



Automated Engine & LLP Hard Time Tracking: *Moving on from manual records.*

*Aero-Engines Europe Conference,
Paris, 22nd October 2015*



- **Established 2000. Dublin, IRL.**
- **Technical Service Provider**
- **Small-Medium Size Airlines and Lessors Worldwide**
- **CFM56-3 / -7B and CF34-3 / -10 series**

- **On-wing technical services:**
Engine Condition Monitoring; Line Troubleshooting; On-site BSI and repairs.

- **CAMO support services:**
Airworthiness Compliance; Maintenance Management; Hard Time tracking; Fleet Planning.

- **Engine Leasing and Lease Management.**

Aviation has had a long love affair with manual, paper-based processes.

Flight Data



Ticketing



MRO MGMT



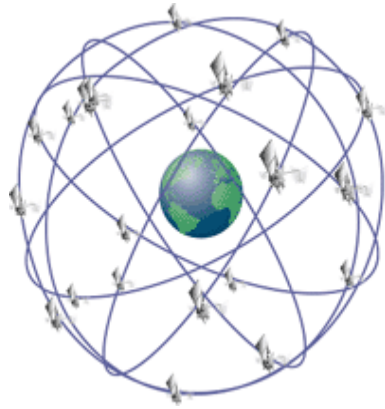
CAMO MGMT

EMERGENCY AIRWORTHINESS DIRECTIVE	
	<p>AD No: 2008-01-02</p> <p>Date: 31 May 2008</p> <p><small>The following information is being disseminated to you by the FAA in accordance with the provisions of 14 CFR 121.631. It is intended to inform you of a potential safety issue and to request that you take the appropriate action to address the issue. This information is not intended to constitute an FAA order. For a full and complete text of this AD, please refer to the FAA website at www.faa.gov/air_traffic/flight_info/aeronav/ad/index.cfm.</small></p>
Type Approval Holder's Name: Thiel-Helldorf Engine GmbH	Type/Model designation(s): T52-V6/62-61 engine
AD/CAA Number: 2008-01-02	
Form 101	10/2007 edition
Subject(s):	FAA-Airworthiness Directives (AD) supersede AD 2006-02-02 used 22 May 2008.
ATA 100	Engine - Check Assembly - Malfunction
Manufacturer:	Thiel-Helldorf Engine GmbH
Model(s):	As this AD is an emergency regulation, it is intended to address the most serious safety issues. These engine malfunctions are hazardous to the aircraft and could result in engine failure and loss of control of the aircraft. These engine malfunctions are hazardous to the aircraft and could result in engine failure and loss of control of the aircraft.
Reason:	In-flight engine malfunctions have been reported on several occasions. The FAA is concerned that these engine malfunctions could result in engine failure and loss of control of the aircraft. The FAA is issuing this AD to require the replacement of the affected engine with a new engine that meets the FAA's requirements.



... but we have now embraced digital technologies, right?

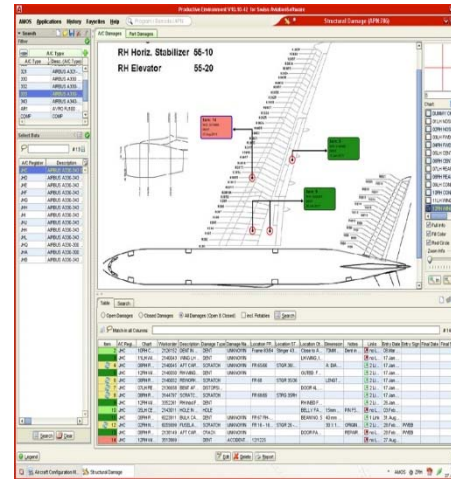
Flight Data



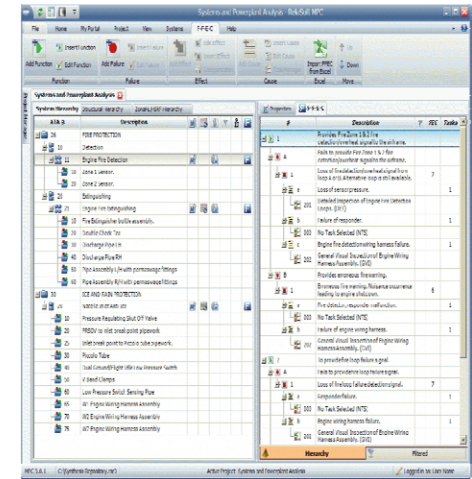
Ticketing



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... Well, not fully.

ENGINE LIFE LIMITED PARTS (LLPs) TRACKING STILL BASED PRIMARILY ON MANUAL DATA COLLATION AND ENTRY.



What are LLPs?

Federal Aviation Regulations

Sec. 43.10 — Disposition of life-limited aircraft parts.

(a) *Definitions used in this section.* For the purposes of this section the following definitions apply.

Life-limited part means any part for which a mandatory replacement limit is specified in the type design, the Instructions for Continued Airworthiness, or the maintenance manual.

Life status means the accumulated cycles, hours, or any other mandatory replacement limit of a life-limited part.

(1) *Record keeping system.* The part may be controlled using a record keeping system that substantiates the part number, serial number, and current life status of the part. Each time the part is removed from a type certificated product, the record must be updated with the current life status. This system may include electronic, paper, or other means of record keeping.



What are LLPs?

Governed by Chapter 5 Limitations set by the OEM



CFM56-3

ENGINE SHOP MANUAL

LIFE LIMITS OF ENGINE ROTATING PARTS

TASK 05-11-00-200-001

1. General.

- A. This section contains FAA and EASA approved part life limits. Do not operate parts more than their life limit. It is the operator's responsibility to make sure that the parts are not operated more than their life limit.

For approval to install a part number, refer to the Service Bulletins and Illustrated Parts Catalog for a list of approved part numbers for each engine model.

2. Requirements.

- A. The CFM56 engine has parts that are life-limited. It is necessary that an accurate history be kept of their operation. The most important data is the flight cycle history of the part. These are different models of the CFM56 engine. Each model operates to a different cycle. Parts used in more than one model can have different life limits for the different models.

- B. Engines may be rerated as determined by the aircraft thrust control system, i.e. Aircraft Flight Management Control (FMC) system and the corresponding Aircraft Flight Manual (AFM) maximum thrust rating. With rerating, life limits vary with the maximum thrust rating.

3. Life Limits.

Subtask 05-11-00-200-051

- A. The maximum life limits for all rotating parts is given in this section that follow. A life limit is given for each part number and each CFM56 engine model for which the part can be used. An accurate history of cycles must be kept for each part serial number. This history must include the total number of cycles operated and the number of cycles remaining. It is recommended that a record be kept of the aircraft model in which the parts are installed and the number of cycles operated in each aircraft model/engine model mix. Each of the flights that follow is one cycle.

- (1) A flight which is a takeoff and landing. This includes when a thrust reverser is used.

- (2) A touch-and-go landing and takeoff used to train pilot.

ALL VERSIONS

ALL

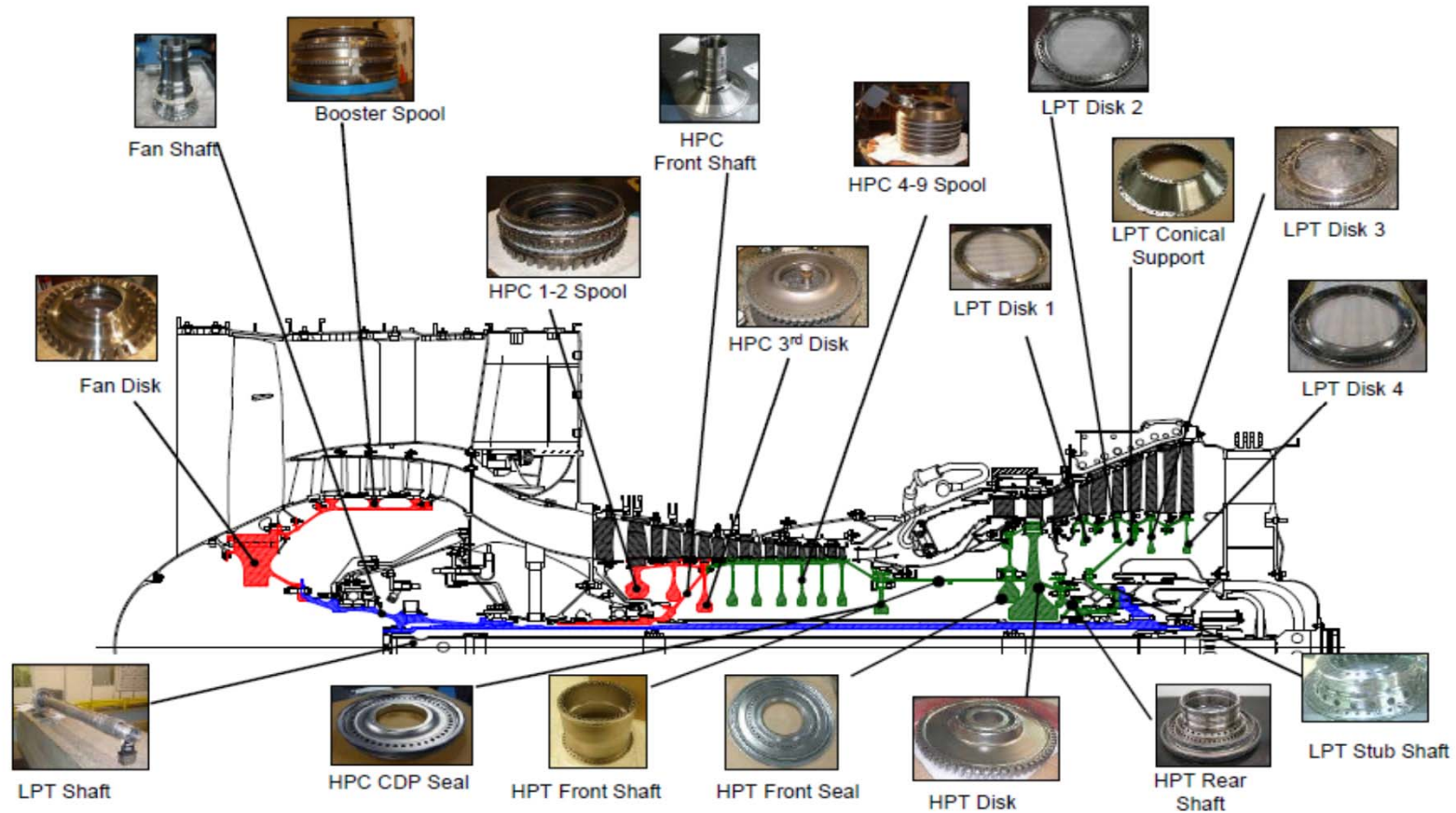
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LIFE LIMITS 001
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JUN 15/2007

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What are LLPs?



For example, LLPs fitted to the CFM56-3 Turbofan (Application B737-300/400/500).

Between 15,000 – 30,000 Flight Cycle Limitation.

Four Types of Flight Deck Transmissions:

➤ **ATS: Air Traffic Services.**

Includes flight safety data and ATC transmissions

➤ **AOC: Airline Operation Communications.**

Includes OOOI, ECH, FDM, FOQA, CMC, EFB data, ETL data.

➤ **AAC: Airline Administration Communications.**

Includes crew rosters & manifests, Nav charts, Aircraft loadsheet uploads ...

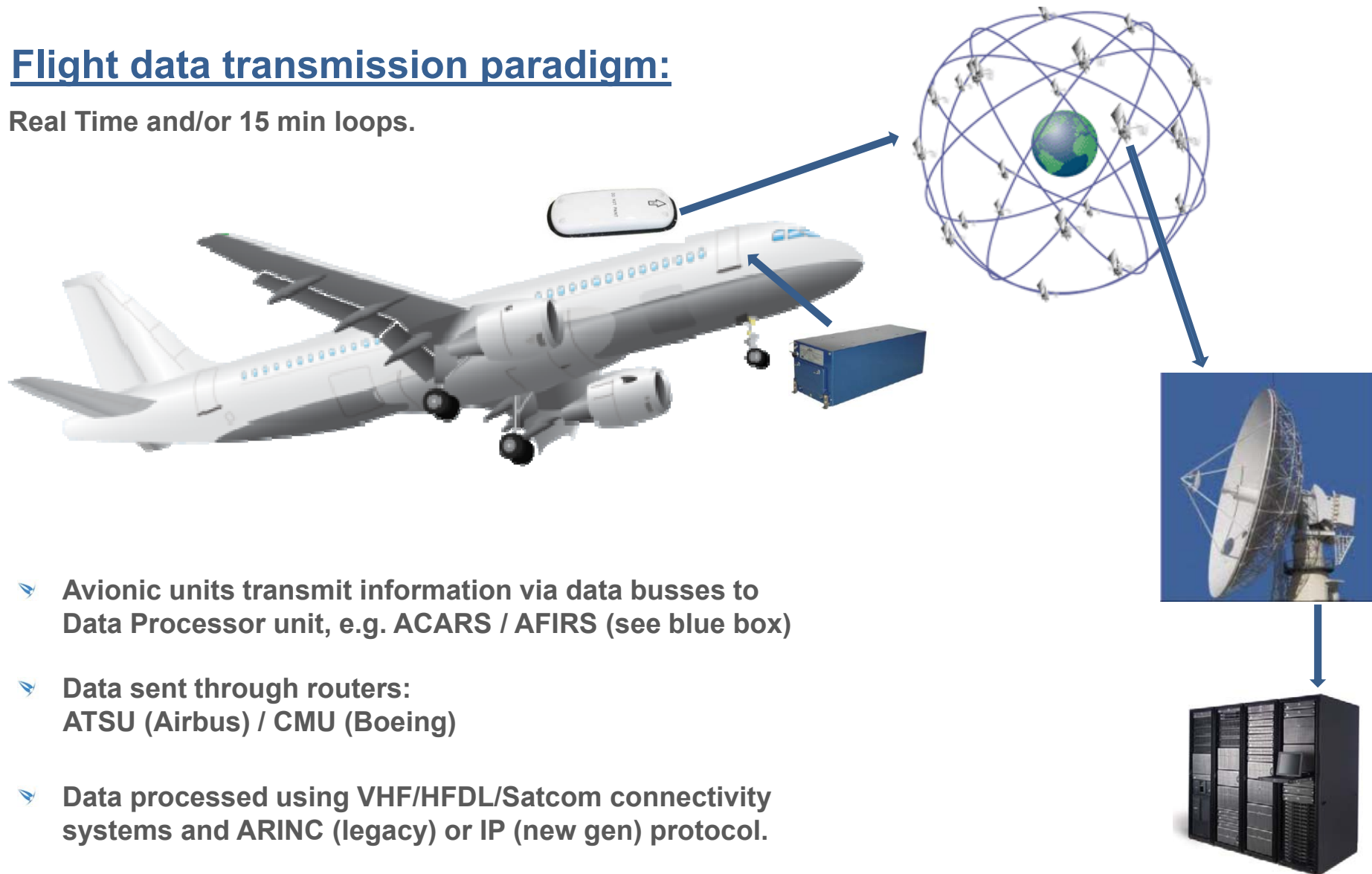
➤ **APC: Air Passenger Communications.**

Passenger-related data.



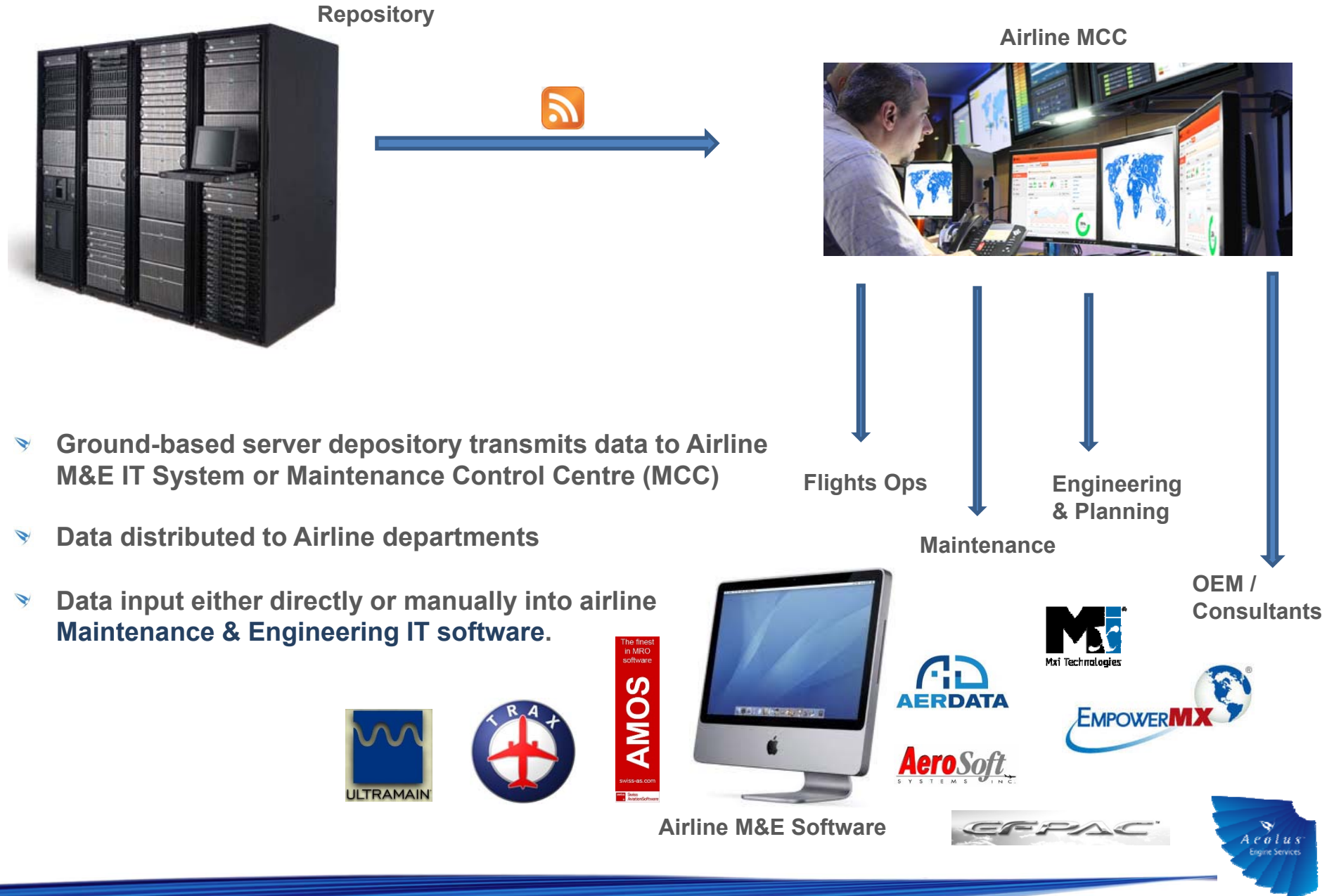
Flight data transmission paradigm:

Real Time and/or 15 min loops.



- Avionic units transmit information via data busses to Data Processor unit, e.g. ACARS / AFIRS (see blue box)
- Data sent through routers: ATSU (Airbus) / CMU (Boeing)
- Data processed using VHF/HFDL/Satcom connectivity systems and ARINC (legacy) or IP (new gen) protocol.
- Data transmitted through antenna to Inmarsat/Iridium Satellite to ground based decoding station and repository.

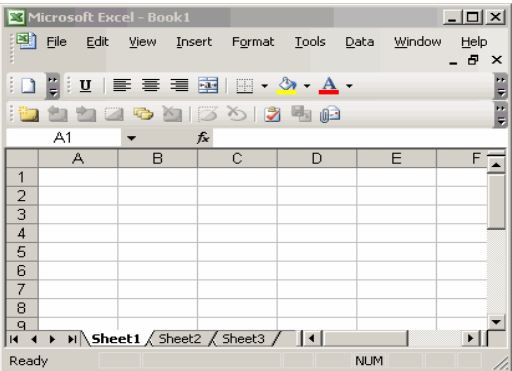
Flight data transmission paradigm:



Why are Aircraft Engine LLPs Tracked manually?



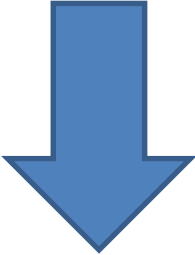
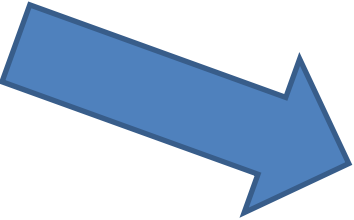
Spread Sheets



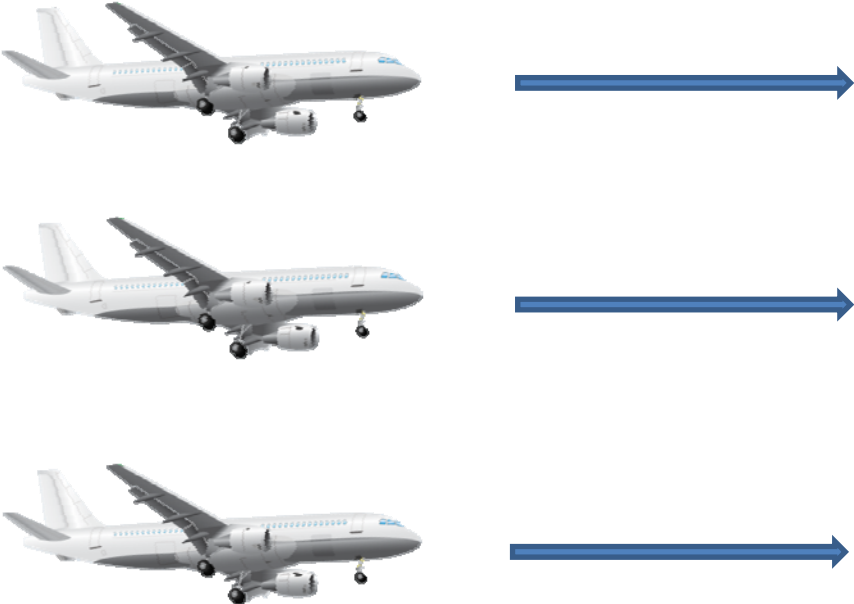
Or



Maintenance Software
With LLP Tracking Capabilities



Why are Aircraft Engine LLPs Tracked manually?



Airline MCC



Flight data collation from multiple aircraft in multiple stations creates collation and processing problems.

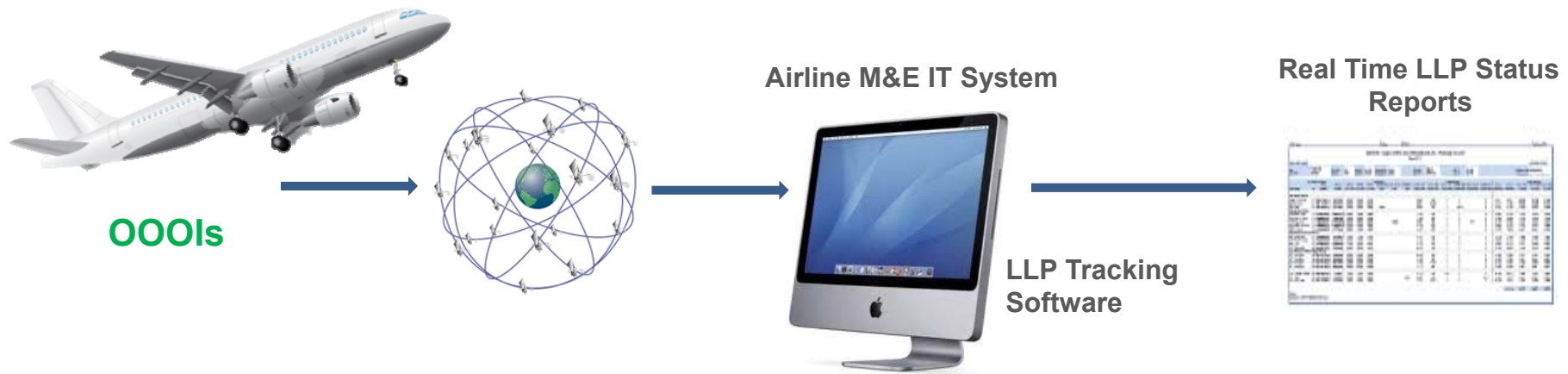
Why are Aircraft Engine LLPs Tracked manually?



Major Draw Backs from Manual LLP Tracking

- **LLP status only valid at most once a month.**
- **Data corruption due to Human Factor errors.**
- **Missed flight segments due to aircraft overlays.**
- **Lost 'Wrench Time'.**
- **Data security and integrity issues.**
- **Slow process involving multi-person data chain.**

Real Time, Automated Engine LLP Tracking Capability is Possible



OOOs are Key to Real-time Engine and LLP tracking

Remember!

✈️ **AOC: Airline Operation Communications.**
Includes **OOOI**, ECH, FDM, FOQA, CMC, EFB data, ETL data.



Username:

Password:

GO

Forgot your password? [Click here!](#)

AEOLUS ENGINE SERVICES
will release **Real-time Engine**
and **LLP tracking Software** in
Q2 2016.

Compatible with existing Flight
data transmissions systems
And
Airline/Third Party Maintenance
Software

Accessible on all modern
communication devices;
smartphone, tablet, PC/Laptop.
No additional hardware required.

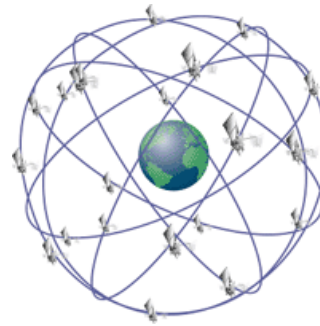
Airlines interested in becoming a 'Beta Test' client should email:
aetrack@aeolus-engineservices.com



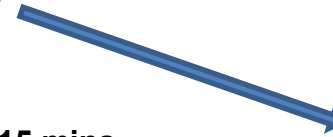
Real Time Data Flowchart



OOOI Data is transmitted during every flight via AFIRS/ACARS.



Received every 1 min / 15 mins

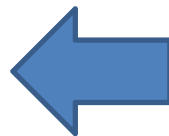


Data Processed in AETRACK Server

Regulatory reports in an instance

Engine ID	Engine Type	Manufacturer	Model	Serial No.	Age	Hours	Status
1000000001	CFM56-3	CFM International	56-3	1000000001	10000	10000	Operational
1000000002	CFM56-3	CFM International	56-3	1000000002	10000	10000	Operational

Engine ID	Engine Type	Manufacturer	Model	Serial No.	Age	Hours	Status
1000000001	CFM56-3	CFM International	56-3	1000000001	10000	10000	Operational
1000000002	CFM56-3	CFM International	56-3	1000000002	10000	10000	Operational

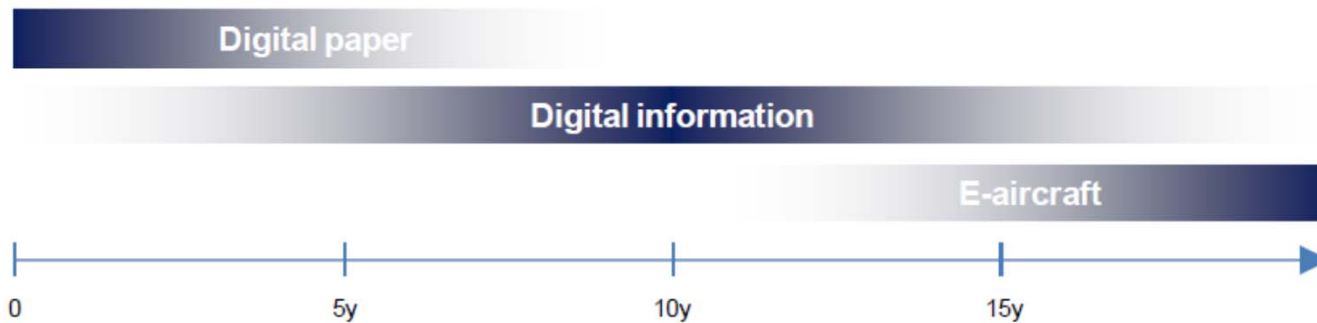


A few clicks on User Interface



Regulatory / Industry Thinking

IATA: The roadmap towards the “E-Aircraft” starts with the elimination of paper as it exists today. Worldwide approval of scanned paper will eliminate paper, avoid cost related to the transport, storage of paper, simultaneously review of data is optimized and data will be accessible worldwide. Before this first phase has ended, the second phase will have started and this clears the path for the introduction of the E-Aircraft.



Source: IATA

Figure 3 - Timeline

It's Time to go Paperless!

ICAO: FEB 2015, ICAO Working Group released proposal for Global Aeronautical Distress & Safety System (GADSS).

Proposes 1-minute and 15-minute satellite tracking for all aircraft, including establishment of a major information repository, with backed up data, accessible to all stakeholders.

Ensures secure and constant transmission of AOC data from aircraft to ground, which can be used for LLP tracking.



Thank you!

