

Application of FDM tools and Flight Inspection

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ABSTRACT

FOQA (Flight Operational Quality Assurance) is recommended by ICAO and required by Airworthiness Authorities to monitor flight operational procedures and detect potential problems, technical flaws, unsafe practices or conditions that would be outside the expected operating procedures.

Relying on 50 years of experience in flight test and data acquisition, management, recording and analysis, Sagem DS has developed a FDM (Flight Data Monitoring) package named AGS (Analysis Ground Station) for flight data read-out and analysis.

Indeed feed back from airlines in daily operational, shows a trend to daily monitor flight path, landing procedure, and share the related pertinent information (e.g.: nav aids information, a/c position and trajectory, environment data) with Airworthiness Authorities in the goal of improving flight safety.

Using advanced techniques in statistics, AGS (Analysis Ground Station) is able to detect precursor or so-called atypical flight with may later on conduct to incident/accident.

So, through analysis of data from all aircraft flying in an area, this FDM package may allow to detect nav aids information drift or potential abnormal/dangerous situations requiring either nav aids calibration or procedure change.

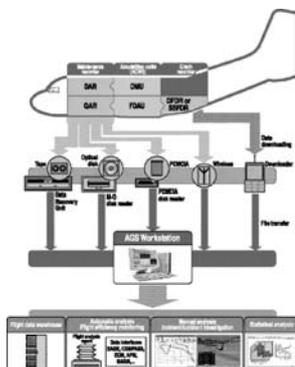
This paper intends to

- Briefly describes FDM tool principles
- Share various experiences from airlines which shows similarity and potential synergies with Flight Inspection Services
- Suggest use of FDM tool for Flight Inspection Services

INTRODUCTION

Relying on 50 years of experience in providing aeronautical equipment for flight tests and data acquisition, management, recording and analysis, Sagem DS has used this technological expertise to answer and develop since 1994 a software package for FDM user's needs.

This package, named AGS allows to read, convert and store data while analysing them, providing customised reports and statistics compiled from all data available in the aircraft and over a whole fleet.

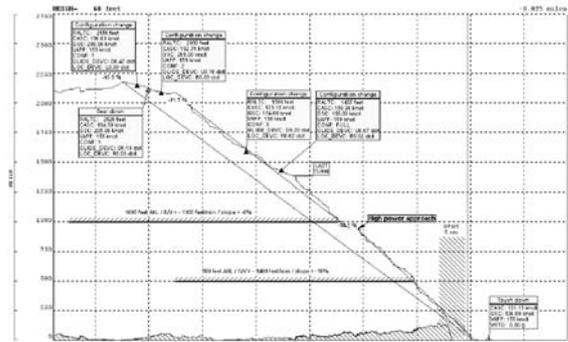


AGS : STRUCTURE AND USE

The FDM goal is to monitor flight operational procedures and detect potential problems, technical flaws, unsafe practices or conditions that would be outside the expected operating procedures. AGS answers to FOQA goals of improving operational safety and efficiency of the pilot training programmes.

Its main contributing features are:

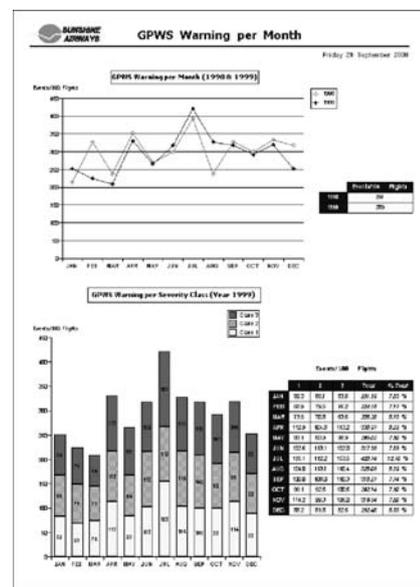
- Automatic flight efficiency monitoring
- Exceedance analysis and incident/accident investigation
- Periodic statistic analysis
- Interfaces for dedicated expert applications



An other area of usage is Maintenance Operation Flight Quality (MOQA). AGS provides monitoring, tracking and documentation of maintenance problems, thus allowing airlines to improve their preventive maintenance procedures, to better manage maintenance engineering and significantly reduce operating costs.

The main features are:

- Management of recording quality
- Automatic event detection
- Exceedance analysis and troubleshooting investigation
- Interfaces for engine trend monitoring program
- Interfaces for aircraft performance program

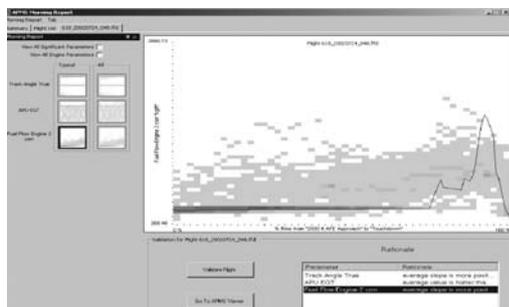
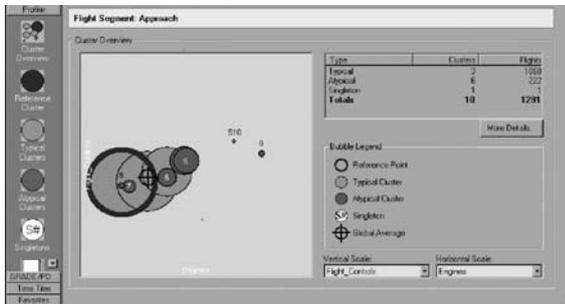


ATYPICAL FLIGHTS

In addition to the above mentioned features, this FDM tool, using advanced techniques in statistics developed by NASA, is able to detect precursor or "atypical" flight with may later on conduct to incident/accident.

Indeed traditional FOQA, and first answer non question while this function implemented in the Morning Report finds atypical flight performance without knowing in advance what to look for.

This provide the user's with the capability to analyse atypical flights.



Some examples of operationally-interesting groups of flights discovered by the Morning Report :

- High-energy arrivals
- Turbulence and accommodation
- Takeoff anomalies
- Atypical climbs
- Landing rollout anomalies
- TCAS RA with escape manoeuvres

EXAMPLE OF USAGE

Primarily used for FOQA, now expanding to MOQA, FDM provides also ways to detect in advance abnormal situations allowing user's to intervene early enough to allow efficient and corrective interventions.

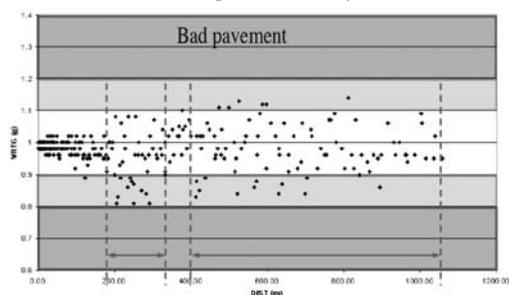
Below are given some uses of AGS features from several users in various daily operations

AIRPORT PROCEDURE MODIFICATIONS

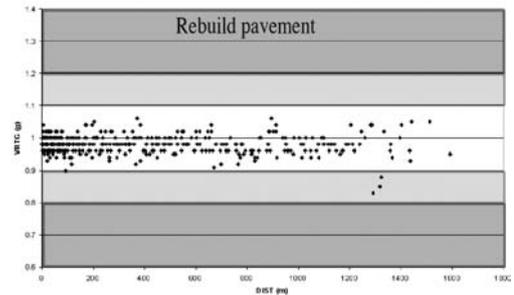
Some major airlines in the world use AGS also to communicate with the authorities concerning the approach and departure procedures. With a huge database of flight, it is easy for the airlines to demonstrate to the authorities in charge of these procedures, that some of them may be a source of accident. Like for example the STARS redesign and the Congonhas Heli-tower in Brazil based on FOQA data provided by TAM.

MONITORING OF ENVIRONMENT.

Using data for demonstration of external incident on flight is a growing trend. For example flight data have been used to avoid ticket, request an assurance coverage or even bring airport to rebuilt part of runway. In this last case, to show the real extension of the problem, a method was developed to spot the most problematic areas of runway. The method offered a common basis to compare all runways.



The study was handed to the airport administrator and as a solution, the airport administration completely rebuild a strip of 15m on the entire length of the runway.



TCAS SURVEY

After a reduction of space separation on major airports, some airlines discover a gap between reported TCAS by the pilots and reported by AGS. When they investigate, they also find out that these gap was much bigger on short flights than on long flights. This because some pilots reported a way only few on the TCAS resolutions which is understandable if you make five departure/approach each day that you may have one resolution for each departure. This brings airline to retrain their pilots about TCAS advisory.

ENGINE VIBRATION

One pilot reported abnormal sounds on both engines during taxi. Nothing was detected in Engine Trend Monitoring software, so full flight data were analysed on AGS, focused on engine vibrations. FDM tool found abnormal vibration pattern. This pattern was replayed over past months of flight for the same fleet and a second aircraft displaying the same alarming pattern was found. The related engines was repaired before failure. This detection avoided probable accident. This pattern is now monitored in real-time

CONCLUSION : POTENTIAL OTHERS USES

Feed-back from more than 100 airlines using AGS in daily operational, shows a trend to daily monitor flight data for various goals.

Beyond FOQA and MOQA traditional usage, a growing trend brings users to look for flight path, landing procedure, and share the related pertinent information with Civil Aviation Authorities in the goal of globally improving flight safety.

Through analysis of data from all aircraft flying in an area and collecting data from Flight Inspection, the CAA may use FDM tool as AGS to detect nav aids information drift or others potential abnormal/dangerous situations.

CAA will be able to improve the procedures and to use flight inspection service on condition or on request.

This obvious synergy between FDM and FIS should be a cost-effective progress for air safety and a mutual advantage for both CAA and airlines depending on the good will to share information.