

Aging Aircraft Airborne Data Monitoring Systems

Many of today's large and small commercial transports are being flown beyond their original intended service lifetimes, and the only feedback the FAA and the airframe manufacturers get from current U.S. air carrier operators is the number of flight hours and landings.

This information defines the pressurization cycles and, thus, the major loads on the pressure hull. The loading history of the rest of the aircraft, wing, tail, flaps, controls, etc., which is dependent on flight operations, is assumed or estimated by approximate methods that are rarely substantiated by actual measurements. In addition, deregulation, advances in technology, and the increased demand for and quantity of air travel have significantly modified how commercial aircraft are being flown.

Because this current practice of flying commercial transports near or beyond their original intended service lifetimes is a trend which is likely to continue into the foreseeable future, a need exists to acquire usage information describing the loading history of the entire aircraft. In addition, without large amounts of new service history usage data, the design criteria for future generations of aircraft cannot be reliably determined.

The Code of Federal Regulations, Aeronautics and Space, Airworthiness Standards are replete with loads criteria much of which were generated prior to deregulation and in some cases prior to the design of both wide-body and fly-by-wire civil aircraft. With the existence of this new technology, newer operating rules and practices, and the anticipation of double the



air traffic within ten years, a need exists to collect large amount of in-service loads data to characterize current usage of both large and small civil aircraft.

The Flight and Ground Loads Program Area has two major elements: the measurement and analysis of flight loads and the measurement and analysis of ground or landing loads. The activities under way in flight loads includes acquiring and publishing data from the limited number of prior loads data collection surveys, as well as installing flight load recorders on selected large and small civil transports to determine flight profiles and in-service load usage information.

The civil transport aircraft flight loads data collection program has been re-established for both large and small transport aircraft. Some recent accomplishments include:

- Purchase and installation of a prototype optical disk ground station.
- Completed technical report summarizing 900 hours from USAir B-737 aircraft.
- Purchase of 12 Optical Quick Access Recorders for installation in USAir B-737/400 and Alaska Airlines MD-82 aircraft; over 25,000 hours of new data have been collected to date.



- Purchase of a Flight Data Replay and Analysis Ground Station for each airline.
- Development and purchase of six solid-state recorders for commuter flight loads survey.
- Installation of a lightweight, low-cost small airplane flight loads monitoring recorder.

In addition, the FAA Technical Center will also establish state-of-the-art flight loads data collection and structural loads monitoring systems to provide large quantities of typical in-service usage history data to support the regional/commuter structural life assessment and extension programs. This research consists of the following tasks: (1) installation of 12 solid-state recording systems in the regional/commuter airline fleet; (2) development of a lightweight, low-cost flight loads data recording system for small aircraft, which can be used to provide in-flight service usage history from which manufacturers and operators can formulate more reliable inspection programs; and (3) software to calculate FAR 23 structural design and fatigue loads from an airplane's basic geometric, aerodynamic, and mass data.

The FAA is conducting a series of video landing parameter surveys at high-capacity commercial airports to acquire a better understanding of typical contact conditions for a wide variety of aircraft and airports as they relate to current aircraft design criteria and practices. As the first step in this research, the FAA, teamed with the US Navy, developed and tested a four-camera video landing parameter survey system designed to record aircraft landing in operational conditions. The system is

designed to be installed at an airport without interfering with the airport's normal operation. To date four such surveys have been completed at John F. Kennedy International Airport, Washington National Airport, Honolulu International Airport, and London City Airport in the United Kingdom. The photograph shows one of the four video cameras recording an aircraft as it touches down. Video landing loads surveys are planned each year for the next five years. Presently, a video landing loads facility is being established at the Atlantic City International Airport to collect landing usage data which will characterize both fair and poor weather operations.

Other aircraft loads research is being conducted in support of the FAA National Resource Specialist (NRS) on Flight Loads and Aeroelasticity. Some of this includes developing statistical discrete gust loads criteria, developing a definition of the operational conditions prone to asymmetric buffet loads, deriving the proper sampling rate for control parameters on the digital flight data recorder, and other research as proposed by the FAA NRS.

To find out more about the Aging Aircraft Flight and Ground Loads Program, contact:

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