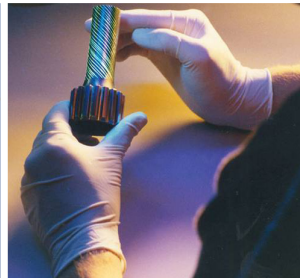


Non-Destructive Inspection



 **Aerospace Vehicles Division**
Structures Testing & Evaluation

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The Non-Destructive Inspection (NDI) group carries out a complete range of NDI services. Assistance is provided to airlines, Air Forces and aircraft component manufacturers. Activities of the NLR include:

- Development and evaluation of new NDI techniques
- NDI of composite and Glare materials
- In-service inspections
- Teardown inspections
- Investigating the reliability of NDI
- Structural Health Monitoring (SHM)
- Quality support (e.g. audits)





The NDI group has specialists (NDI level 3 qualifications) and facilities enabling the development of inspection procedures in many NDI disciplines.

The group activities range from fundamental studies, development of inspection solutions, education and training of NDI personnel to in-service inspections for third parties. All these activities can be carried out in the following phases:

- Inspection after manufacturing
- Inspection during in-service
- Teardown inspection

Visual

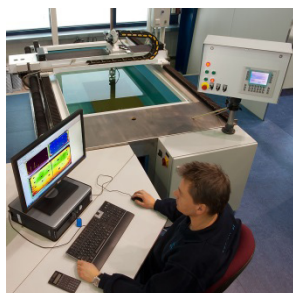
Visual inspection is the oldest, most economical and widely used inspection technique. Difficult accessible areas can be visually inspected with a state-of-the-art video inspection system which enables remote inspection. Test results can be stored on location and sent directly to the customer.

Ultrasonic

After visual inspection ultrasonic inspection (UT) is the so - called "work horse" technique for composite materials. The technique makes use of ultrasonic waves which are in fact propagating mechanical vibrations with a frequency range of about 1 - 50 MHz. Automatic inspection can be carried out with ultrasonic C-scan systems, featuring: 3D geometries, phased array, immersion and squirter mode. Maximum scan size X-4000mm, Y-2500mm and Z-2500mm.



NLR ultrasonic C-scan facilities



Manual phased array

Eddy current

Eddy current inspection (ET) is a primary technique for the in-service inspection of metallic aircraft components. The technique is capable e.g. to inspect longitudinal lap-joints and circumferential butt-joints of a fuselage, but also rapid bolthole inspections are possible.

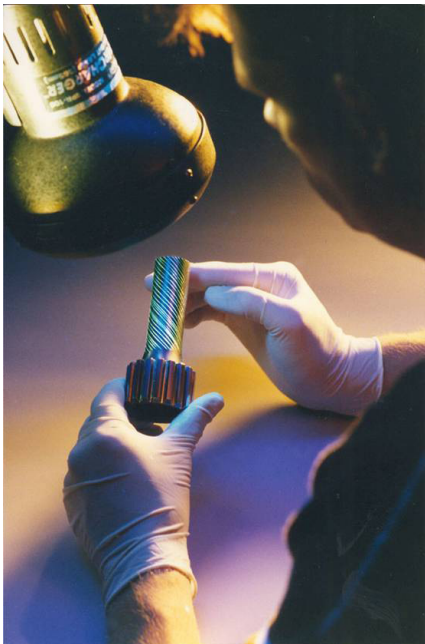


Eddy current rotor inspection

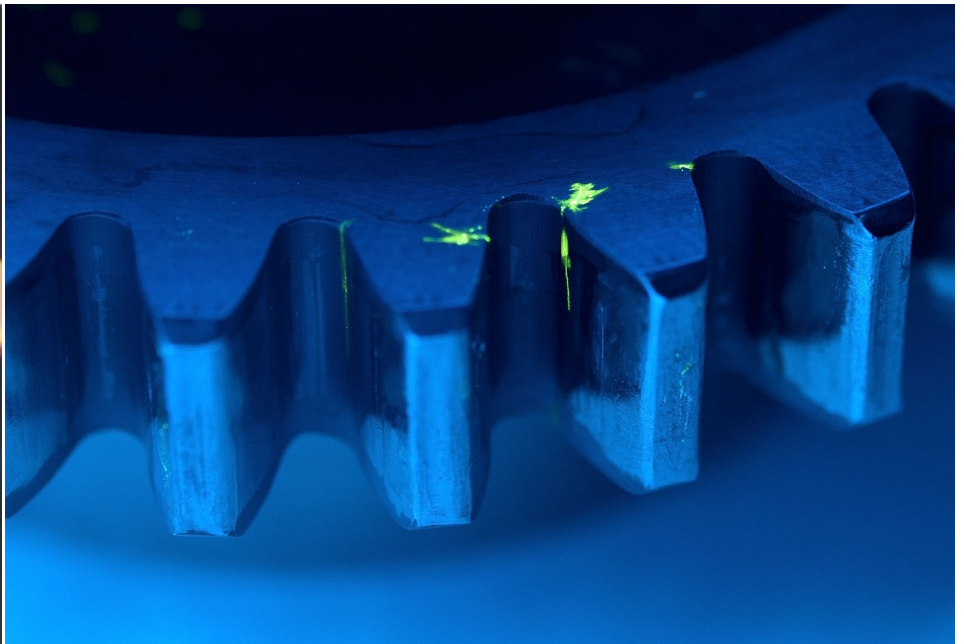


Penetrant

Liquid penetrant inspection (PT) is used to detect small cracks or discontinuities open to the surface which may not be revealed by normal visual inspection. Penetrant inspection can be used on most airframe parts. The inspection is performed by applying a special liquid to the surface. This liquid has excellent capillary action and penetrates into very small defects. A visual indication is then obtained by colour contrast or by fluorescence under black light.



PT indications of torsion cracks



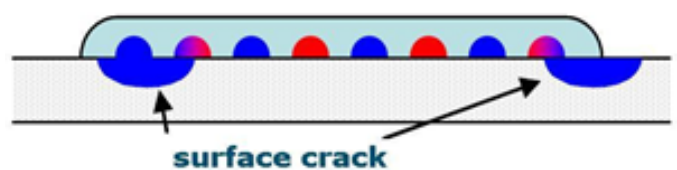
PT indications of gear wheel

Acoustic emission

The acoustic emission technique (AE) is based on the principle that acoustic emissions are generated when defects initiate or grow in a material under stress. Acoustic emission is not a 100 % NDI method but can be considered as a passive monitoring technique for the detection of dynamic defects such as crack growth and impact events.

Comparative vacuum monitoring

Comparative vacuum monitoring (CVM) is a relatively new technique that can be used for monitoring areas of a component where damage is expected to occur. The technique is based on the principle that a small volume maintained at a low vacuum is extremely sensitive to any ingress of air. The working principle is illustrated in the figure below, the red lines represent the vacuum lines, the blue the atmospheric lines.



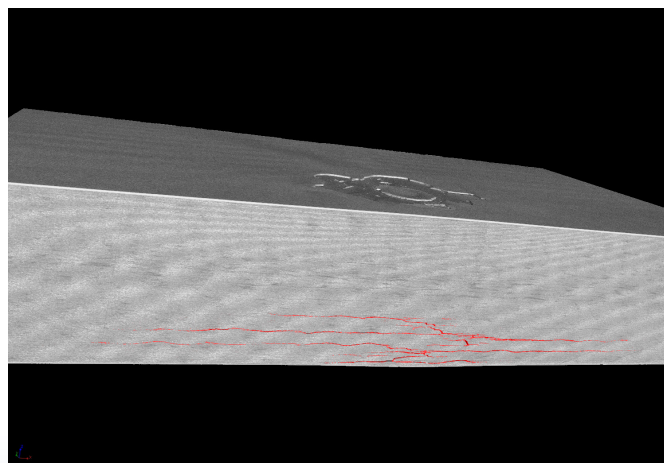


CIVA software

CIVA^{NDE} is a software package that can model ultrasonic, eddy current and X-ray inspection. The simulation of the inspection techniques consists of two modules, a 'Beam Field computation' and a 'Defect response' module.

Additional capabilities / equipment

- Avizo *fire* and *wind* analysis and modelling software for CT-scan data
- Magnetic particle inspection
- Fokker Bondtester
- Portable ultrasonic (conventional and phased array)
- Coating thickness
- Eddy current array
- Conductivity measurements



CT-scan image of impact damage in a composite



Please contact us for more information

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