Pacific Northwest NATIONAL LABORATORY

The Morning Report

Advanced Proactive Aviation Safety and System Monitoring Tool

The Morning Report, a new data-intensive approach to **analyzing flight data, performs an analysis overnight on massive amounts of operational flight data** from thousands of flights to identify patterns and events that could signify problems during flights. These data are presented every morning in an intuitively organized report. No currently available technology provides such ready access from the top level overview to the finest details of each flight.

Pacific Northwest National Laboratory scientists teamed with NASA (and Battelle, Flight Safety Consultants, ProWorks Corporation, and Safe Flight) to bring the aviation industry the most revolutionary tool since the invention of the calculator.

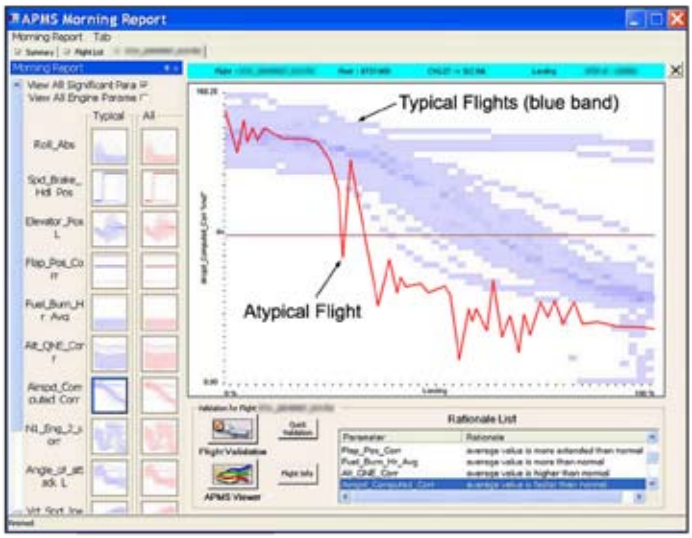
The Morning Report provides aviation experts with information about flight patterns and operational conditions that they need but normally never see. Unlike black box recorders, *The Morning Report* allows airlines to take a **proactive approach** to aviation safety by identifying possible problem practices and conditions and then enabling corrective actions to be planned and implemented. The infamous black box recorders just document a few dozen variables for the last part of the flight and are only available for analysis in the event of an accident. *The Morning Report* provides the potential for accident prevention through informing pilots of risky behavior or by identification of earlier mechanical problems.

While *The Morning Report* is a **sophisticated, data-intensive computing system, the user does not need to be a statistician or even require extensive training in use of the software!** The system automatically analyzes gigabytes of data from thousands of airline flights overnight, generating an intuitively structured report for aviation specialists to read *every morning*.

R&D 100

R&D Magazine **has named "The Morning Report" one of the world's 100 most significant scientific and technical innovations for 2005. This invention was further honored by the 2005 R&D Editor's Choice Award for Product with the Greatest Impact on Safety, the 2006 Outstanding Statistical Application Award by the American Statistics Association and the 2007 Federal Laboratory Consortium Award. PNNL shares the R&D 100 Award with co-developers NASA Ames Research Center, Battelle, Flight Safety Consultants, ProWorks Corporation, and Safe Flight. See the 5-minute video presentation on The Morning Report: www.pnl.gov/statistics/RandD100.htm**

U.S. DEPARTMENT OF ENERGY



The Morning Report revolutionizes air traffic safety helping airlines recognize anomalies that may become problems.

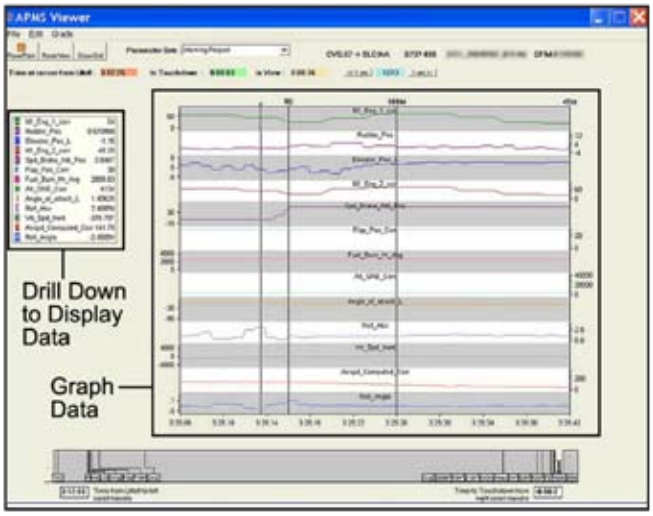
To run *The Morning Report* system, data collection instrumentation is installed on the airlines' aircraft to record hundreds of data variables from each of thousands of flights throughout the day, documenting the operation of the airplane. Examples of data recorded during the flight include speed, roll (wing angle), equipment status (landing gear up or down), and engine temperature. Before the technology represented by *The Morning Report*, these gigabytes of data went largely unanalyzed and, until now, the benefits of the knowledge that could be derived from these data were unrealized.

Unlike other safety analysis options, *The Morning Report* can provide new information about flights that were never identified as noteworthy. Until now, the analytical power and the software did not exist to harvest the data and allow the user to easily interpret the results. The **mathematical algorithms identify flights with previously "unenvisioned" characteristics**. By analyzing key elements of an atypical flight, airlines can gain insight into potential situations in a way and to a degree never before possible. The capabilities provided by *The Morning Report* enable aviation experts to **rapidly and painlessly identify rare real-world events** (out of tens of thousands of flight hours), quickly display their characteristics, and identify ones that may be precursors to unsafe situations.

The software program that generates the report is elegantly intuitive, providing aviation analysts with animated graphical displays of flight pattern clusters and an array of graphs that can be easily compressed or expanded for time phases so that the **user can pinpoint the exact moment and details of interest during an atypical flight**.

The Morning Report represents a paradigm shift in thinking about aviation safety. Previously, recorded flight information was only useful under two circumstances: a catastrophic accident, which warranted post-mortem analysis of the data (from the black box), and to monitor pre-defined situations that aviation experts might choose to program (from the existing ground stations). With *The Morning Report*, airlines can now evaluate conditions on a wide variety of flights and have the ability to isolate specific occurrences or practices that may not be unsafe in and of themselves, but could indeed be precursors to unsafe conditions.

The Morning Report's software and algorithms are being **adapted to monitor the electric power grid. It can be extended to other domains** (such as cyber security, U.S. customs, and the Space Shuttle program).



The user can drill further into the data of any portion of any flight to view hundreds of other variables. These data can be expanded or condensed over time to pinpoint the exact moments of interest.

ABOUT PNNL

Pacific Northwest National Laboratory is a Department of Energy Office of Science national laboratory where interdisciplinary teams advance science and technology and deliver solutions to America's most intractable problems in energy, national security, and the environment. PNNL employs 4,000 staff, has a $855 million annual budget, and has been managed by Ohio-based Battelle since the Lab's inception in 1965.

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