



The Role of FDM into Embraer's SMS

EMBRAER | Capt. Dan Ramirez

OBJECTIVE

To share how Flight Data Monitoring and Safety Management interact inside Embraer



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 **Embraer at a Glance**

 **FDM AND SMS**



EMBRAER AT A GLANCE

EMBRAER AT A GLANCE

1946

Brazil launches a national strategic aerospace initiative via the Aeronautics Technical Center (CTA) and the Technological Institute of Aeronautics (ITA).

1969

Federal Government creates Embraer to develop aeronautical engineering and manufacture aircraft in Brazil.

1994

Embraer is privatized, fusing technological and industry expertise with an entrepreneurial approach.

2016

Embraer is one of the world's leading manufacturers of commercial and executive jets, with substantial and growing operations in defense and security.



EMBRAER AT A GLANCE

- ✔ World's largest manufacturer of commercial jets up to 130 seats
- ✔ Defense & Security products are present in more than 60 countries
- ✔ More than 800 executive aircraft delivered worldwide and widest business jets portfolio in the industry



EMBRAER FAMILY AIRCRAFT

COMMERCIAL AVIATION

Standard capacity – single class

ERJ 145

37 to 50



E170

70 to 78



E175

78 to 88



E190

98 to 114



E195

108 to 124



E175-E2*

80 to 88



E190-E2*

97 to 106



E195-E2*

118 to 132



EXECUTIVE AVIATION

Phenom 100E

6 to 8



Phenom 300

8 to 11



Legacy 450*

7 to 9



Legacy 500

8 to 12



Legacy 600

13 to 14



Legacy 650

13 to 14



Lineage 1000E

13 to 19



EMBRAER FAMILY AIRCRAFT

DEFENSE & SECURITY

A-29 Super Tucano



ISR



Special Missions**



KC-390*



Aircraft modernization • Aircraft Maintenance, Repair and Overhaul (MRO) • Unmanned Aerial Vehicles (UAV) • Training and Operational Support (TOS) • Surveillance Systems***/C4I**** • Air Traffic Control Systems • Remote Sensing • Air Surveillance Radars • Satellites.

*Under development.

**Transport of official personnel, MEDEVAC, in-flight inspection (FIS).

*** Application for defense & security.

****Command, Control, Communication, Computation and Intelligence.

AGRICULTURAL AVIATION

Ipanema



EMBRAER SYSTEMS

Development and integration of complex systems for sectors beyond aviation and defense.



AIR SAFETY AT EMBRAER

Safety Programs

- SMS implementation
- Regional Office Support
- FDM for technical aspects (AIM)
- Flight Data Analysis to support investigations
- In house animation software development
- Animations to support investigations, operational evaluation, product development

Safety Risk Management

- Risks identification based on Service Difficulty Reports and Prevention Reports
- Risk index calculation
- Organization of the PSC (Product Safety Board) and ASC (Air Safety Committee)
- Action plan chronogram and effectiveness follow up

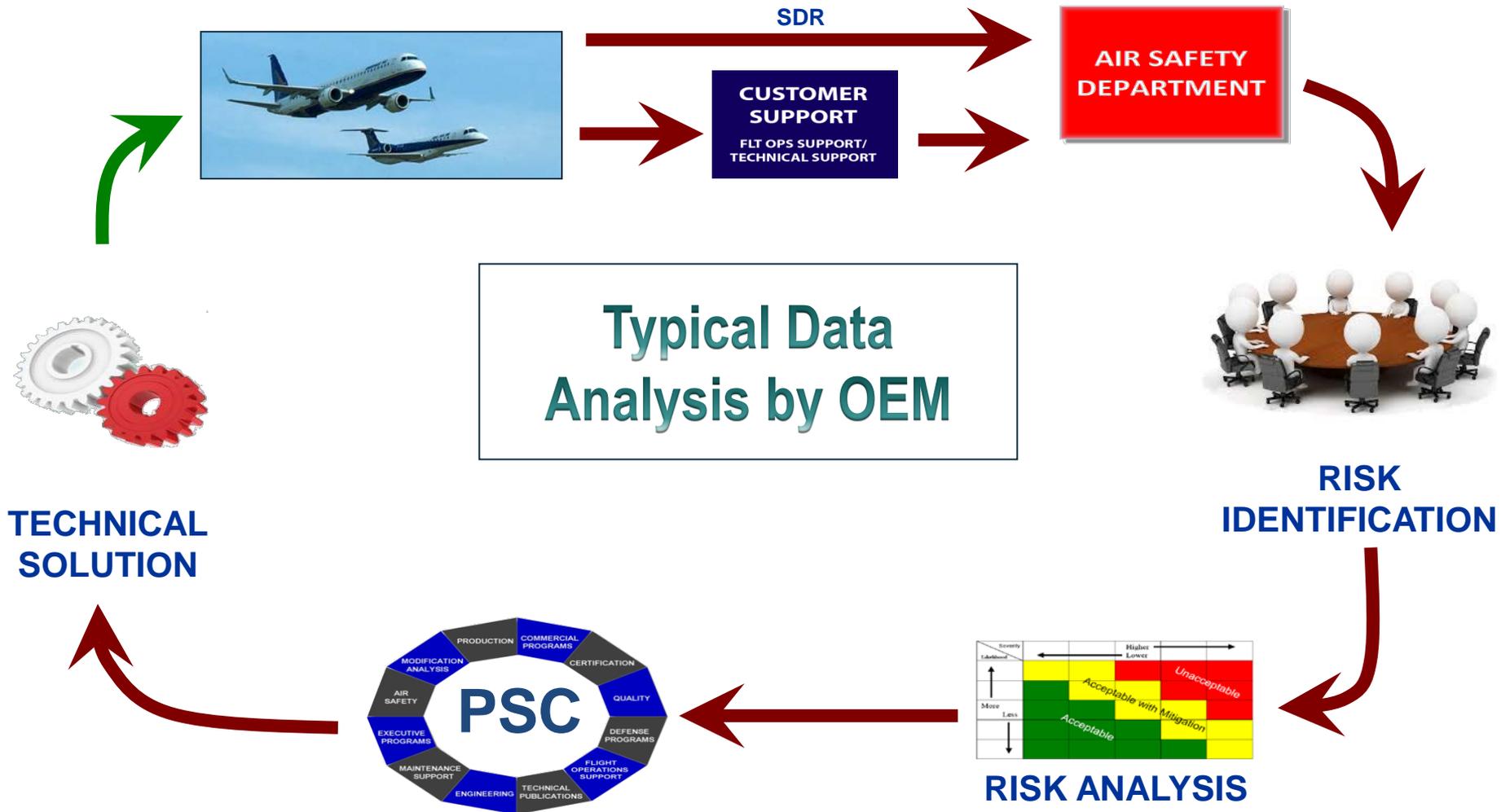
Investigations, HF and Op. Aspects

- Support for Official Investigations
- Safety Recommendations Follow Up
- Cooperation with authorities for Trainings
- Management of the Embraer Crisis Management Plan
- Operational and Cabin Safety Analyses
- Safety Statistics

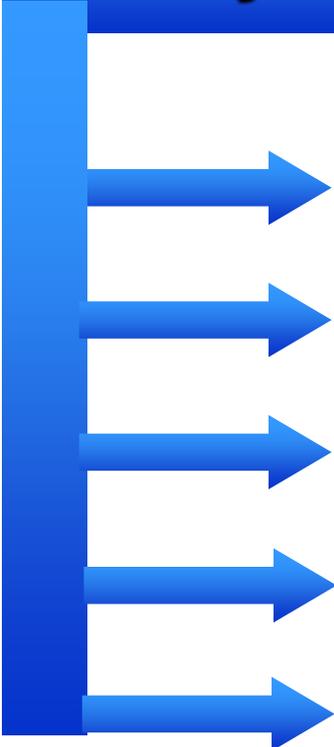


SMS and FOQA/MOQA

EMBRAER FDM DATA PROGRAMS



Why Does the OEM needs flight data ?

- 
- Aircraft systems **complexity**
 - On-board **software** – How to investigate ?
 - Need for precise and factual data
 - Time history of the aircraft behaviour
 - Factual information to the parts supplier



ICAO Safety Management Manual Doc 9859 AN/460



ICAO Safety Management Manual Doc 9859 AN/460

ICAO requirement

16.3.11 Annex 6, Part I, contains provisions for **FDA programmes to be part of an operator's SMS.** Operators of larger aircraft conducting international commercial air transport operations are required to have a non-punitive FDA programme, which contains adequate safeguards to protect the source(s) of the data. They may utilize the services of a specialist contractor to operate the programme.

From 1 January 2005, an operator of an aeroplane of a maximum certificated take-off mass in excess of 27 000 kg shall establish and maintain a flight data analysis programme as part of its safety management system.

Annex 6, Part 1, Chapter 3

FDA programmes to be part of an operator's SMS.



ICAO Safety Management Manual Doc 9859 AN/460

16.3.4 For the purposes of this manual, an FDA programme may be defined as:

- *A proactive and non-punitive programme for gathering and analysing data recorded during routine flights to improve flight crew performance, operating procedures, flight training, air traffic control procedures, air navigation services, or aircraft maintenance and design.*

aircraft maintenance and design.



The manufacturer involvement could be beneficial to improve overall safety of the system



ICAO SMS and FOQA/MOQA

The manufacturer contributions for your
FDM



→ **FOQA** : Operational Safety Support

→ **MOQA** : Aircraft Integrity Monitoring (AIM)

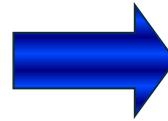


FOQA – Operational Safety Support

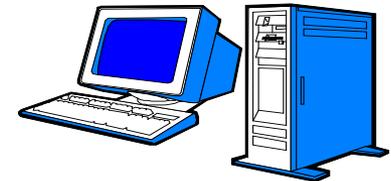
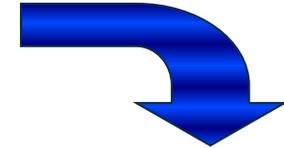
EMBRAER FDM DATA PROGRAMS



QAR



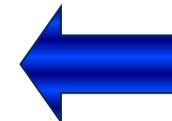
Data Transfer



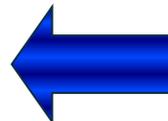
Data Processing



Reports



FOQA/ERC Committee

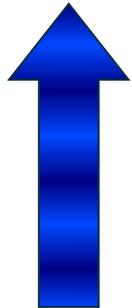


Embraer Safety SME is brought to the ERC when a technical issue is identified

Corrective
Actions



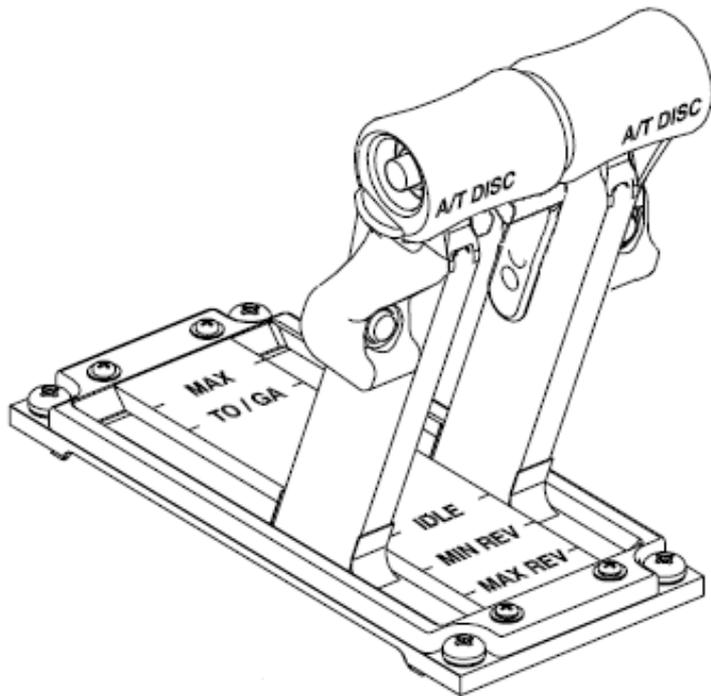
Follow Up



Operational FOQA
Support



FOQA – Suggestion for Procedure



Correct Takeoff

TO/GA Position : TLA >73 deg



ATTCS Engaged

In case of one engine failure

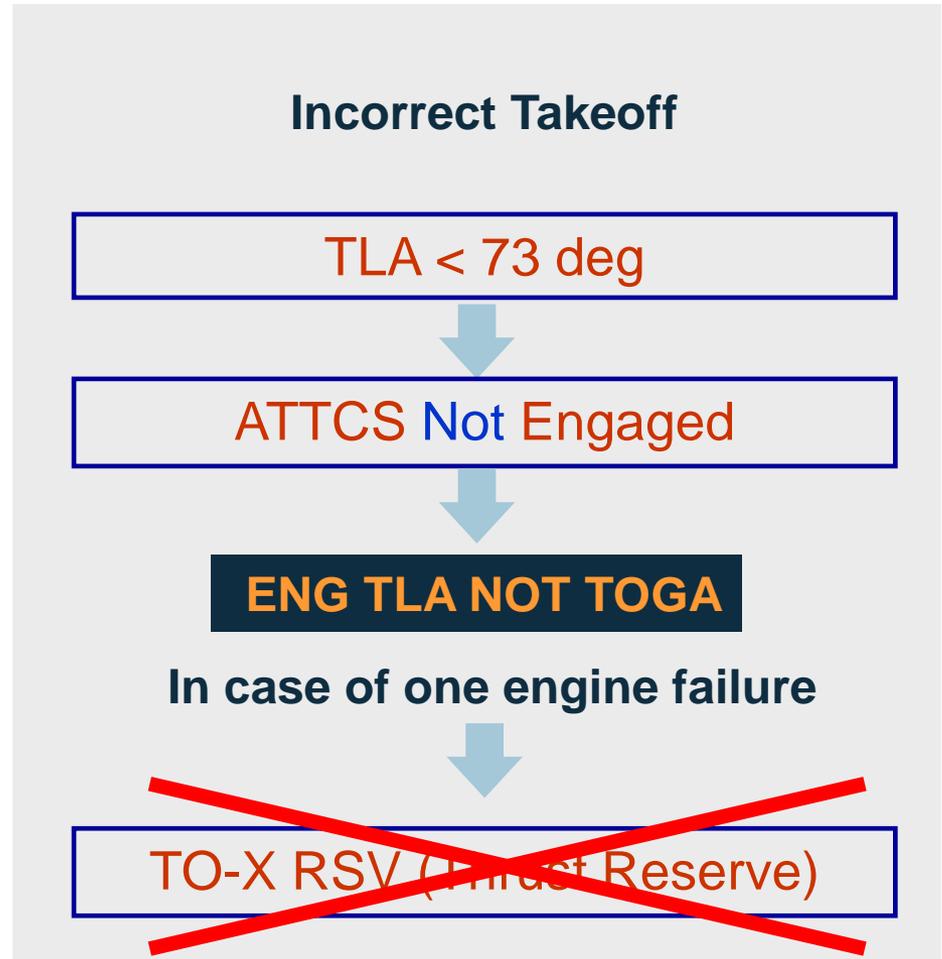
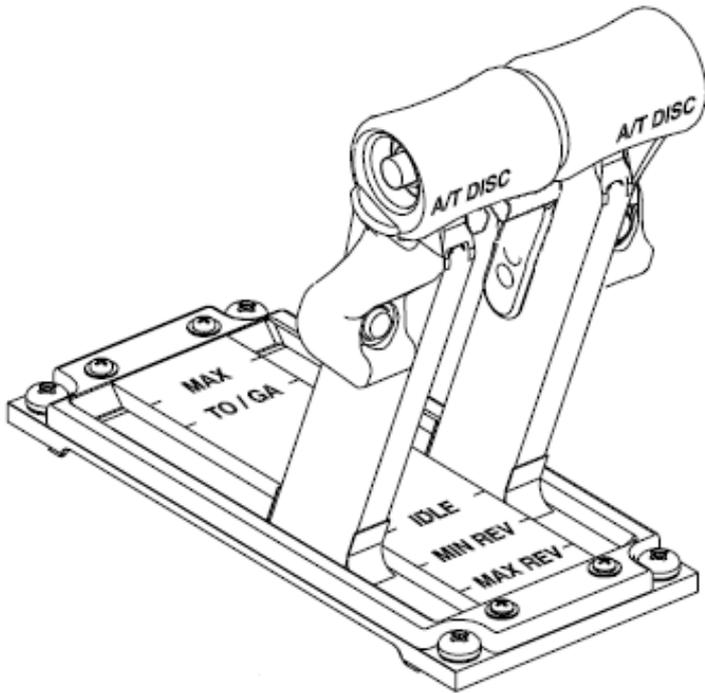


TO-X RSV (Thrust Reserve)

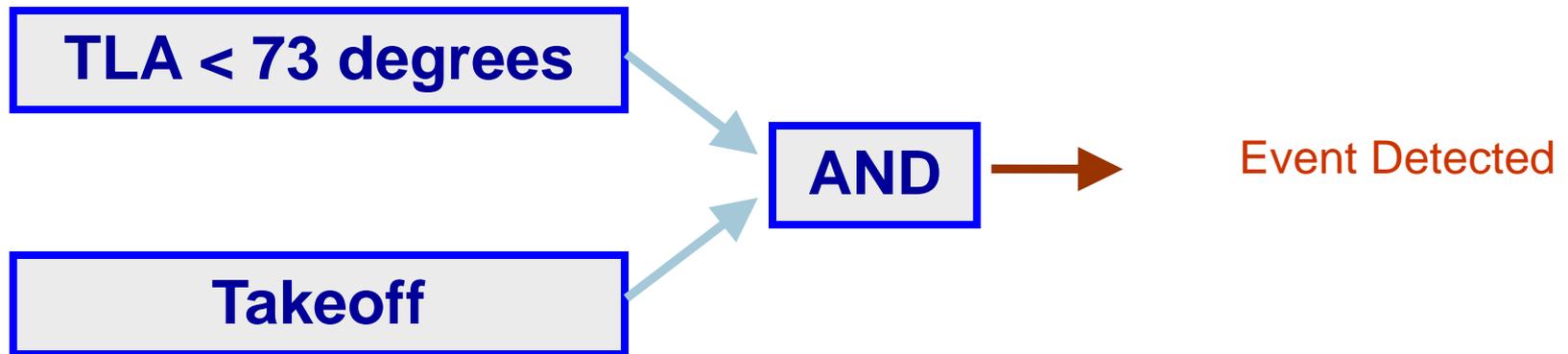


FOQA – Suggestion for Procedure

No Thrust Reserve (TO-X)
if ATTCS is not engaged



FOQA can detect this situation



More information on Operational Bulletin No.170-006/07

We encouraged the operator to augment the FDM/FOQA procedures to include a TLA check as mentioned above.



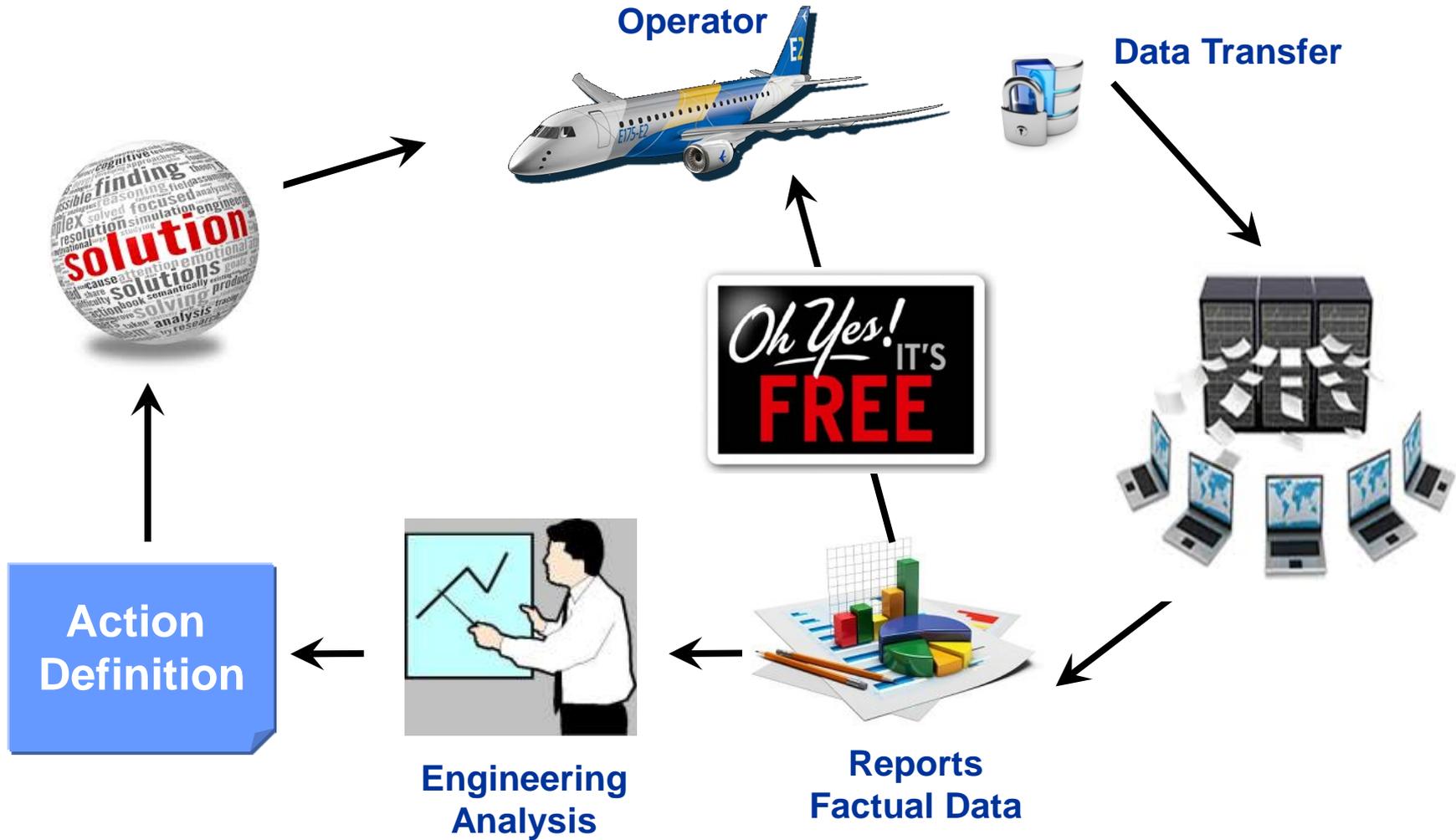
Aircraft Integrity Monitoring (AIM)

Aircraft Integrity Monitoring (AIM)

- The AIM is a program for routine in-flight recorded data analysis in order to **detect abnormal** on-board systems **conditions** and/or adverse **trends**.
- The AIM also has the goal to **support** and **enhance** the process of the **in-service technical difficulties investigation** and follow up the effectiveness of the respective Embraer corrective actions.
- The source of data for AIM can be FDR/QAR.



Aircraft Integrity Monitoring (AIM)



Aircraft Integrity Monitoring (AIM)

Fleet



Flight Data



FOQA / MOQA



Barrier

 **EMBRAER**



Aircraft Integrity Monitoring (AIM)

Fleet



Flight Data



FOQA



MOQA

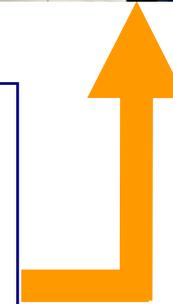


**Extracting
more results
from your
investment
on FOQA**

Flight Data



 **EMBRAER**

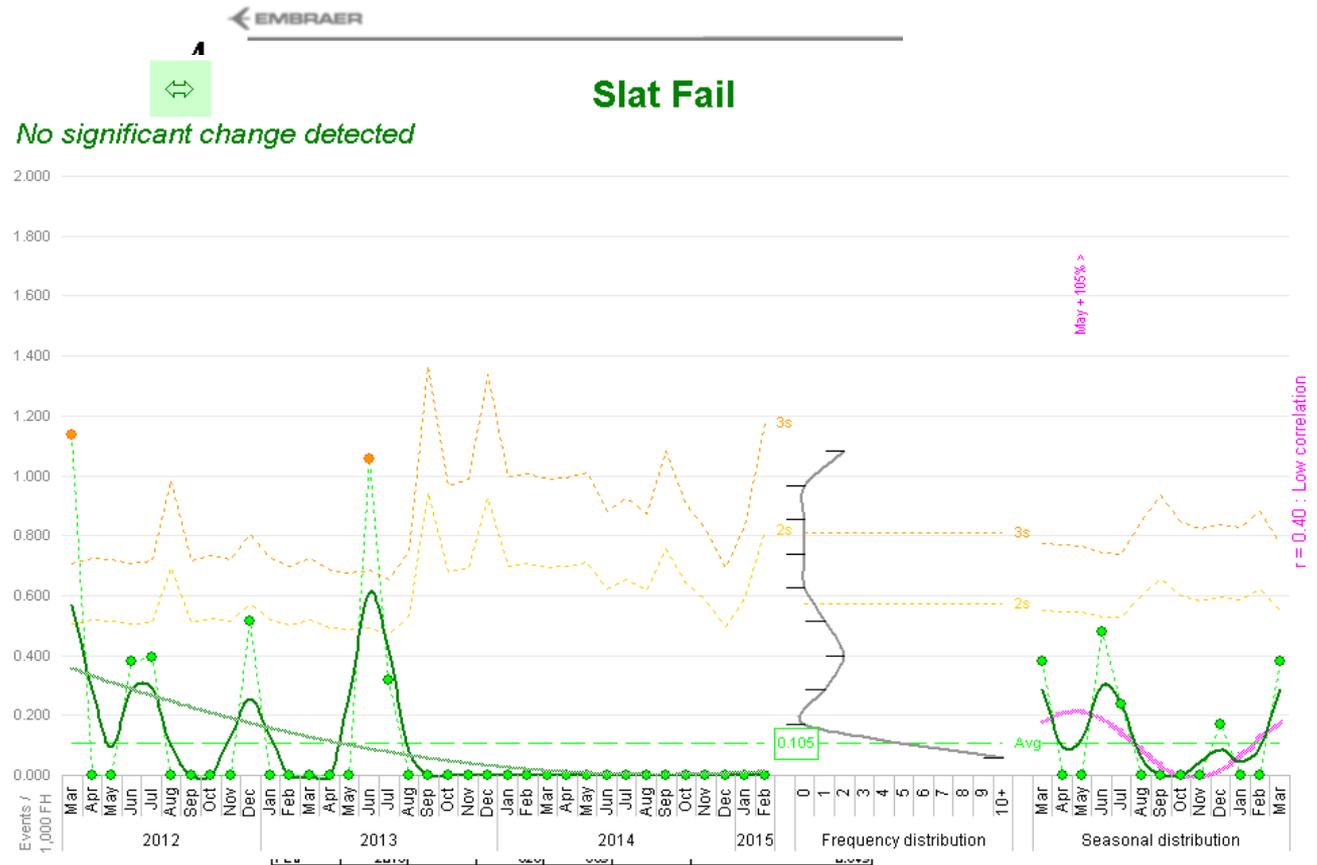


**Expanding
your MOQA
with solutions
for in-service
difficulties**



EMBRAER FDM DATA PROGRAMS

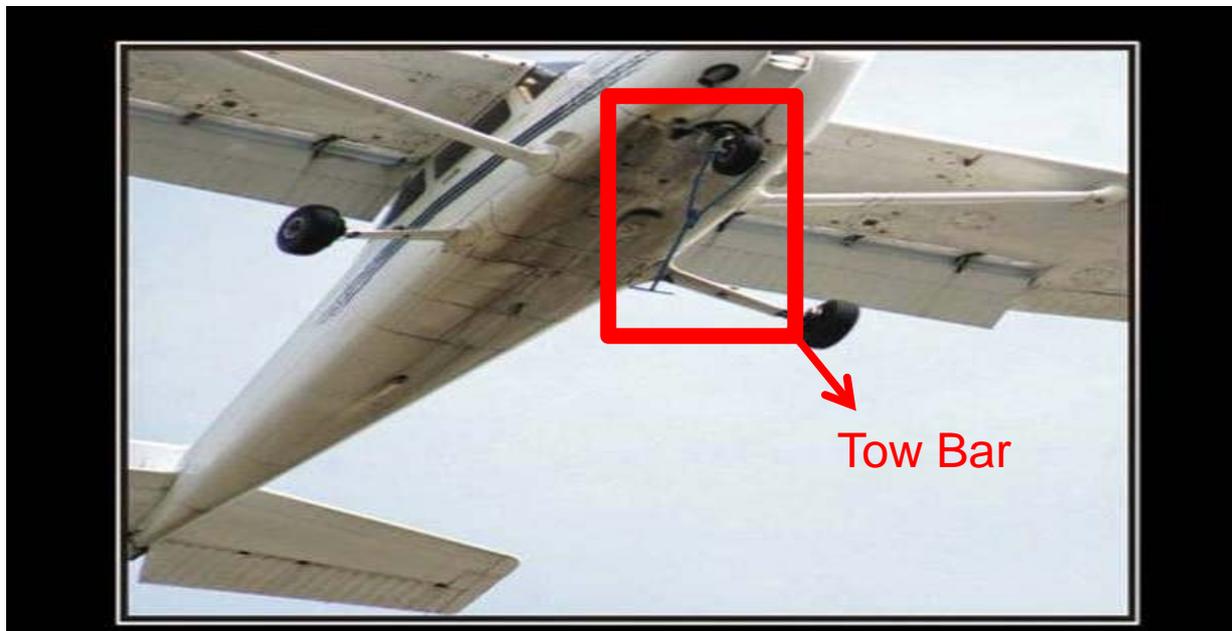
Periodically, Airlines that have the AIM agreements will receive a report with the statistics of the main issues monitored by Embraer.



AIM is not FOQA

The AIM does not have the goal to detect or identify operational deviations, or to monitor flight crew performance.

AIM data is de-identified.



EMBRAER FDM DATA PROGRAMS

Sample of Collaboration

Report

Example of Pilot's report:
"Aircraft failed to capture ILS."



EMBRAER FDM DATA PROGRAMS

No Flight Data

Example of Pilot's report:
" Aircraft failed to capture ILS. "

Report



Embraer Analysis:

Altitude = ?

Airspeed = ?

Trajectory = ?

Auto Pilot Mode = ?

Bank Angle = ?



Avionics Manufacturer: ?



EMBRAER FDM DATA PROGRAMS

Example of Pilot's report:
" Aircraft failed to capture ILS "

Report

Flight Data

Embraer engineering analysis:

Altitude = 4100 feet

Airspeed = 210 knots

Trajectory = Correct

Auto Pilot Mode = Approach

Bank Angle = 20 degrees

With Flight Data



Avionics Manufacturer: **Action**



Conclusion

EMBRAER FDM DATA PROGRAMS

**Effectiveness
Follow up**

**Problem
Report**

**Solution
Definition**

**Engineering
Analysis**



QUESTIONS?



THANK YOU



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