

By Ian Harbison

The New Technology of NDT

Specialized NDT in the engine shops at FL Technics covers turbine blades, disks, and other critical engine components. FL Technics image.



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on-destructive testing (NDT) has always had an important role to play in aviation production and maintenance. It has had to adapt to examine new materials and processes but has also developed technology to improve fault detection and analysis. Ian

Harbison reports.

As well as basic visual inspection by eye or with magnification, there are a number of other techniques in common use to inspect a variety of components in a range of different materials.

MPI

Magnetic Particle Inspection (MPI) generates a magnetic field inside the component, which must be made of ferromagnetic materials. Magnetic particle powder is applied to the surfaces which is attracted by the magnetic flux leaking through any defects. This makes it easy to spot surface problems, such as toe cracks, crater cracks as well as areas of porosity in castings, shafts, and welds.

DPI

Dye Penetrant Inspection (DPI) service is used to detect casting, forging and welding surface defects such as hairline cracks, toe cracks, crater cracks, as well as surface porosity, leaks and fatigue cracks. The components, such as shafts, castings, and welds, along with machined small components, are coated with a dye and then illuminated by white light or UV light, for which a fluorescent dye is used. It is generally used on non-ferromagnetic materials.

Ultrasonic Testing

Ultrasonic Inspection (UT) uses ultrasonic waves to scan for flaws, delamination or other discontinuities in materials like composites and aluminum, or to measure thickness in a wide range of materials and applications. It can measure internal defects in most materials and is also useful for inspecting forgings, castings, and structural steel welds. It can also be used to scan for collision damage or to carry out post-repair surveys.

A development in ultrasonic inspection is Phased Array testing. A disadvantage of conventional methods is that the ultrasound source has to be moved manually around the component. Using a phased array means the sound direction can be steered electronically, reducing the survey time.

Radiography

In radiography, the component is placed between a gamma or X-ray radiation source and a detector holding photographic film. The rays pass through the component and an image is imprinted on the film. When processed, the image will show any internal defects.

A development here is computed tomography, which rotates X-ray beams around the test article to generate a series of detailed images. Advanced reconstruction algorithms then compile the images into a highly detailed 3D model that can be used to detect internal flaws such as voids, cracks, and inclusions.

Just as there is a range of techniques, there is a range of OEMs and end users.

FL Technics

Ovidijus Rucinskas, head of NDT at FL Technics, says a variety of techniques are used across the company's activities. Comprehensive inspections are routinely carried out during scheduled heavy maintenance checks, while line maintenance uses on-wing

inspections for in-service aircraft, addressing immediate airworthiness concerns.

Specialized NDT in the engine shops covers turbine blades, disks, and other critical engine components and the component shops use magnetic particle and dye penetrant inspections for crack detection, for wheels and brakes, for example. FL Technics has the capability for eddy current

testing, ultrasonic testing, magnetic particle testing, penetration testing, thermography testing (water ingress method) and engine and APU borescope inspection (B1 rating) as part of its base maintenance capabilities in several locations.

It provides services for operators, MROs and leasing companies. Services can cover one-time or periodic inspections, fleet-wide support or long-term maintenance agreements. The company can also dispatch teams within 24 hours to a client's chosen location globally to provide any type of NDT service.

As NDT is not only used in aviation, but in rather a lot of other industries, he sees that aviation does not evolve as quickly as other sectors might. It takes rigorous testing and evaluation to get approval for new NDT techniques from the regulatory authorities. In fact, approval is required from every authority that FL Technics is involved with, such as EASA, U.K. CAA and Bermuda.

As materials evolve, NDT equipment has also advanced to meet OEM-prepared procedures, ensuring compliance and improved accuracy. New techniques such as computed tomography (CT) scanning, laser ultrasonics, eddy current array and others are being developed. However, these are primarily used in



Ovidijus Rucinskas,
FL Technics

FL Technics can do eddy current testing, ultrasonic testing, magnetic particle testing, penetration testing, thermography testing (water ingress method) and engine and APU borescope inspection (B1 rating) as part of its base maintenance capabilities in several locations. FL Technics image.



Ben Linke,
Waygate Technologies



the manufacturing process rather than in maintenance. In maintenance, traditional ultrasonic, eddy current, magnetic particle testing and penetrant testing remain the primary methods.

Waygate

Ben Linke, CEO of Waygate Technologies, says aerospace non-destructive testing (NDT)

accounts for 30% of the company's business with a 50/50 split between MRO and manufacturing. Other sectors include space exploration, automotive, rail, electronics, battery, and research and development. It offers ultrasonic, radiography and computed tomography (CT) solutions for aerospace, as well as visual inspection systems (RVI).

The company works with various key stakeholders in the market to effectively modernize the industry. Waygate Technologies has signed a joint technology development agreement (JTDA) in 2023 with GE Aerospace to develop software and hardware inspection solutions for commercial aircraft engines. It has also been partnering with Rolls-Royce to develop the so-called Intelligent Borescope to inspect high-pressure turbine (HPT) blades.

The Intelligent Borescope uses Waygate Technologies' Mentor Visual iQ+ video borescope, which has two-way communication with Rhinestahl's turning tool and Menu Directed Inspection (MDI) for specific step-by-step instructions to ease the inspection workflow and standardize data.

In both cases, the applications are powered by AI – the aim is to avoid the traditionally labor-intensive and time-consuming processes that generate inconsistent data that can result in repeat inspections and, more importantly, can see engines removed prematurely for maintenance, causing unnecessary expense for operators.

By using high-resolution, templated imaging systems that capture detailed visuals of the HPT blades during inspections and combing them with AI-powered algorithms to subsequently analyze the images, even the smallest amount of wear and tear can be quickly identified. The data is then easily and immediately accessible in a cloud to enable accurate maintenance decisions and optimize the time-on-wing of the engines. The imagery can also be used to develop repair schemes to return the blades to optimum aerodynamic efficiency.

He points out that HPT blades are subjected to temperatures of 1600°C and extreme centrifugal forces. With engine OEMs pushing for even higher operating temperatures for greater efficiency, and increased pollution causing more blade erosion,

With Powerscan HE, Waygate Technologies owns one of the most powerful industrial CT scanners in the world to inspect large high-density parts and additive components in aerospace. Waygate image.

regular checks will become even more important.

A newer application of computed tomography is scanning components produced by additive manufacture. This is the only way that any voids in the material can be detected, caused by problems as material is being laid down layer by layer.

Looking further ahead, in 10-15 years, or 25 years if Airbus concerns about infrastructure are correct, hydrogen powered aircraft will be around. One of the most important checks that will have to be made after construction of composite fuel tanks is to check for micro cracks on the interior surfaces that could lead to leaks. The company is already working on the problem in collaboration with the U.K. National Composites Centre.

Ease of use will also become more important in the future, he says, because of skill shortages. There is a retirement bulge looming so there will be many young recruits coming into the industry. Technology developments can help them get up to speed quickly.

SEAL Aviation

For Jerel Bristol, president of SEAL Aviation Repair Services, NDT is an integral part of the company's fuel leak and structural repair services. These can be carried out at its facilities in Fort Lauderdale and Treasure Coast International Airport in Fort Pierce, Florida, or the company will deploy a team to the customer's



Waygate Technologies' Mentor Visual iQ+ is an advanced video borescope for engine inspection in the market. Waygate Technologies image.



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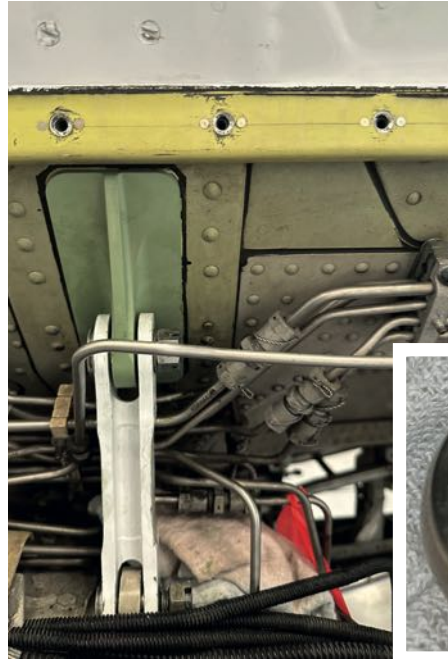
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location to deal with AOGs. Capabilities include radiography, eddy current, ultrasound, bond testing, paint thickness testing, liquid penetrant, magnetic particle and optical prism testing.

These can be applied to a wide range of aircraft, although business jets are a specialty. A recent example of how the different aspects come together was on a Hawker 800A. An inspection found corrosion on the wing link attachment fitting. The company brought along its own jacks, pads and shoring to support the aircraft, as well as installing a temporary wing link to ensure structural rigidity. This type of work usually involves an engineering mechanic and a sheet metal technician, making SEAL Aviation a one-stop shop. The removed link was then tested to determine the level of corrosion and repaired. After this, to determine airworthiness, it is tested again to confirm complete removal of the corrosion and that the remaining thickness of the material is within limits.

Bristol notes that, with more manufacturers using composite materials, the use of ultrasonic testing and phased array testing is becoming more common to find discontinuities such as cracks, delamination and disbonding. **AAM**



Left: Shown here is the corrosion found on the wing link attachment fitting of a Hawker 800A. SEAL Aviation image.

Below: A closer look at the corrosion on the removed link. The piece was then tested to determine the level of corrosion and repaired. SEAL Aviation image.

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FL Technics is a leading global provider of aircraft maintenance, repair and overhaul (MRO) services, specializing in a comprehensive range of solutions such as maintenance, parts and materials supply, technical training, wheels and brakes, engine services, engineering and aerospace logistics. Holding certifications, including EASA Part-145, Part-CAMO, Part-147, Part-21, FAA-145, UK CAA Part 145 and other NAA as well as adhering to the quality standards of ISO 9001, ISO 14001 and EN 9110, their operations extend across hangars in Lithuania, Indonesia and the UK, supported by more than 70 strategically positioned line maintenance stations worldwide.

FL Technics can be reached at:

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T: +370 5 252 5015

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Flawless Flaw Detection with Evident's OmniScan X4

By Joy Finnegan



Aviation Maintenance had the opportunity to see Evident's OmniScan X4 flaw detector in action at a recent trade show. The OmniScan X4 is a portable, powerful solution that offers speed and versatility for detecting flaws and corrosion. The company says the unit can help boost productivity while

increasing confidence in assessment results. The X4 has advanced phased array capabilities, total focusing method (TFM) and phase coherence imaging (PCI) to detect and interpret challenging flaws. Utilizing it can help identify damage earlier, Evident says. We spoke with Evident's Rod Matheson, director, global product marketing NDT and Victor Chumillas Puya, NDT and RVI sales specialist, to learn more about this latest iteration of the OmniScan.

Aviation Maintenance: Tell us about the OmniScan X4 flaw detector.

Rod Matheson: It's really an evolution, both in terms of the

transition from the OmniScan X3, but also in terms of future advancements. We provide quarterly updates of the instrument's software free of charge to our customers. As the demands of the aviation industry expand and there are more requirements in



The Evident OmniScan X4. Evident image.

Faster, more consistent inspections with the D-2060 CE

Inspect parts more quickly and comply with industry standards with an automatic double mag shot, adjustable mag shot timer, and machine repeatability.



certain inspections, this flaw detector will be able to grow and evolve with the customer's needs. What we tried to do with the X4 is to help ensure a simple transition for existing OmniScan users, and customers looking to get on board with the OmniScan X4 can quickly get up and running. It's an advanced flaw detector equipped with the tools they need to help them carry out these critical inspections as efficiently as possible.

Victor Chumillas Puya: It's an instrument that can be used for many applications in aerospace and oil and gas. For instance, it's equipped with phase coherence imaging (PCI) to detect and accentuate historically hard-to-find flaws, including hook cracks and stress corrosion cracking (SCC). With PCI, you can identify individual flaws in areas of many fine cracks and characterize them with certainty. This is particularly helpful in aerospace inspections that require metallic crack imaging and sizing.

AVM: Why is it better than what was available before?

Matheson: It's all about the evolution. It has a more powerful processor on board that makes the software faster and more responsive. It also has one terabyte of storage, which is crucial for large-area scans and handling large data sets.

Technicians want the space to store their inspection data and not have to constantly stop to transfer it. They may have an aircraft on the ground, which as we all know, is a huge cost, and they need to get that aircraft back into the skies. Since downtime is costly, speed and workflow efficiency are critical, it's key that customers have confidence and trust the results, trust that it's reliable. The OmniScan X4 is a ruggedized unit designed to work in challenging and hazardous environments, whether in aerospace or the oil and gas sector.

AVM: It looks fairly user-friendly. Is it?

Matheson: The interface and the workflow are very much something that we've developed over 20-plus years, culminating with the OmniScan X4. I would say that what we have developed here is really something in terms of simplicity and speed for our customers.

Chumillas Puya: Another important contributing factor to its speed is that we offer an OmniScan X4 model that supports a phased array group of up to 128 elements. It enables technicians to achieve much wider coverage with one pass when using a 128-element probe, such as the one in our RollerFORM XL wheel probe. So, this is very interesting because it's more efficient, quicker, and saves time. Its

detection and measurement capabilities help to identify and evaluate the severity of damage before it becomes critical.

AVM: Even though it is powerful, it is also portable.

Matheson: Yes, it's a portable system. If we go back years ago

and look at what phased array systems used to look like, they were much bulkier. Even by today's standards, this is a truly portable system. It's packed with a lot of power, yet it remains a portable solution in phased array.

AVM: Give an example of when the OmniScan X4 would be used.

Matheson: It can be used in many different applications, with a wide portfolio of probes and scanner solutions. A good example in aerospace is wing inspection. We have various accessories, including the GLIDER scanner, that allow the technician to efficiently inspect a large area. Connected to the OmniScan X4, the GLIDER scanner enables the inspector to manually scan a large area of the composite material, acquiring precise 2-axis encoded data of the volume.

Another example is our RollerFORM XL scanner, which is a wheel probe used to inspect composites and other smooth-surfaced materials. You can actually roll it across the component. It gives us a complete visual understanding on the display as well as the data behind that. It helps technicians locate and size defects with confidence. We also offer a vast array of complementary phased array probes to match the type and thickness of the material you need to inspect.

AVM: What would you use the different probes for?

Matheson: It depends on the application. If you're inspecting some sort of complex geometry, for example, you should choose your probe accordingly. Whether it's for a wing, aileron or fuselage, first, you need to understand the inspection requirements, and second, you need to know what the manufacturer specifies for that inspection. If it's an Airbus or a Boeing, there'll be specific criteria. Then we can build a comprehensive solution based on the OmniScan X4 flaw detector and associated probes, scanners, software, and accessories.

AVM: What about training? Do you offer training with the product?

Matheson: Absolutely. Training is one of our key strengths. Evident has a global training network with specialists all around the world. That's huge when you consider the critical nature of aerospace inspections. Whether it's to help you get the best out of the instrument, to support your ongoing calibration requirements, or if your equipment needs repairing, we have repair centers globally as well. Providing a high level of support is very important to Evident. When you invest in an Evident solution, you gain access to comprehensive service and assistance.

AVM: Explain the inspection process.

Chumillas Puya: Before inspecting the part, the user is able to create an overview in the scan plan workflow, assisted by our intuitive application presets. These presets can help speed up the setup and improve the consistency of results. We provide presets for common corrosion and flaw detection applications, and they can be used to help with the setup of some of our industrial scanners, such as the HydroFORM, RollerFORM, or FlexoFORM scanner. Each option provides preprogrammed parameters that can be edited as needed.

After the technician is finished scanning, they can analyze the data on the instrument or export the info and analyze it with PC software, which we also supply to our customers. It is very easy. The instrument helps and, as we said before, the interface of the instrument is user-friendly. We made sure to design an interface that is very intuitive for everybody.



Evident says the OmniScan X4 allows for wider coverage with one pass. Evident image.

Matheson: Phased array detection is based on multiple beams of sound as opposed to conventional ultrasonic flaw detection. Phased array UT enables the technician to get a full visual understanding of the inspected component. And then, we can go in and examine that data in more detail. Using the OmniScan X4 and RollerFORM XL scanner, data is acquired very quickly, whereas if you were using a traditional phased array probe, it takes longer.

Chumillas Puya: So, very quickly, I have the information about the size, I have the information about the thickness and I can also identify the location of the indication.

Matheson: I think it's also worth mentioning our dedicated ScanPlan software. It has the same intuitive user interface and tools as the onboard OmniScan X4 scan plan. With ScanPlan software,



With the ScanPlan software, users can create setups that can then be imported into the device making it easy to prepare. Evident images.

users can create basic setups that can then be imported into the device. ScanPlan software's 2D and 3D views are easy to prepare, and inspectors can take screenshots for reporting purposes. The idea is to speed up the process and give you more flexibility in terms of equipment management.

The OmniScan X4 unit can also be used in collaboration with others; for example, using the Remote Calibration Service. You can use the RCS to communicate via the OmniScan X4 with the manufacturer, sharing information with them or with the line maintenance manager, that sort of thing. The X4 is equipped with cloud connectivity, so you have the ability to share data and collaborate.

AVM: What else should readers know about Evident and the OmniScan X4?

Matheson: It's a brand that's known all over the world. Ultimately, we are about aviation safety, of course, the critical safety of an aircraft, and this touches the entire life cycle of the aircraft. From raw material through manufacturing, to in-service maintenance and even the decommissioning of the aircraft, throughout each stage, the OmniScan X4 can be of service.

We continue to evolve the OmniScan X4 with each MXU software update, so that adds value for the customer, at no additional cost. The instrument's performance will continue to evolve quite literally. We also want to work with aerospace professionals — manufacturers, maintenance organizations and industry experts — to get their insights on how we can further enhance their inspection efficiency. It's a journey, and we're committed to evolving alongside our customers. **AM**



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