

# Air Data Report Improves Flight Safety

## Originating Technology/NASA Contribution

Aviation is one of the safest means of transportation, but aviation safety professionals always work to make it safer. When flights operate outside of the norm, analysts perk up, as these flights are perhaps also operating outside the realm of safety. These out-of-the-ordinary flights, or atypicalities, are, therefore, the ones that need to be studied, and this is where NASA steps in.

Traditionally, safety analysts compare data to preset parameters to determine the existence of atypical events, but a newly developed NASA program could point analysts to issues which might otherwise have been unforeseen if the analysts had only been looking for these predetermined events. The fundamental difference between NASA's methodology and traditional exceedance detection originates from the concept of detecting atypicalities without any predefined parameters.

This is the basic concept behind NASA's Morning Report software created at Ames Research Center. It is not the only software of its kind; rather, it aims to address some of the shortcomings of traditional safety systems. The software aggregates large volumes of flight data and then uses an advanced cluster-based, data-mining technique to find the unexpected or the abnormal, without needing the user to pre-define any events. Simply put, it spots deviations and highlights them for analysis.

The software was designed at Ames under the sponsorship of the Aviation Safety Program in the NASA Aeronautics Research Mission Directorate, which seeks to make aviation safer by developing advanced tools that find latent safety issues from large sources of flight digital and operational data sources.

Since its inception in 1999, the NASA team has collaborated with air carriers and vendors of flight operational quality assurance (FOQA) software, a widely used tool that seeks to provide airline managers with information that will enable them to better understand risks to flight operation and how to then manage these risks.

The focus on FOQA software led to development of the Morning Report tool. The tool, created with the assistance of the Pacific Northwest National Laboratory, provides flight analysts with a daily morning report of atypical flights, displayed with the ability to plot those parameters against what is typical for that phase of flight and particular airport.

The Morning Report tool uses multivariate statistical algorithms to analyze large amounts of data from airline flights overnight and then generates an intuitively struc-

ture report each morning. It combines these powerful algorithms for analysis with user-intuitive software, allowing users to isolate and understand details underlying any portion of any given flight. It is the only technology of its kind that provides both the global overview as well as the ability to view the smallest details of any flight.

## Partnership

In 2004, [Sagem Avionics Inc.](#) entered a licensing agreement with NASA for the commercialization of the



Sagem Avionics incorporated NASA's Morning Report tool into its AGS comprehensive flight operations monitoring system, which processes all available data from aircraft recorders and provides customized reports.

Morning Report software. The company, based in Grand Prairie, Texas, also licensed the NASA Aviation Data Integration System (ADIS) tool, which allows for the integration of data from disparate sources into the flight data analysis process.

Sagem Avionics has been providing aeronautical equipment for flight testing, as well as acquisition, management, recording, and analysis of flight data for over 5 decades. In fact, Sagem Avionics' Analysis Ground Station (AGS) was the first commercially produced FOQA analysis tool. Similarly, it is the first and only analysis software that has incorporated the NASA Morning Report technology.

## Product Outcome

Sagem Avionics' AGS product, incorporating the Morning Report tool, processes and analyzes available data from aircraft recorders and then produces easy-to-read, configurable, customized reports. The automated system is powerful enough to process very large volumes of data quickly and accurately, to help users detect irregular or divergent practices, technical flaws, and problems that might develop when aircraft operate outside of normal procedures.

In addition to the Morning Report technology, the AGS system also provides automatic, statistical, and manual analysis of flight data. The automatic analysis processes all available data from aircraft recorders and provides customized reports of daily events with classification levels. Since it is automated, the systematic rereading of recorded data minimizes repetitive daily tasks, and it updates its flight and event database regularly, making itself more knowledgeable and effective each day.

All events detected in the course of the automatic analysis are stored in the AGS database for statistical analysis, allowing users to produce predefined reports or create new ones to detect patterns and trends. These reports can be automatically edited, published, and exported in various formats, including HyperText Markup Language (HTML) and e-mail.

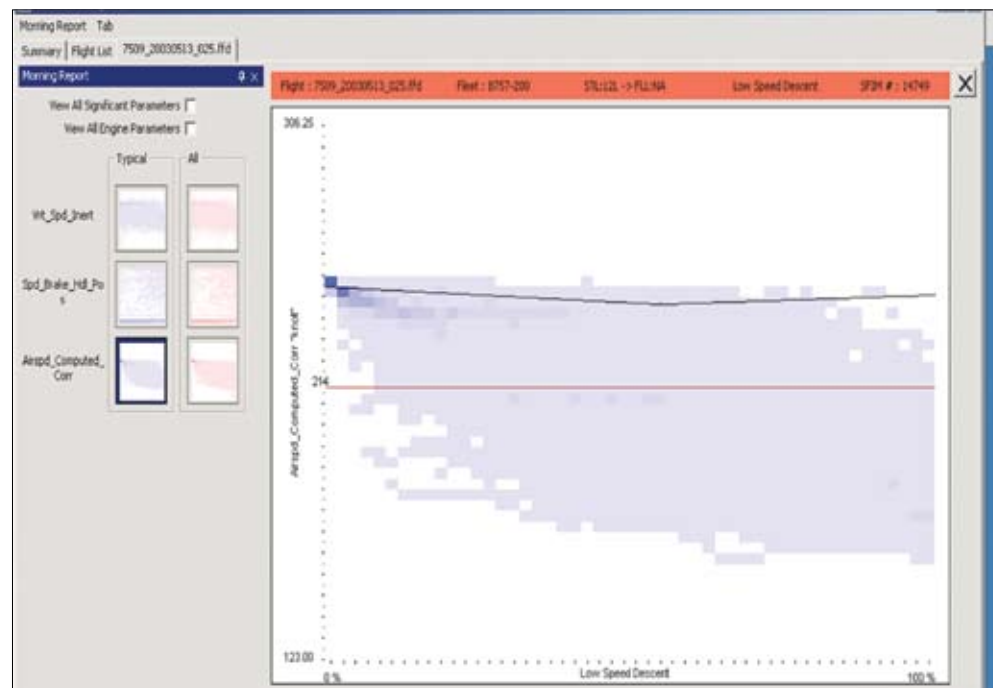
The manual analysis feature includes all of the necessary components for accurate investigations of any specific flight, allowing analysts to zero in on those flights operating outside of the norm. It displays engineering values in several formats (tables, curves, graphic charts, and generic cockpit instrument representation), making it ideal for investigating a wide range of these isolated events.

The fast and user-friendly AGS system manages large volumes and a wide variety of input data, but also monitors the media quality while controlling the entire data flow. The entire analysis process requires less than 3 seconds per flight hour and has been designed for compatibility with the standard personal computer. The complete system is integrated into a unique program with a standardized and homogeneous user interface.

The AGS turnkey system is plug-and-play, with all components integrated directly into the system. Users

have access to decoding frames for aircraft parameter conversion in engineering units; procedure sets for the customer fleet and dedicated to flight operation and engineering maintenance analysis; and predefined statistic reports for periodic analysis of fleet activity.

To better meet customer requirements, Sagem developed the original AGS in collaboration with airlines, so that the system takes into account their technical evolutions and needs. Thanks to its modular architecture, AGS can be used by all carriers, from the smallest to the largest. Each airline is able to easily perform specific treatments and to build its own flight data analysis system. Further, the AGS is designed to support any aircraft and flight data recorders. ❖



The Morning Report tool automatically identifies statistically extreme flights to airline FOQA analysts. The new software may help analysts identify the precursors of incidents or accidents.