iGPS receivers incorporated into probe stay within reach of the transmitters surrounding the aircraft.

NEED FOR CONSISTENT DAMAGE INTERPRETATION

Aircraft incur structural and other damage from a variety of sources. Currently, aircraft damage is detected through visual inspection or through the aid of handheld, non-destructive inspection devices. Regardless of the inspection method, capturing exact damage location and spatial orientation is critical for determining effects on aircraft capability and accurately cataloguing damage for future reference. Typically, hand measurements are taken relative to structural features such as fasteners, doors and panels are then manually noted and archived on paper. The use of photographs and tape/caliper measurements makes this practice inaccurate, labor intensive, and incompatible with digital data-processing requirements.

To improve the speed and quality of aircraft damage inspection procedures, SURVICE Engineering Company, based in Belcamp, Maryland, researched potential technology enabling solutions. The expertise and experience of the company’s metrology group SURVICE Metrology identified Metris iGPS as the metrology solution that is suitable for inspecting aircraft surface damage. “The principal asset of Metris iGPS is the capability to create a local, GPS-enabled environment using two or more iGPS transmitters,” Mark Butkiewicz, manager of SURVICE Metrology, explains. “In this large-scale environment, iGPS technology allows the location of aircraft damage to be determined instantly. By pinpointing a particular damage location with the tip of a measurement probe that incorporates iGPS receivers, the 3D coordinates of the damage location are acquired on the spot.”

METRIS IGPS RECOGNIZED AS THE RIGHT TOOL FOR THE JOB

The aircraft damage solution is associated with a funded R&D contract. Aircraft inspection personnel need a robust solution that is easy to operate, practical to carry around, and based on a large inspection volume that can cover aircraft measuring 20 by 20 meters. Successfully proof tested in a major aircraft program, the technical capability of commercial, off-the-shelf Metris iGPS hardware coupled with software developed by SURVICE Engineering Company confirms valid measurement and provides a controlled digital data flow, regardless of indoor or outdoor use.

Through the use of custom software, data is immediately translated, overlaid onto the aircraft CAD model, and made available to various analysis tools for real-time processing. “The ability to use the Metris Software Development Kit (SDK) to dynamically interface with the iGPS hardware and develop custom solutions for our clients is one of the key elements that have led to the success of this program,” states Mark Butkiewicz.

To begin the process of locating damage, an inspection officer sets up the iGPS system near the aircraft. After
Mark Butkiewicz, Manager of SURVICE Metrology

"ONE CLICK ON THE METRIS IGPS PROBE BUTTON IS SUFFICIENT TO TAKE A MEASUREMENT, ACQUIRE THE 3D COORDINATES, AND VISUALIZE THE LOCATION ON THE DIGITAL AIRCRAFT MODEL."

Mark Butkiewicz explains: "The system is truly portable and entirely battery operated." It includes two environmentally sealed Metris iGPS transmitters mounted on tripods. The inspection officer operates the lightweight touch probe unit (including Metris iGPS receivers) and wears a dedicated belt equipped with iGPS peripherals to wirelessly stream geometric data to a laptop computer. One click on the probe button is sufficient to take a measurement, acquire the 3D coordinates, and visualize the location on the digital aircraft model. The system robustly operates inside aircraft hangars as well as on flight lines, carrier hangar decks, and forward deployed areas. We are intimately familiar with Metris iGPS, since we successfully used it at diverse, remote locations, with weather conditions ranging from hot desert to subfreezing temperatures.

More transmitters can be added to increase the size and accessibility of the GPS-enabled area, and multiple operators can run probe measurements simultaneously to compress inspection time. Using a set of extensions, the probe can be lengthened up to approximately 1.8 meter. Because the sensors are in the aft part of the probe bar, the tip can be placed deep inside the aircraft structure without compromising the signal. As long as the probe sensors are within visual range of at least two transmitters, Metris iGPS is able to perform a valid measurement. In a two-transmitter setup, 1mm (40 mils) precision is guaranteed at 50 meters; in a configuration with more transmitters, accuracy increases to 0.4mm (16 mils). At these levels, the system meets or exceeds any accuracy requirements that might be imposed.

METRIS IGPS PLAYS ESSENTIAL ROLE IN COLLECTING CRITICAL DATA

Measurements showed that the iGPS technology easily meets location, length, shape, and orientation requirements of damage, including scratches, gouges, bubbles, holes, and cracks. For accuracy requirements related to depth, height, and width characteristics of local aircraft damage, however, another form of measurement is required. In the second stage of the funded R&D program - which is now ongoing - Metris K-Scan’s ability to execute laser scans of individual damage items will be evaluated. While the position and orientation of the K-Scan device is dynamically tracked by a portable Metris Optical CMM unit, the handheld K-Scan acquires a detailed scan of the local damage area. The acquired cloud of hundred thousands of points features individual point measurement accuracy of 25 micron (1 mil). From the 3D surface created on the basis of this point cloud, the exact depth, height, and width characteristics of a damage feature can be quickly retrieved.

The second phase of the funded R&D program focuses on further optimizing the aircraft damage inspection solution. "In general, the project team will further streamline system setup, calibration, and alignment through simplified hardware, better user prompting, and more intelligent software," Mark Butkiewicz concludes. "The potential will be investigated to use the Metris iGPS system to improve time-critical damage inspection routines. The iGPS system can be set up and used within this time slot and will be used to help determine suitability for flight. In general, this capability will save time on identification and planning of repairs by quickly providing the needed information in an electronic format suitable for expediting the entire process."