METRIS IGPS STREAMLINES AIRCRAFT DAMAGE POSITIONING AND CHARACTERIZATION

Since the damage inflicted on aircraft can affect structural integrity and/or radar signature, specific aircraft types are inspected to triage damage and define repair actions. To radically improve current manual damage identification practices, metrology specialists from SURVICE Engineering Company are integrating Metris iGPS as the core of a turnkey aircraft damage inspection solution. Metris iGPS, a non-contact, large-scale metrology solution, quickly and accurately acquires locations and characteristics of aircraft damage, both in and outdoors. The spatial coordinates of visual damage being addressed are instantly tracked by Metris iGPS and marked on a digital 3D aircraft model, simultaneously stepping up process accuracy and efficiency.

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."

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iGPS efficiently identifies the precise location of damage inflicted on aircrafts.

- ✓ Instant tracking of spatial coordinates of aircraft damage location
- ✓ Portable solution enabling a 20 by 20 meter metrology area
- ✓ Straightforward integration into turnkey aircraft damage inspection solution
- ✓ Reliable operation under all weather conditions

METRIS IGPS RECOGNIZED AS THE RIGHT TOOL FOR THE JOB

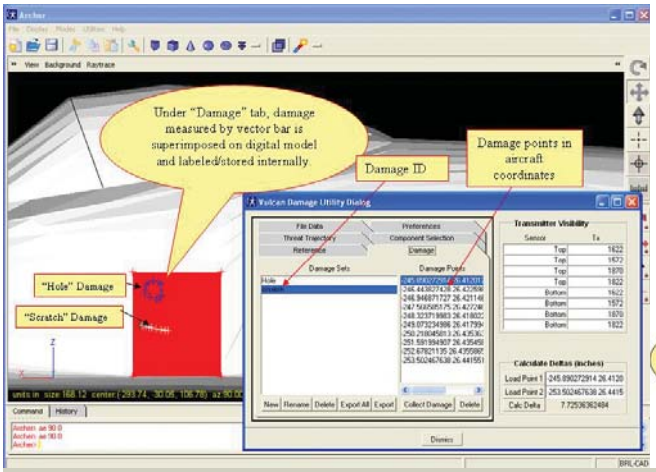
The aircraft damage solution is associated with a funded R&D contract. Aircraft inspection personnel need a robust solution that is easy to operate, practical to carry around, and based on a large inspection volume that can cover aircraft measuring 20 by 20 meters. Successfully proof tested in a major 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.

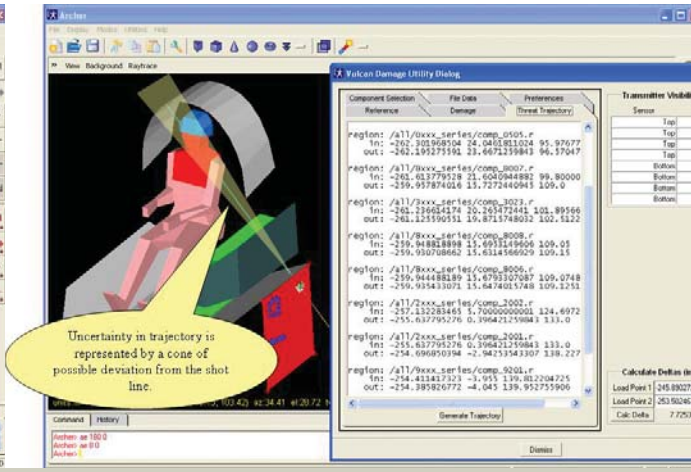
To begin the process of locating damage, an inspection officer sets up the iGPS system near the aircraft. After

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

calibrating the system by using fixed reference points on the aircraft, the software loads the geometric aircraft model and orients this model into the iGPS field coordinate system. Based on triangulation of transmitter signals, the iGPS system determines the location of the probe tip operated by the officer. Any location the officer measures on the aircraft is automatically superimposed to the same location onto the geometric model. Automatic mapping establishes accurate damage cataloguing and helps determine threat trajectory and radar cross-section changes. In this way, details of external damage and the direction of the threat provide useful information regarding potential internal damage.



Any point measured on the aircraft is superimposed to the same location onto the geometric model.



The threat trajectory line indicates which internal aircraft components may have been damaged.

A PRACTICAL SOLUTION THAT EXCEEDS ACCURACY REQUIREMENTS

"The system is truly portable and entirely battery operated," Mark Butkiewicz explains. "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.

"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, Manager of SURVICE Metrology

"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."