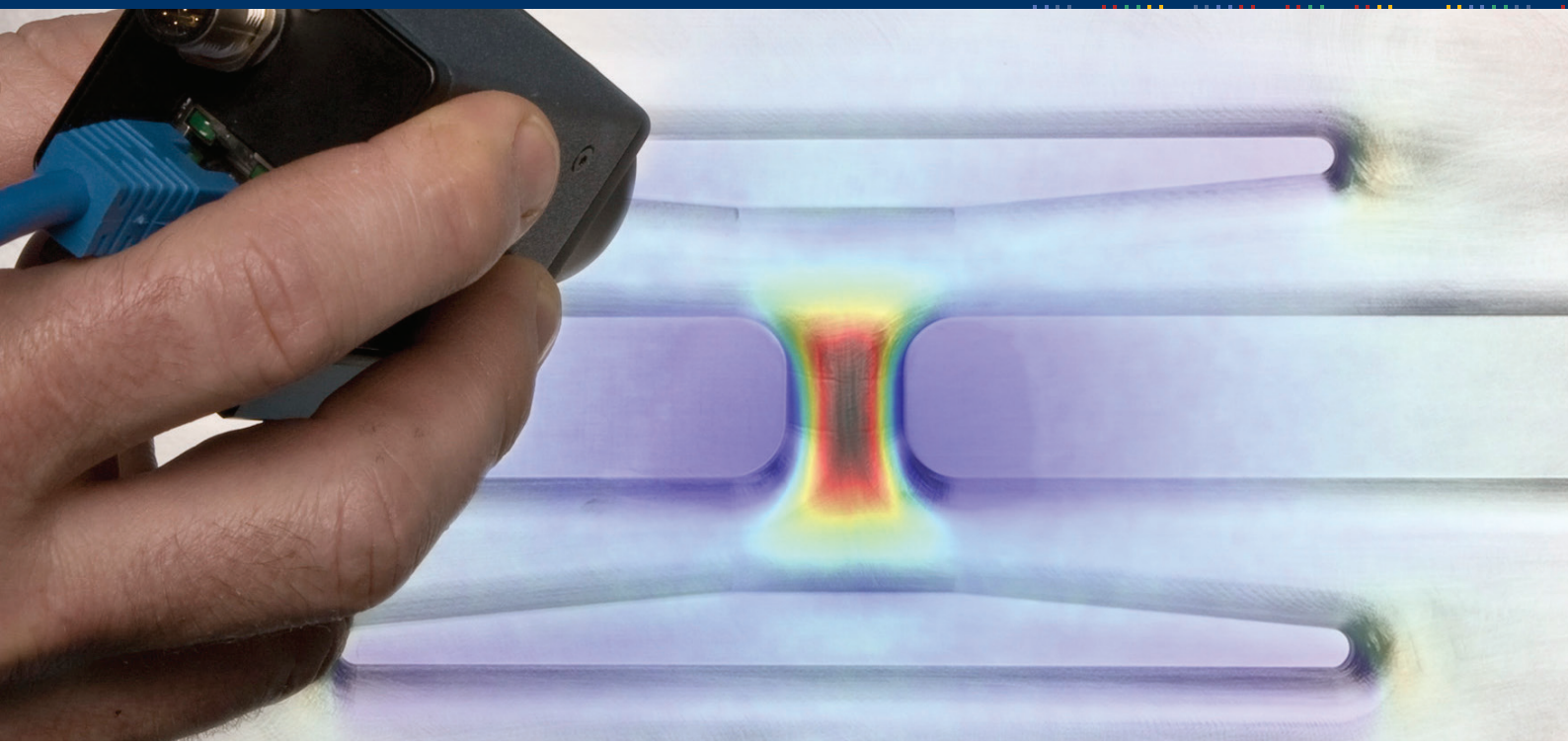
Australian Government
Department of Defence
Defence Science and Technology Group



A Compact Low Cost Stress Imaging Capability

MiTE is a thermoelastic stress analysis capability that exploits recent advances in low-cost microbolometer detector technology to create a highly affordable, rugged, compact and portable means of imaging stress in dynamically loaded structures.

The importance of stress measurement for structural design and structural integrity assessment has not diminished with the growth of finite element modelling. To the contrary, it is set to increase as the flexibility offered by modelling combined with increasingly ambitious performance and efficiency goals lead to more complicated lightweight structural designs. Although finite element analysis (FEA) is highly flexible and relatively cost efficient accurate predictions rely on a good knowledge of boundary conditions, load inputs, material properties, fastener behaviour, and other factors. Knowledge of these is seldom perfect, which creates predictive uncertainties that can only be identified through experimental validation.

As well as providing a low-cost means of validating structural FEA, MiTE can potentially assist in:

- Identification of structural hot spots or areas of structural weakness
- Structural health monitoring
- Detection, monitoring and characterisation of fatigue cracks
- Nondestructive inspection
- Research and teaching in structural mechanics

The MiTE application is available as freeware after registering at http://www.dsto.defence.gov.au/mite/.

Hardware is not supplied. The following is required:

- Notebook computer with Windows 7 or Windows XP.
- Infrared camera. Currently supported : FLIR A315, A325, A615, A645, A655, A35, A65; Xenics Gobi-640-GigE.
- USB data acquisition unit (NI USB-6000).

Technical Data (FLIR A35)

Stress sensitivity: 1 MPa*
Resolution (pixel): 320x256
Spatial resolution (IFOV): 2.78 mrad
Frame rate: 60 Hz
Camera output: Gigabit Ethernet
Camera mass: 200 grams
Camera size: 106x40x43 mm

* typical value for aircraft grade aluminium alloy. Varies with processing time.

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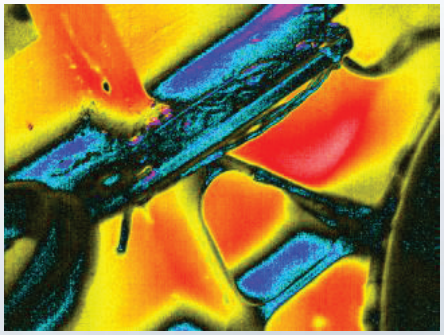
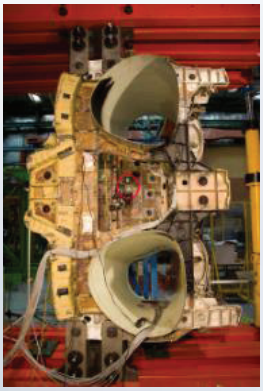
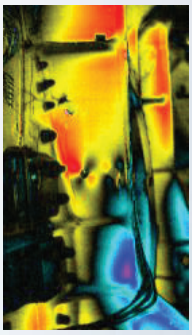
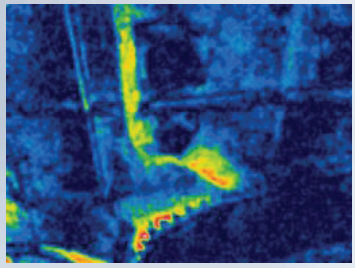
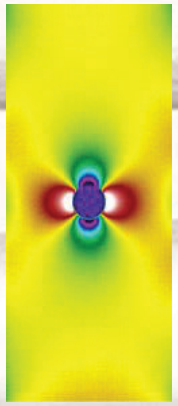
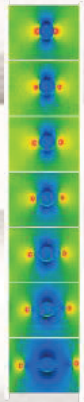
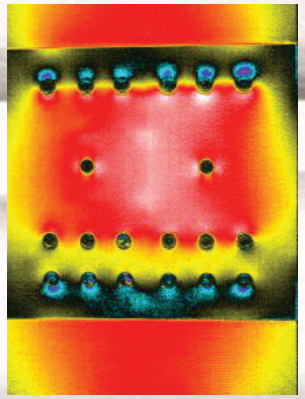
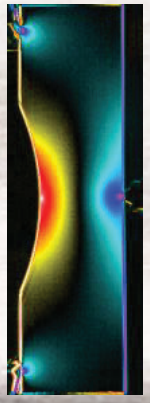
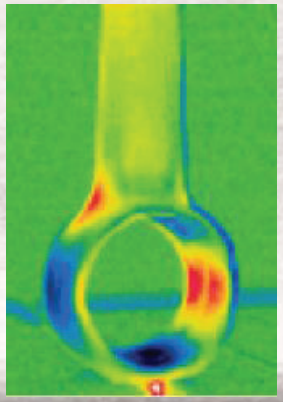
MiTE

Full-Scale Structural Testing.

Support to Royal Australian Air Force F/A-18 structural integrity program. Clockwise from top left: outer wing (carbon fibre skin) in bending, oblique view of the centre-barrel aft bulkhead, centre-barrel full-scale fatigue test rig with microbolometer (circled) attached to centre bulkhead, stress concentration in fatigue prone area, side view of aft bulkhead.

Coupon Testing.

From left: metallic plate containing a circular hole, crack growth from a hole, load distribution in a riveted joint, adhesively bonded woven carbon fibre doubler in uniaxial tension, arched beam in three-point bending (note small crack in arch), connecting rod in compression.