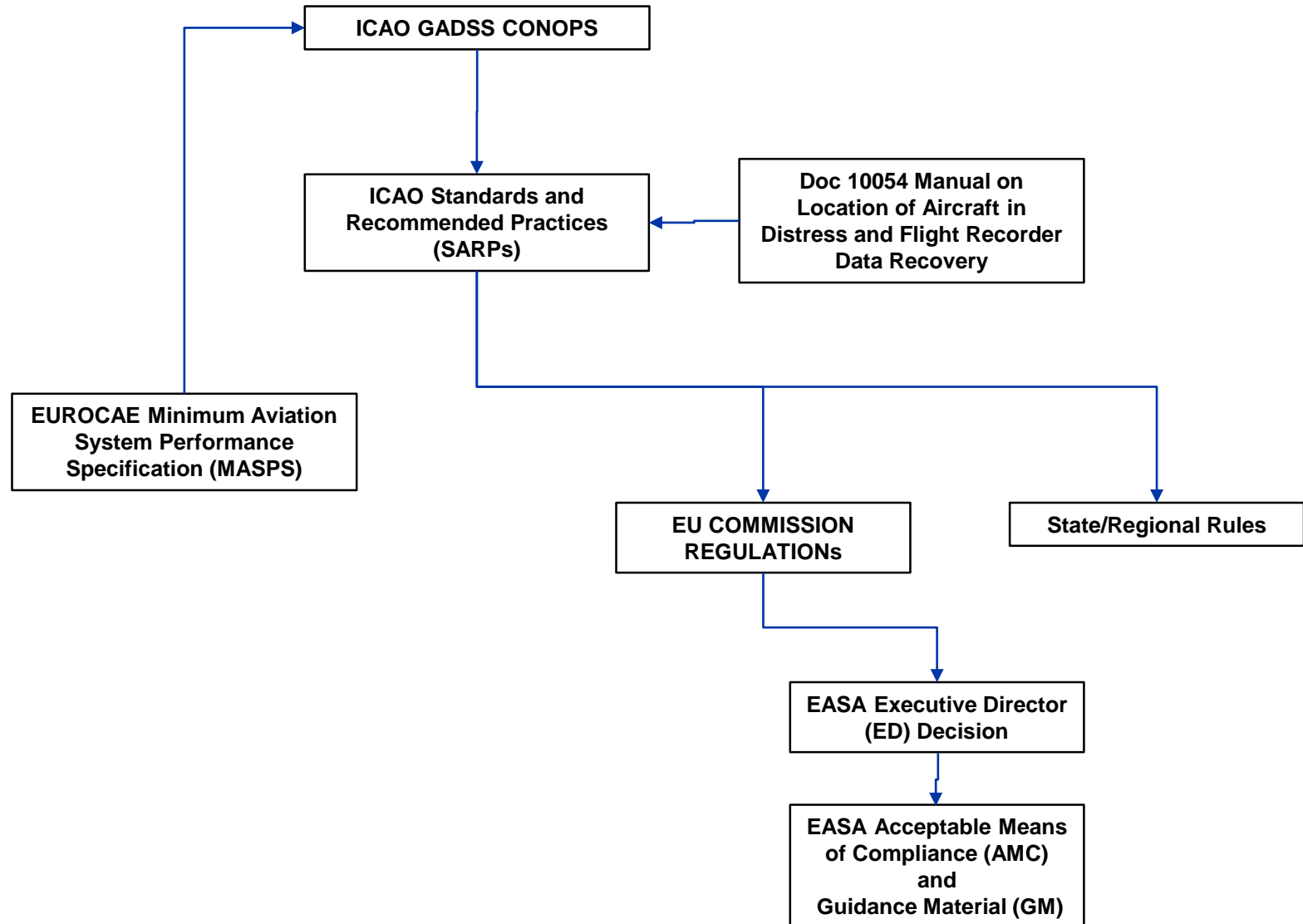Amends 965/2012 to add CAT.GEN.MPA.210 Location of an Aircraft in Distress

Annex II ED Decision 2015/XXX/R
AMC and GM to Part-CAT — Issue 2, Amendment X'
(Draft, ?)
AMC and GM related to aircraft tracking systems and to location of an aircraft in distress

Relationships Between ADT Requirements

ADT Systems of Interest

- ## Aircraft
  - Aircraft state information
  - Distress and event Detection systems, triggering systems
  - Transmission systems
  - Crew interfaces

- ## Data Transmission Systems
  - Air-ground data links such as Satellite constellations and associated ground terminals and systems (e.g. COSPAS SARSAT, Inmarsat etc…)

- ## Ground Systems and Services
  - Aircraft Operator (e.g. Airline Operations Center)
  - Airspace Operator (e.g air traffic services or air navigation service providers)
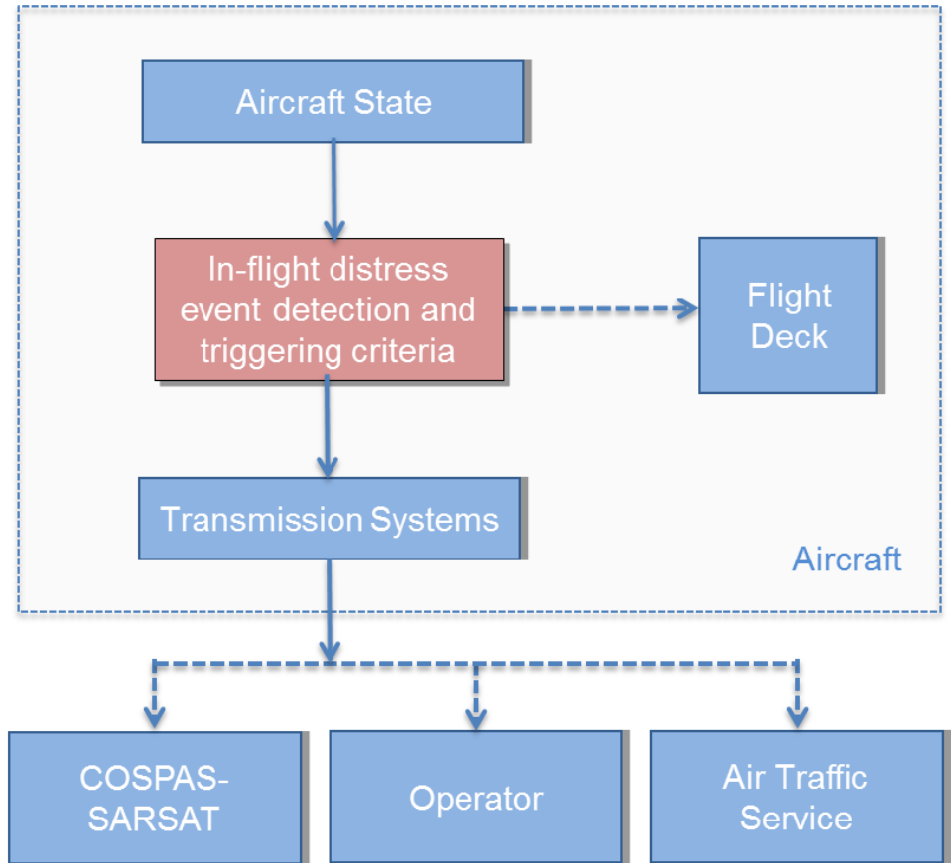 - Search and Rescue Organizations (e.g. RCCs etc…)

FIGURE 2-1: IN-FLIGHT AIRCRAFT DISTRESS EVENT DETECTION AND TRIGGERING CRITERIA SYSTEM MODEL

Source ED-237, Figure 2-1

ADT Requirements Overview/Walk-Through

Microsoft Word Document

Embedded file: Initial Draft Autonomous Distress Tracking (ADT)

System-Level Requirements

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Issues/Items for Discussion (not for conclusion at this meeting)

- **Requirement Maturity/Stability:** There are a number of non-finalized driving requirements documents - what is sufficient basis to initiate (driving requirements sufficiently mature/stable vs targeted Entry Into Service), how do we handle change etc…

- **Ensure applicable requirements identified and included:**
  - What are we missing?
  - How do we identify industry relevant requirements not covered in existing requirements sources (e.g. "ilities", operational goals etc…)

- **Identify requirements that need further development/refinement:** High level, potentially high impact requirements such as "world wide coverage" or "tamper-proof" type requirements – how do we refine/make more specific?

- **Other?**

Concluding Discussions

Issues/Items for Discussion

- Preliminary Plan for Execution of Requirements Phase

- Requirements Sources Discussions

- Requirements Overview Discussions

- Other?

Acronyms

ACARS	Aircraft Communications Addressing and Reporting System
ADFR	Automatically Deployable Flight Recorder
ADS-C	Automatic Dependent Surveillance - Contract
ADS-B	Automatic Dependent Surveillance - Broadcast
ADT	Autonomous Distress Tracker
AEEC	Airline Electronic Engineering Committee
AMC:	Acceptable Means of Compliance
AOC	Airline Operation Center
APIM	ARINC Project Initiation/Modification
ATC	Air Traffic Control
ATS	Air Traffic. Services
CAT	Commercial Air Transport Operations
COMM	Communications
CONOPS	Concept of Operations
COSPAS/SARSAT	Search and Rescue Satellite-Aided Tracking/Cosmicheskaya Sistyema Poiska Avariynich Sudov (Space System for the Search of Vessels in Distress)
CVR	Cockpit Voice Recorder
EASA	European Aviation Safety Agency
ED	EUROCAE Document
ED	Executive Director
ELT	Emergency Locator Transmitter
ELT-DT	Emergency Locator Transmitter – Distress Tracker
EFDR	Enhanced Flight Data Recovery
EU	European Union
EUROCAE	European Organisation for Civil Aviation Equipment
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FDR	Flight Data Recorder
FDS	Flight Data Streaming

GADSS	Global Aviation Distress Safety System
GATS	Global Aircraft Tracking System
GM	Guidance Material
GNSS	Global Navigation Satellite System
HW	Hardware
ICAO	International Civil Aviation Organization
kHz	kilo-Hertz
LF-ULD	Low Frequency Underwater Locator Device
MASPS	Minimum Aviation System Performance Specification
NM	Nautical Mile
OEM	Original Equipment Manufacturer
RCC	Rescue Coordination Center
RTCA	Radio Technical Commission for Aeronautics inc.
SAI	Systems Architecture and Interfaces Subcommittee
SARPs	Standards And Recommended Practices
SATCOM	Satellite Communications
SC	Special Committee
SW	Software
TBD	To Be Determined
TRFD	Timely Recovery of Flight Data
WG	Working Group
WRC	World Radio Communication Conference