

## 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.**

The Federal Aviation Administration has re-established a flight loads data collection program for civil aircraft. The initial phase of the research consisted of the acquisition and publication of a substantial quantity of data, which had been previously collected yet not published. Data collected by NASA on large transports was analyzed and published; this included usage information of the B-727, B-747, DC-10, and L-1011. Similarly, NASA has also collected usage data not yet published on over 70 general aviation airplanes, both single and twin engine on wing. These data were also analyzed and published. European data on the usage of the F-27 and F-28 were similarly acquired, analyzed, and published.

The second phase of the research included taking advantage of newer technologies and improving and enhancing both the data acquisition and analysis process. Included in this research were improved and simplified methods of analyzing and reporting gust loads, newer processes of separating gusts from maneuver accelerations, and new methods to experimentally determine aircraft landing parameters from video image data. A user's guide for FAR23 loads was developed, which provides the technology to the small aircraft industry to predict aircraft loads from simple airplane geometry. Formal publications exist which document the research described above.



The third and most important phase of the research, which is still ongoing, consists of the acquisition of new flight and landing load usage data for a wide variety of airplane models in typical usage environments. Digital Flight Data Recorder (DFDR) information for large transports was acquired by use of high-density Optical Quick Access Recorders. The B-737 model was the first model instrumented followed by the MD-82, B-767, and A-320. Major aircraft types were involved including twin engine on wing, twin engine in rear, wide bodies, and airplanes with digital flight controls. Also included were data from the three major manufacturers: Boeing, Boeing-Douglas, and Airbus. Two data reports describing B-737 in-service usage and one on the MD-82 were published. In FY00, a B-767 data report is expected to be published and the A-320 data collection and analysis will commence. Three different airlines are cooperating by providing data for subject research.

Data from small airplanes are also being collected. Special loads recorders were installed on eight Cessna-172 airplanes and data is presently being processed and analyzed. BE1900D DFDR data was offloaded and 900 flights were processed and analyzed. A draft report is available, and newer recorders are being installed on BE1900Ds. The Canadair Regional Jet



airplane is being added to the program in late FY00. Again, coverage is made for both turboprops and jets used in regional service and data from a highly popular general aviation Cessna-172 is being acquired and analyzed.

Airplane sinkspeed data has been acquired from video-landing surveys at high activity airports. Surveys have been conducted at JFK International, Washington National (DCA), Honolulu International, London City, and Philadelphia International Airports. Data reports for JFK and DCA have been published and reports for other surveys will be forthcoming. A permanent video landing facility was established at Atlantic City International Airport, New Jersey. Landing data from this facility was used to verify video survey data accuracy by comparing the data to the results from a Boeing flight test MD-90 airplane equipped with an advanced Internal Navigation System. The facility will also be used to collect landing data during both good and inclement weather conditions on an ongoing basis.

In-service data collection will continue for quite some time, however, the final phase of the research involves the conduct of special advanced studies on aircraft loads. Research has been conducted or initiated on the following areas: asymmetric buffet, statistical discrete gusts, time-phased vertical and lateral gusts, landing gear ground turning conditions, control system modification to reduce aft fuselage turbulence accelerations, and the conduct of a review of the continuous turbulence model.

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

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