Challenge:
Structural integrity monitoring of airframes in heavy airtanker fleet.

Products Used: nCode Automation

Customer: U.S. Forest Service

Summary:
A challenging aspect to wildland firefighting is managing the array of large airtankers and the array of helicopters that work to support the ground firefighters. In 2004, the National Transportation Safety Board (NTSB) informed the Forest Service that they were responsible for the airworthiness of the heavy airtankers instead of the contractors with FAA oversight. With the need for more structural integrity monitoring of the airframes in the heavy airtanker fleet, the Forest Service used nCode Automation from nCode International to help them do just that...

Project Background
Despite reductions in fuel loading and fire prevention efforts on the ground, forest and rangeland fires are a part of the natural role of ecosystems across the country. Wildland fires occur between January and October, from Florida across to California. Tens of thousands of acres of wildlands can be consumed, placing firefighters and communities at risk and often resulting in losses to treasured watershed and local economies. The U.S. Forest Service along with the Department of the Interior land management agencies and the States are charged with first preventing and then managing fires. Aircraft play a strategic role in this plan: from the safe deployment of Smokejumpers and Helitack crews, through aerial reconnaissance and fire intelligence gathering, to aerial delivery of fire retardant and water. The Forest Service owns and operates about 44 aircraft and contracts for over 800 fixed wing and helicopter aircraft annually.

The very nature of the firefighting flight plan is outside the normal design envelope for most point-to-point aircraft and can impart significant operating loads on the airframe. This is an ongoing concern when the aircraft used in such missions, in this case heavy airtankers, are typically aging P3 Orions and P2V Neptunes that entered military service over 20 years ago. In recent years there have been catastrophic failures that lead to aircrew fatalities. In following the NTSB recommendations of 2004, the agencies implemented an airframe operational loads monitoring program to understand the range and severity of loads on these aircraft.

U.S. Forest Service Implements nCode Automation
The Forest Service used a data acquisition system to measure operating loads and aircraft status data on each mission and an nCode Automation monitoring system from nCode to automatically handle the data transfers, manage the massive amounts of raw data, process and intelligently disseminate the data, and to produce reports on request.

During the mission, a lot of data are recorded; typically measurements of acceleration, airspeed, flap positions, landing gear positions and a GPS reference signal. Mission data is sent to the Forest Service by the aircraft operators, with routinely kept records of fuel and retardant load, takeoff time and airport to complete the record. This information is safely archived in nCode Automation (based in a server farm in Boise, Idaho) which already fulfills a NTSB recommendation – the data cannot be lost, overwritten or otherwise corrupted, while audit trails now track who does what and when to this resource.
One of the key aspects of setting up the nCode Automation system was to ensure that the data processing and upload was streamlined to support the Forest Service’s unique requirements. Data is coming from all over the country through operators that need to concentrate on their firefighting support task. Because of the remoteness of some bases, mailing the complete data to the Forest Service was considered the most effective and reliable method. It also simplified the workload of the pilot.

nCode worked closely with the Forest Service and the hardware supplier to then automate the analysis process. Each mission is now extracted, checked for validity and automatically loaded into nCode Automation. During the upload, the data is analyzed to find all identifiable maneuvers and their maximum loads. As a result of this effort, an entire set of missions is now uploaded in a few minutes.

nCode Automation is more than a web-enabled data repository. It now allows authorized users to login and access copies of the raw data, and to even process the data itself. For example, a typical application could be to search the records for maneuvers, looking for peak loads or trends.

**Extending The System**

The next step is to intelligently reduce the raw data into something that is of direct relevance. An automated analysis process is being implemented in a second phase to establish maneuver exceedence reports that describe the load distribution for the fleet.

The data will be used by a number of universities and consultants to establish operational guidelines and to correlate flight loads with a number of other environmental factors. Airtanker contractors will also have access to this kind of data for the first time. Bob Roth indicated that contractors play an important part in the data delivery process and they will be looking to learn what the data can tell them about their operations.

According to John Nelson, Forest Service Aviation Management Specialist, “nCode's nCode Automation is well-suited to what we were looking for. It was easy to set-up and get going, and has made our work so much easier. For the last few months we've been processing the airframe data just as we hoped.” The Forest Service system uses commercial off-the-shelf components such as Oracle and JBoss Application Server technology to implement nCode Automation. The current system is configured for five concurrent users but is easily expanded as the usage grows.

**About HBM nCode products**

nCode products are provided by HBM, a world-wide technology and market leader, offering products and services across the entire measurement spectrum, from virtual to physical. For over 25 years, nCode has been the leading brand for durability and data analysis solutions. Its technologies aid customers understand product performance, accelerate product development and improve design. The company’s Product Lifecycle Performance portfolio comprises tools which enable data acquisition in the harshest environments, analysis of the most complex test data sets, and optimization of product durability. The power and ease of use of HBM technologies is a direct result of its world-class development process, expertise and in-depth experience of a broad range of industries. nCode product development is ISO9001 certified. Product support is available through nCode offices in Europe, North America and Asia. For more information, please visit www.hbm.com/ncode.