

MECHANICAL TEST FACILITY

NPL 



New Mechanical Test Facility

Welcome to the official opening of NPL's state-of-the-art Mechanical Test Facility (MTF).

This facility, combined with NPL's extensive expertise in materials characterisation and assurance, provides a unique capability for research and commercial testing services. As businesses continue to face diverse challenges due to the pandemic, this facility will help boost UK recovery by serving as a UK centre of excellence.



**Characterise New
Materials &
Products**



**Overcome UK
Supply Chain
Limitations**



**Facilitate Quicker
Product
Development**



**Support
Industrial
Innovation**



**Assist Green
Industrial
Revolution**



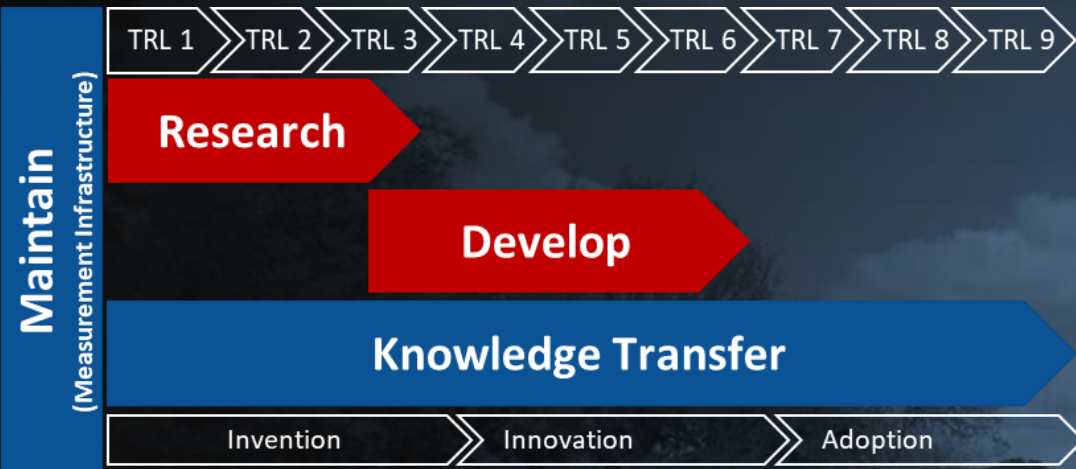
Mark Summers
Head of Advanced Manufacturing

Strategic Vision



Strategic delivery model

NPL Ecosystem



Strategic model



National challenge portfolio



PRODUCTIVITY & COMPETITIVENESS

Confidence in data for existing technologies and step change innovation



ENVIRONMENT

Tackling Climate change through transition to net zero



SECURITY

Protecting the resilience of critical national infrastructure



WELLBEING

Enabling early diagnosis, future therapies, and medical technologies

MEASUREMENT INFRASTRUCTURE

- Meet existing regulatory or legislative requirements
- Essential capability that underpins a broad range of research areas
- Sustain core metrology capability within national measurement system
- Realisation & maintenance of SI units & primary scales at existing scope and uncertainty levels

TACTICAL

STRATEGIC

Future game changers



High performance data driven environment that will minimise physical activities, facilitating virtual verification, validation and certification.



Highly efficient technology innovation within the end to end future factory ecosystem that eliminates the need for product and process inspection



Automated high fidelity simulation, analysis and validation of manufacturing for medicines, bioproducts and medical devices, facilitating real time quality control throughout supply chains

Priorities



Tackling Climate change through transition to net zero



Efficient and sustainable manufacturing through energy and resource conservation



Advanced manufacturing technologies to address priority health and bioeconomy needs

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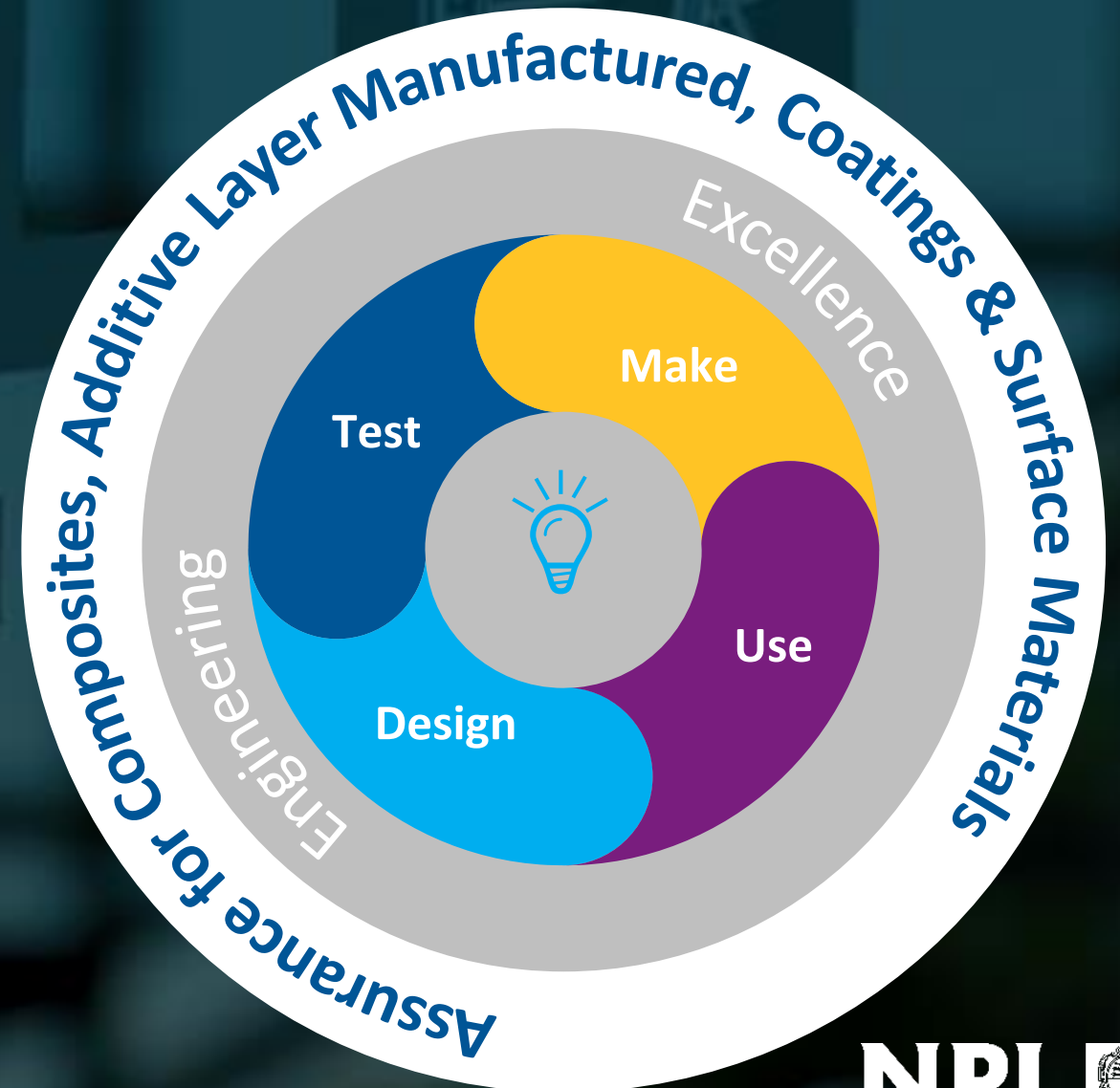
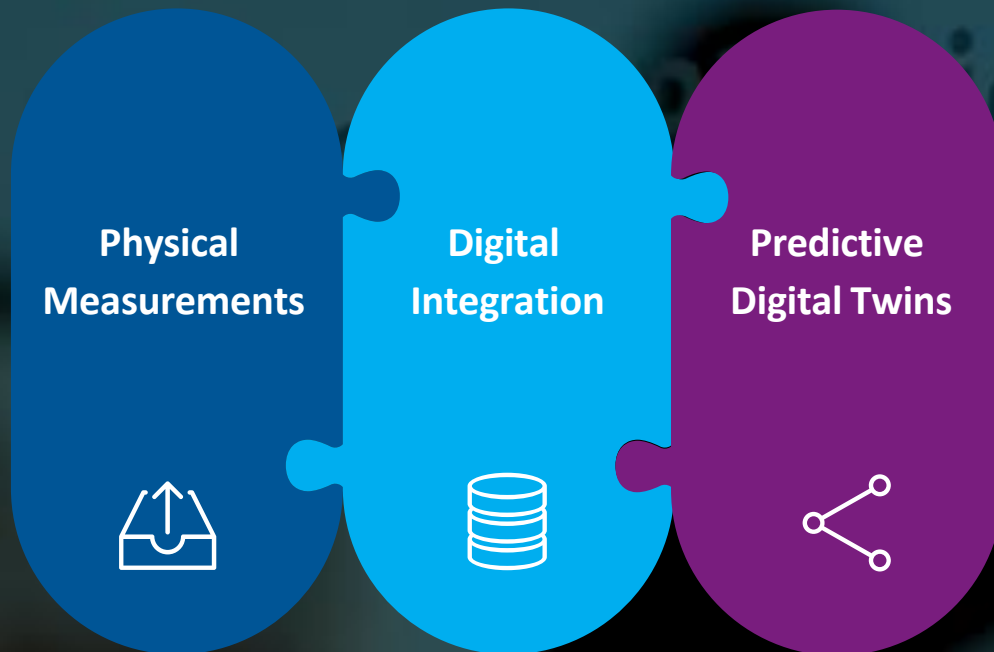
The image shows a mechanical test facility. On the left, there is a large vertical testing machine with a thick black protective sleeve. In the center, there is a glass-enclosed testing machine with 'NPL' branding. On the right, another large vertical testing machine is visible, with two computer monitors on a desk in front of it. The room has white walls, a grey floor, and a green exit sign above a doorway in the background.

MECHANICAL TEST FACILITY

Michael Gower, Principal Research Scientist
NPL Advanced Engineering Materials Group

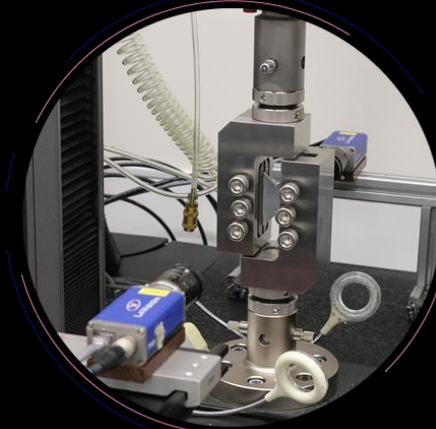
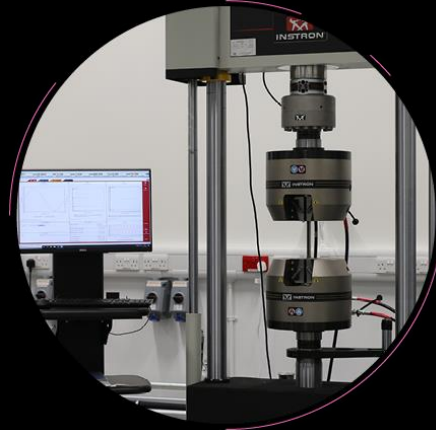
Our mission

“To provide **Assurance for Advanced Materials** underpinning an Engineering Excellence Framework of **Smart Design-Test-Make-Use**”



The facility

- State-of-the-art facility for mechanical characterisation of advanced materials
- Complete refurbishment of laboratory space
- Value partnership with Instron
- A UK centre of excellence for research and commercial delivery providing materials assurance to the UK's advanced manufacturing sector





Overview of Equipment



± 50 kN (S)



± 100 kN (S)



± 250 kN (S)



± 250 kN (S)



± 3 kN (S/D)



ETMT

± 3 kN (S/D)



LCF

± 100 kN (S/D)



± 25 kN (D)



TMF ± 100 kN (D)



± 100 kN (D)



± 100 kN (D)



± 250 kN (D)



± 250 kN (D)



VHS ± 100 kN
(up to 20 m/s)



$\pm 1,000$ kN (S/D)



State-of-the-art hydraulic pack & control system

Specimen machining capability

Environmental conditioning laboratory

Automated Randex storage system



Quasi-static test capability



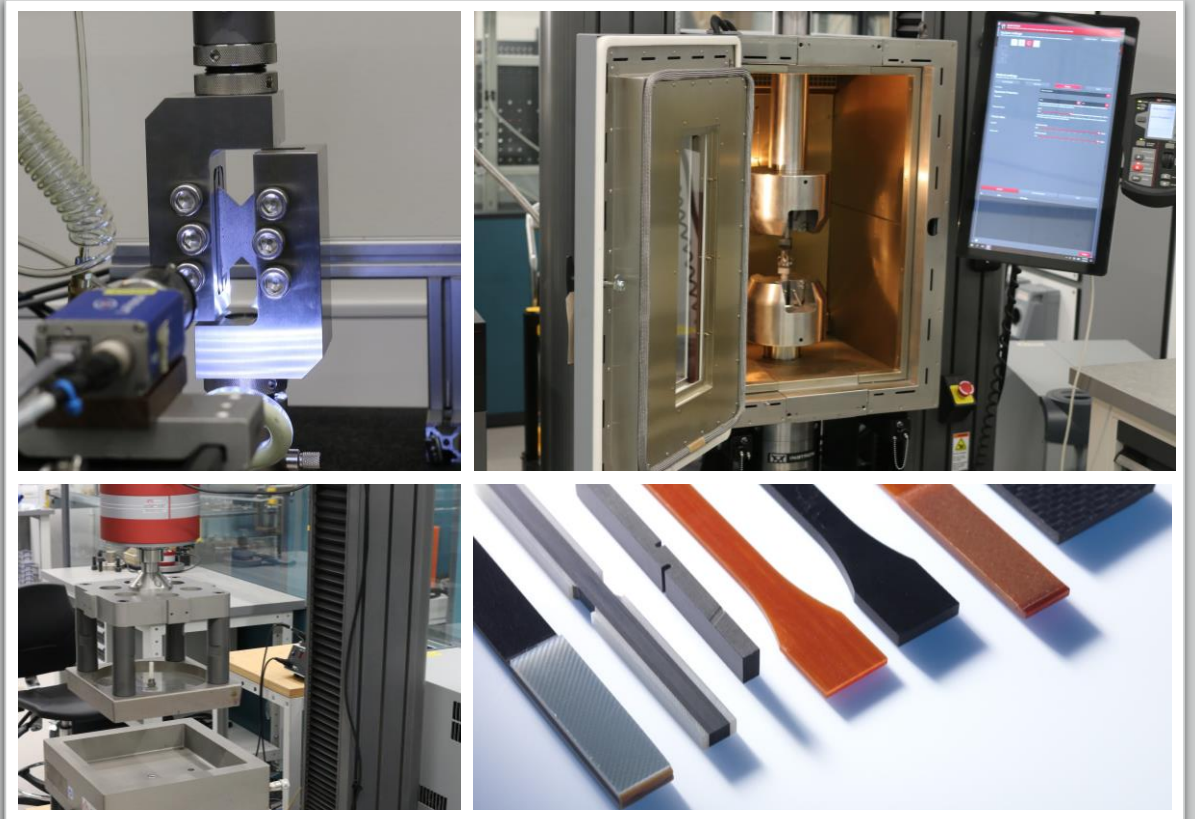
- A range of test frames for quasi-static characterisation of materials up to ± 250 kN
- Ambient and non-ambient (-165°C to $+350^{\circ}\text{C}$)
- Contact and non-contact strain measurement capability

Impact through measurement

Mechanical characterisation of Additively Manufactured (AM) materials

EDF Energy and Atkins work with NPL to improve damage detection in graphite fuel bricks

Supporting metrology for liquid composite (LCM) moulding processes



Fatigue test capability

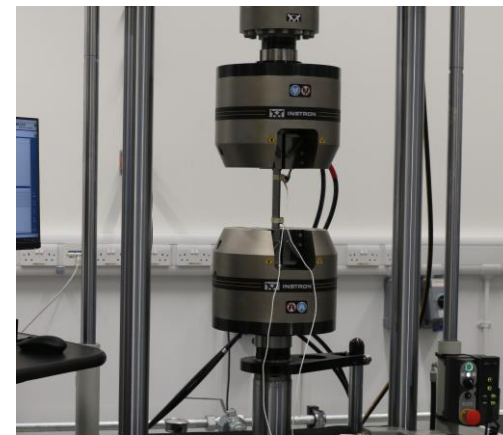
- A suite of machines for fatigue characterisation of materials up to ± 1 MN
- Ambient and non-ambient (temperature and humidity)
- Contact and non-contact strain measurement capability, NDT for damage growth

Impact through measurement

Long-term through-thickness fatigue of conditioned FRP – high humidity and temperature

Development of digital twins for thin-walled composite space structures

Developing methods to characterise the microstructure of AM components.



Dynamic testing

- Floor standing, four column Instron Very High Speed (VHS) servo-hydraulic machine
- ± 100 kN load capacity and up to 20 m/s actuator speed
- High speed camera and DIC (later in 2021)

Impact through measurement

Measurement of rate dependent mechanical properties of thermoplastic composites for automotive interiors

Measurement of crush (compression) properties of CFRP composites for input to simulation codes

Good Practice for intermediate strain rate testing



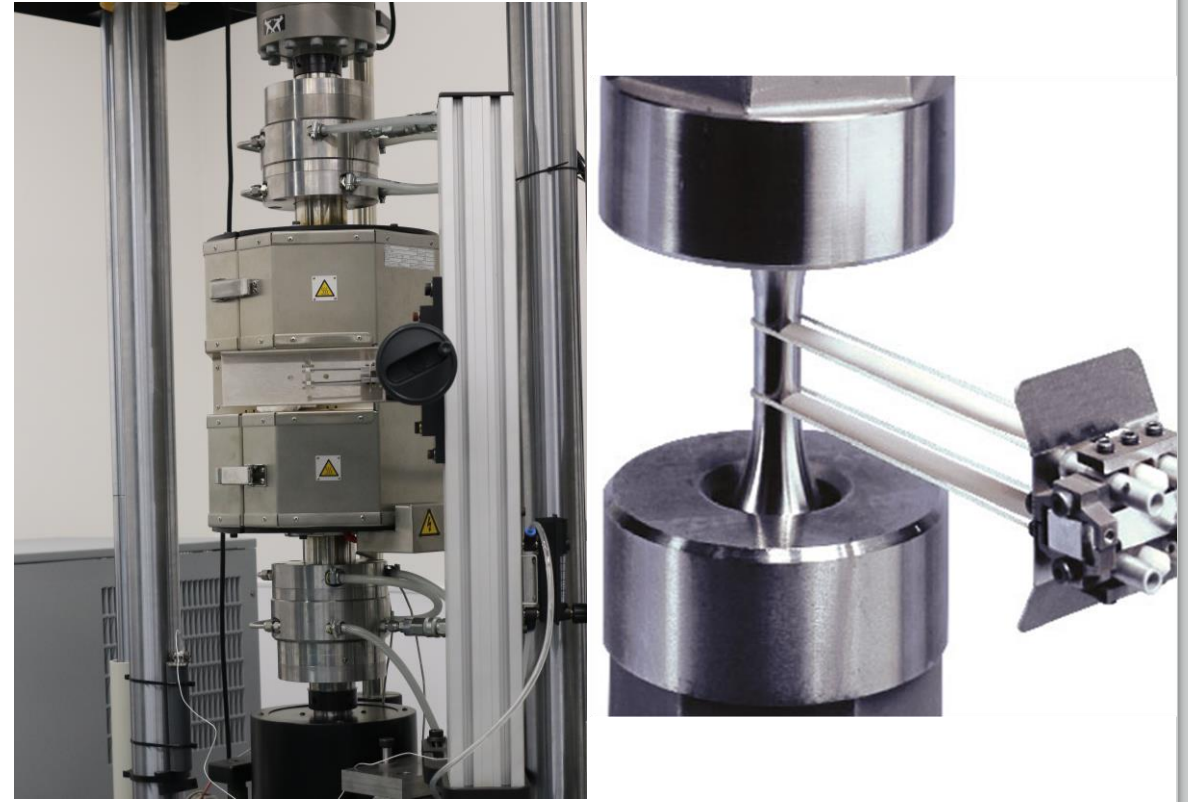
Low-cycle fatigue (LCF)

- ± 100 kN servo-electric dynamic floor-standing test machine
- On specimen temperatures of up to 1000°C

Impact through measurement

Onset of cracking in coatings using high temperature LCF and acoustic emission

Mechanical performance of innovative joints under low-cycle fatigue and high-temperature

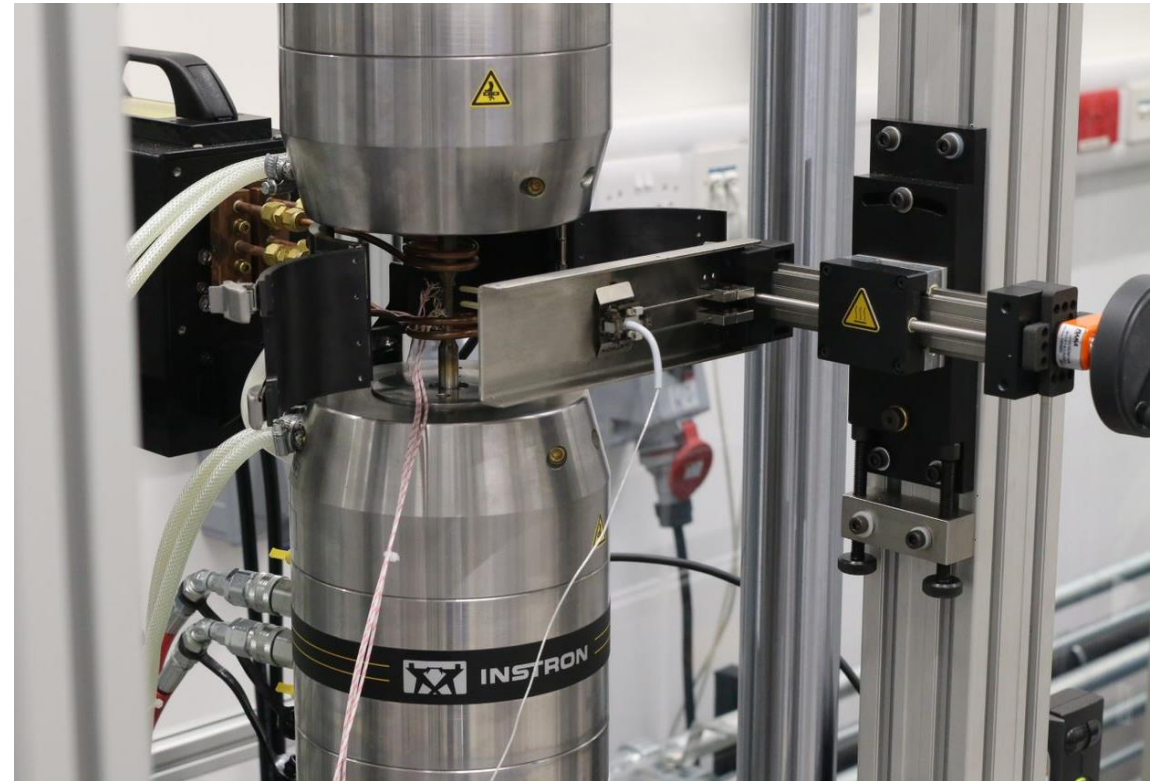


Thermo-mechanical fatigue

- ± 100 kN floor-standing modified 8801 servo-hydraulic test frame
- Induction heating system, extensometry to 1000°C
- Analysis of combined thermal & mechanical loading cycles of high-performance materials

Impact through measurement

Thermal fatigue life of coatings for aerospace and power generation applications



Electro-thermal mechanical testing (ETMT)

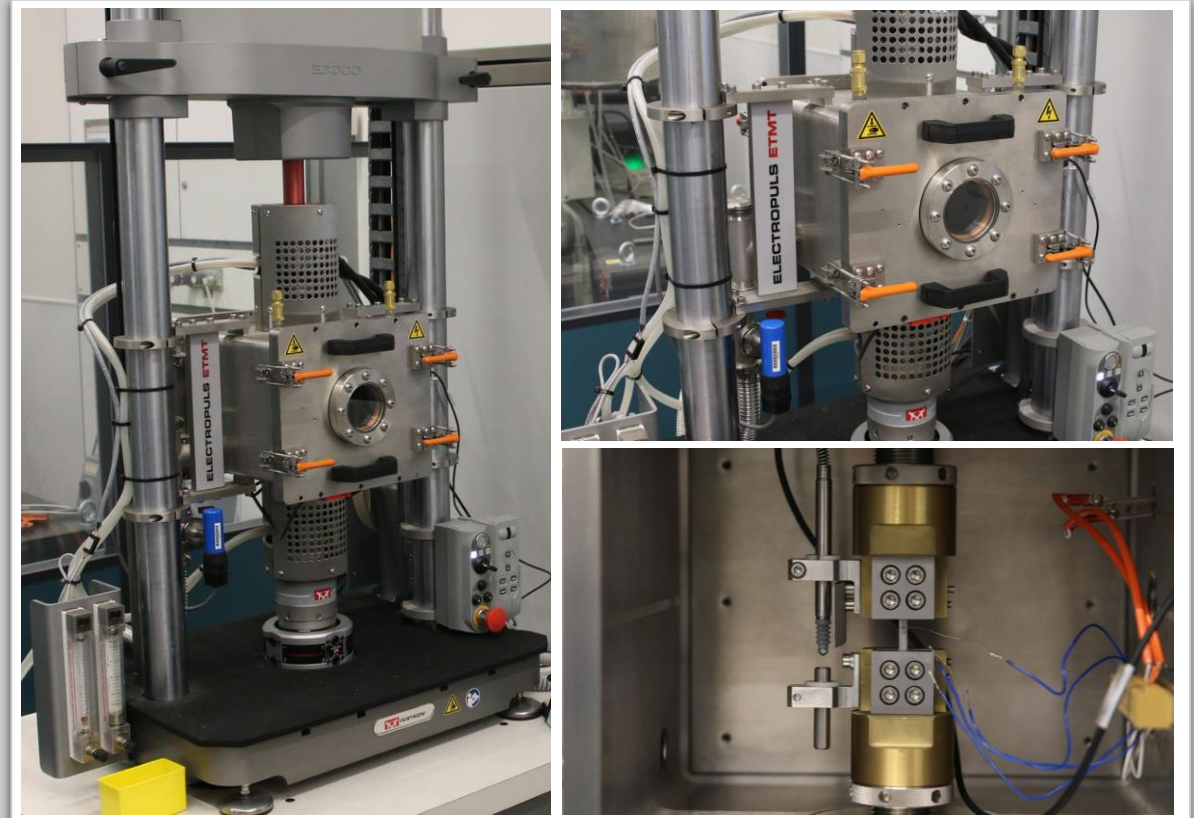


- Compact table-top system for performing accelerated high-temperature metals research
- Fatigue loading rates of up to 1000 N/s; heating (200°C/s) and cooling (100°C/s)
- Direct resistance heating system capable of delivering specimen temperatures of up to 1500°C

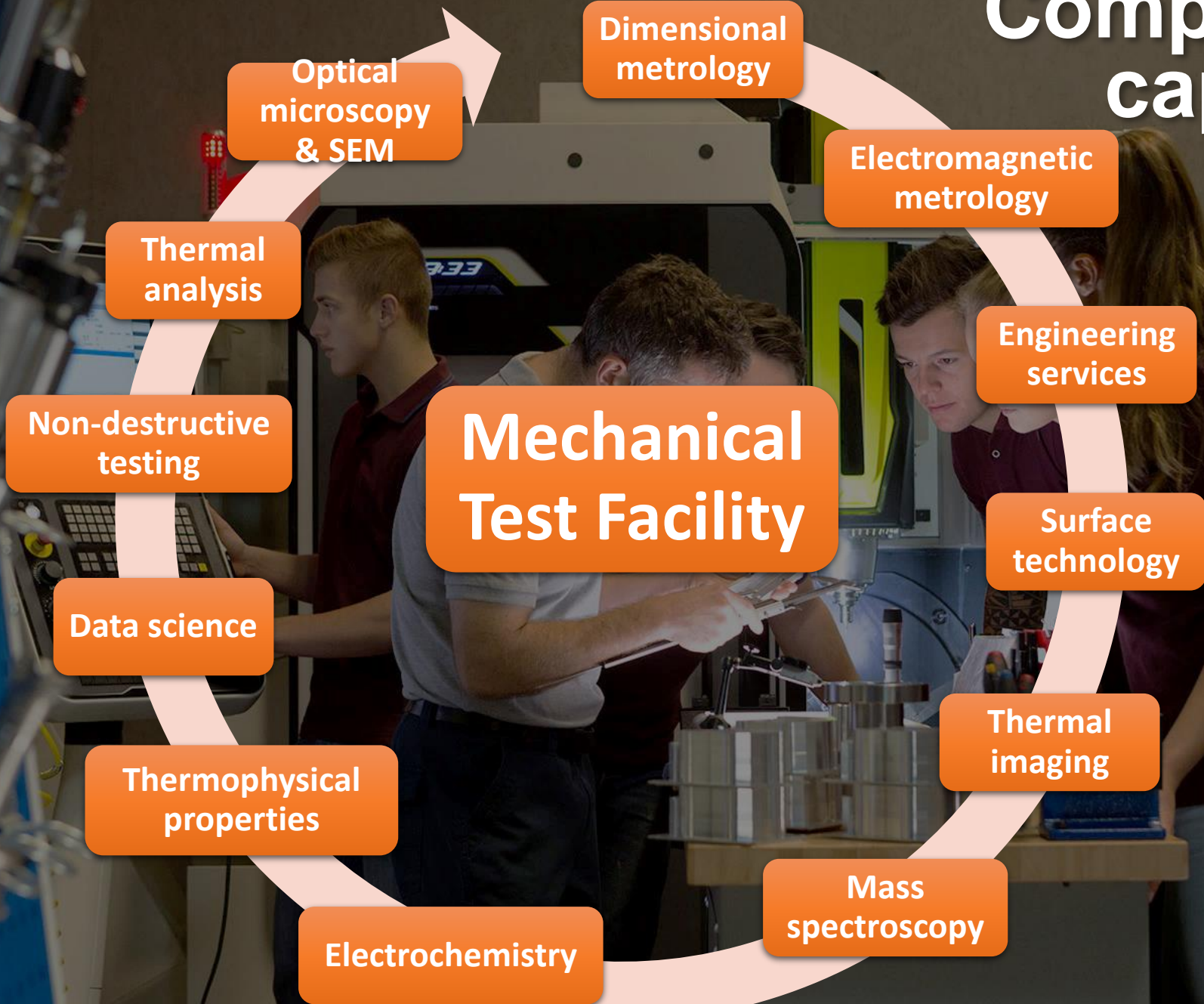
Impact through measurement

Metrology approach relating internal structure to AM processes

Mechanical properties of an alloy as a function of temperature



Complementary capability



Measurement for Recovery #M4R

Building confidence in the future



A4I Analysis for Innovators

We Are Here To Help



Characterise New Materials & Products



Overcome UK Supply Chain Limitations



Facilitate Quicker Product Development



Support Industrial Innovation



Assist Green Industrial Revolution



Q&A Session

George Pask - Group Leader, Advanced Engineering Materials (AEM) - NPL

Michael Gower - Principal Research Scientist, AEM & Science Area Leader for Composites - NPL

Tony Fry - Principal Research Scientist, AEM & Science Area Leader for Additive Manufactured Materials - NPL

Mark Summers - Head of Advanced Manufacturing - NPL

Peter Fuller - Area Sales & Applications Engineer - Instron

Peter Bailey - Senior Applications Specialist - Instron

Why NPL?

National Measurement
Institute



State-of-the-art Facility



Trusted Experts



Sector Agnostic



Leaders In
International Material
Standardisation



Bespoke Test
Methods



Challenge-specific
meetings

Next Webinar:
16th March @ 3:00pm

Visit our website
(www.npl.co.uk/campaigns/mechanical-test-facility)



Email: george.pask@npl.co.uk

Register for upcoming webinar: npl.co.uk/events