

KARL STORZ

All American maintenance

American Airlines is the largest airline in the world and is transforming its maintenance center – part of this involves Remote Visual Inspection

■ Christopher Hounsfield

Serving more than 250 cities in more than 40 countries with a combined network fleet of more than 1,000 aircraft, American Airlines is the world's largest airline. The company, which can trace its roots back to 1926 when Charles Lindbergh flew the mail, has been able to remain profitable even during the most difficult economic times by setting high goals and implementing innovative business plans to achieve them. American's Tulsa Maintenance & Engineering base has become an integral part of this business strategy.

While numerous other airlines are outsourcing maintenance overseas to cut costs, American has kept it in-house, preferring to focus on quality and service. Work at the Tulsa base, the world's largest maintenance facility, is done on American's fleet of MD-80, Boeing 757, 737 and Airbus A300 aircraft. Overhaul work is also conducted on the Pratt and Whitney JT-8, GE CF6 and CFM-56 engines.

American's strategy is to transform the Maintenance and Engineering Center into a profit center. This is being achieved through American's highly successful 'continuous improvement' process to reduce costs, generating revenue from third-party maintenance contracts, and bringing in-house any currently outsourced work that can be accomplished more efficiently in one of their three overhaul facilities.

This past year, American Airlines has made tremendous strides at the Tulsa facility, as well as at its two additional overhaul maintenance bases located in Fort Worth, Texas and Kansas City, Missouri. From increased efficiencies to numerous cost-savings initiatives, American Airlines' maintenance and engineering employees have succeeded in reducing costs and making Maintenance, Repair

and Overhaul (MRO) improvements to become a competitive MRO provider.

Expanded inspection services

One of the most successful initiatives of the program has been the expansion of American's inspection services. American Airlines Engine Quality Assurance group offers many downstream opportunities. The engine shop is a one-stop shop for engine maintenance with full capabilities to support on wing maintenance as well as overhaul and repair for many engine components and parts. In order to upgrade and broaden their inspection service capabilities, American Airlines purchased state of the art Remote Visual Inspection (RVI) equipment after an

extensive evaluation of the world's leading borescope manufacturers.

During the selection process, American Airlines Engine Quality Assurance group set specific criteria. The instrument, critical to the inspection process, needed to be portable, operate on wing or in the shop, be intuitive, flexible and produce extremely reliable inspection and measurement data. Above all, it had to meet American's goal of continuous improvement by adding to the quality and efficiency of the inspection services provided by the Tulsa maintenance facility.

After its capabilities were shown to meet and exceed the requirements set forth by American Airlines, the TechnoPack X by Karl Storz, a portable, fully digital remote visual inspection

1. American Airlines is making its maintenance center a profit-making enterprise



system with LaserTrue™ measurement, was selected. "The TPX enables our inspectors to quickly and accurately perform engine inspections with precise measurement of any internal damaged components" said Ashraf Naqvi, quality assurance supervisor. "Repeatability of results is what impressed us. When two or three inspectors perform the same inspection and get the same outcome, you know you can trust the equipment."

The TPX proved to be easily set up and operational. When the lid of the case is opened, the monitor with keyboard and touchpad raise into position. Everything, including the videoscope, fiberoptic or borescope, is already connected so the inspector simply turns on the power, inserts the scope and begins the inspection. The system operates on AC as well as an internal DC battery power with a built-in recharger.

Designed with the user in mind

The TPX features a combination CCU/light source that provides inspectors with a familiar, easy-to-use interface offering broad compatibility with a large selection of off-the-shelf hardware and software. It has a fully digital platform and operates Windows XP on a Pentium™ 1.1GHz Intel chip. The TPX has a variety of configurations. It offers extensive image/data management and communications capabilities, including wireless remote control, whether it is used in the case, as a standalone unit or in a backpack. These capabilities include over six and half hours of MPEG 2 digital video storage and playback and AVI (audio) with text annotation for documentation.

Brightness sensitivity can be enhanced up to 60X via a user-adjustable gain setting and remote digital integration. An Instant Recognition (IR) feature of the digital processor identifies the videoscope or camera attached and automatically adjusts to maximize image quality.

The self-contained light source features a manual shutter and an interchangeable 50W/24W metal-halide lamp module that enables inspectors to maximize battery life by switching lamp modules as needed.

Higher resolution equals more accuracy

One essential capability required by American Airlines was an accurate, repeatable, and easy to use measurement system. Measurement has increasingly become the critical factor for evaluating current conditions and trend monitoring in remote video inspection.

The reliability of RVI measurement results is greatly influenced by the sharpness and clarity of images (image resolution) available to inspectors. Furthermore, image resolution is determined not only by the physical (optical) resolution that is captured by the scope, but also by the screen resolution that is displayed for inspectors to view.

To deliver the highest measurement image resolution possible, Karl Storz incorporated two important design features into the TPX system. First, the videoscope itself transmits a larger, higher resolution image to the TPX processor. The laser true measuring system does this with a single, full field ccd image for measurement that is presented by an optical tip with a high performance aperture and field lens eliminating light loss.

Secondly, the measurement image is displayed on a large, high-resolution LCD. The measurement is inherently more accurate, as cursor and displayed pixel resolution remain at their maximum, allowing the inspector to precisely identify the critical points on a defect. This full screen also presents a larger image for viewing and evaluation, reducing the eye strain and fatigue typically associated with multiple inspections or detailed analysis.

Simple, accurate measuring of defects

Measuring a defect with the TPX is an easy, two step process. After inserting the scope, the operator follows normal inspection procedures. When a questionable area is located, the operator turns on the measurement system, which automatically projects the laser through the scope onto the work piece. A single button actuation freezes and archives the image. The inspector may now position the cursors for immediate on-line measurement, or continue inspecting while maintaining a perma-



2. Inspection and overhaul services for engines is a 'one-stop-shop'

3. The digital TechnoPack X is fully portable

ment record for off-line measurement later. This is accomplished without the necessity for a tip adaptor change.

"This was especially useful for us," said Ashraf. "Not having to change scopes or tips during an inspection and then relocate the defect to make a measurement saves us a lot of time, and seeing the measurements on the full screen improves our accuracy making it easier to reach a decision."

Inspectors at American's Tulsa maintenance base also have a selection of measurement options, including distance (point-to-point), depth, area, cumulative (line) and line-to-point. They can store measurement data with the images and add audio, text and graphic annotations to live or stored images. They can also retrieve, re-measure and email stored images at any time. In addition to this, they can use the same measurement and evaluation software program on a PC.

Inspectors are also able to use a two-point laser measurement mode of the system as a Go/No-Go comparator for fast, on-screen evaluation. By using the known width between the two points, inspectors can pre-screen defects to determine if they meet allowable tolerances, often eliminating further analysis immediately. Multiple measurement techniques offer additional flexibility and cost saving benefits.

Storage capability was another important capability American considered when they selected their video-scope inspection system. They realized that in order to market their inspection services to other airlines, numerous images and videos of all sizes would have to be archived for documentation, comparison and trend analysis. They also saw that Karl Storz had designed the TechnoPack X to provide maximum storage and transfer capabilities. Four USB ports allow inspectors to utilize off-the-shelf USB devices, such as plug and play thumb drives, floppy disk drives and PC card readers. There is also a built-in 20 GB hard drive, a CD/DVD read/write drive (burner) and a high-speed Ethernet connection that allows inspectors to quickly and easily access, exchange, and virtually move data, including live transmission to a remote site via a standard internet URL.

Viewing images in comfort

Inspectors using the TPX are able to comfortably view images under different site conditions. A built-in, high-resolution 12in big screen monitor allows more than one inspector to view the images from greater distances. The same 12in monitor can be used when the TPX is deployed as a standalone unit. There is also a 7in LCD high-resolution monitor for remote viewing. This monitor can either be attached to the handle of the videoscope or remotely placed in the most convenient viewing location.

The control system is also designed to make things easier for aviation inspectors. When the case is opened, a built-in full-size QWERTY keyboard with pointer and mouse springs into position. Built-in control buttons on the videoscope give the inspector full remote control of the TPX. When it is used as a field or desktop unit, an integral membrane keyboard with touch pad and hot keys provides the same control functions. The wireless mouse can be used for remote operation.

Videoscopes

Karl Storz is a manufacturer of RVI equipment throughout the world. Karl Storz videoscopes are available in diameters from 3.8mm to 8mm and 2m to 7.5m working lengths (custom lengths are available). Videoscopes are offered with tungsten braids for enhanced durability in demanding environments. Standard products feature a full, four-way articulation range that exceeds 180° degrees and permits 360° coverage of the area to reduce inspection time.

Manual articulation gives inspectors tactile fingertip control of the scope. This eliminates backlash or overshoot and bending ceases when pressure on the control is released. Furthermore, the tactile feedback allows the inspector to immediately detect obstacles or any resistance to the progress of the probe. There is also a wide selection of interchangeable tip adaptors that enable one scope to do the work of several. These tips include direct- and side-viewing, magnifying, near, and far-focus. The dual-purpose tip adaptors, most common in aviation for their value and simplicity of use, provide a full screen image for simultaneous general inspection and measurement.

4. The system is equipped with a QWERTY keyboard



The TPX operates with all Karl Storz scopes as well as other manufacturers' borescopes and fiberscopes. The Telecam™ CCD camera attaches to the eyepiece of the borescope or fiberscope and displays the live full screen image on the TPX.

"This was a cost saver for us with our extensive inventory of borescopes and fiberscopes" said Ashraf. "By being compatible with our current instruments the TPX can be used in many more applications without our having to purchase new equipment." ■

5. Inspectors can use a two-point laser measurement mode



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