Joining Technologies Overview

Dr Chris Dungey
Regional Group Manager
Joining Technologies Group

Materials Joining and Engineering Technologies

What is TWI?



- Membership-based
  - 2,000 Industrial Members in 65 countries
- RTO
  - Assisting industry to develop and apply all forms of joining technology safely and efficiently
  - Representing virtually all sectors of the manufacturing industry
- Training, examination & certification provider
- Professional institution
  - 6,000 Professional Members

TWI

- Speciality in **welding and joining processes**
- & allied technologies such as **non-destructive testing, materials, corrosion and structural integrity**
- Established in **1922** & developed into the British Welding Research Association (BWRA) in **1946**
- The Welding Institute (TWI) created in **1968**
- It has **UK offices and research facilities:**
  - Cambridge (HQ), Middlesbrough, Rotherham, Aberdeen and Port Talbot, Wales.
- There are also **offices and training facilities in the rest of the world**:
  - North America, South East Asia, China, Australia, Central Asia, India and the Middle East.

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Joining Overview

- Arc Welding
- Electron Beam Processing
- Friction Processing
- Laser Processing
- Micro-Joining

- Composites Joining
- Diffusion Bonding and Brazing
- Adhesives and Sealants
- Coatings

- Additive Manufacturing

- Prototyping

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FoF Opportunities with TWI

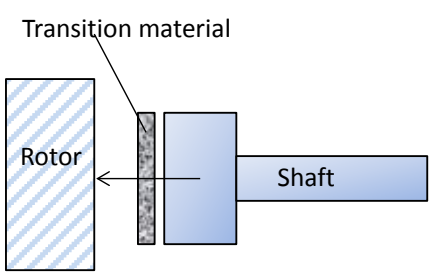
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TurboJoint – FoF-12

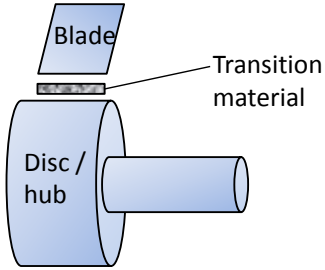
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TurboJoint – FoF-12

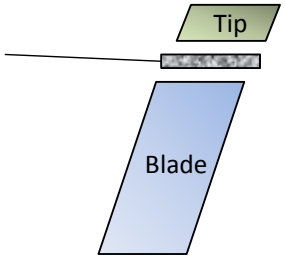
- Aims to develop method(s) for **joining dis-similar metals and metal/ceramics for Turbomachinery**:



Rotor – Shaft assembly



Blade – disc assembly



Blade tipping







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Possible Joint Combinations (suggestions / examples)

Combination / Application	Metal / Metal	Intermetallic / Metal	Ceramic / Metal
Shaft/Shaft	Ti alloy 1 - Ti alloy 2 Titanium - steel	ODS Material - steel	BN or SiC - steel
Shaft/Rotor	Inconel 718 - CrMoV steel	gammaTiAl - steel	Si_3N_4 - steel
Blade/Disc	Aluminium – Ni or Ti alloys	Nb-Si_2 - Titanium	Si_3N_4 - Ni alloy Nb-Si_2 - Steel
Blade/ Leading Edge	NiCoRe alloys – CoFe alloys	Single Xstal or DS Ni	Cermet - Ni alloy

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Suggested Applications (for proposal)

- **App 1: Steam-Turbine (Power Gen)**
  - shaft/shaft or rotor/shaft
  - Dissimilar metals (lots of choices with varying difficulty)
- **App 2: Turbo-Chargers (Automotive Powertrain)**
  - rotor/shaft
  - (Suggested) either Si_3N_4-steel and/or Single Xstal-steel
- **App 3: Gas Turbine Compressor wheel tipping (Power Gen / Aero Engine)**
  - blade/disc or blade/leading edge
  - (Suggested) Nb-Si_2-titanium
- **App 4: Gas Turbine Compressor gear (Power Gen / Aero Engine)**
  - Rotor/shaft
  - Titanium-Steel

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Interest / Required

- **We are looking for Partners:**
  - **End-Users** (for other material / joint requirements)
  - **Industrial technology providers** (processing / monitoring / NDT equipment / etc.
  - **Research Centres** who could add to the potential ‘solution’ / processing element

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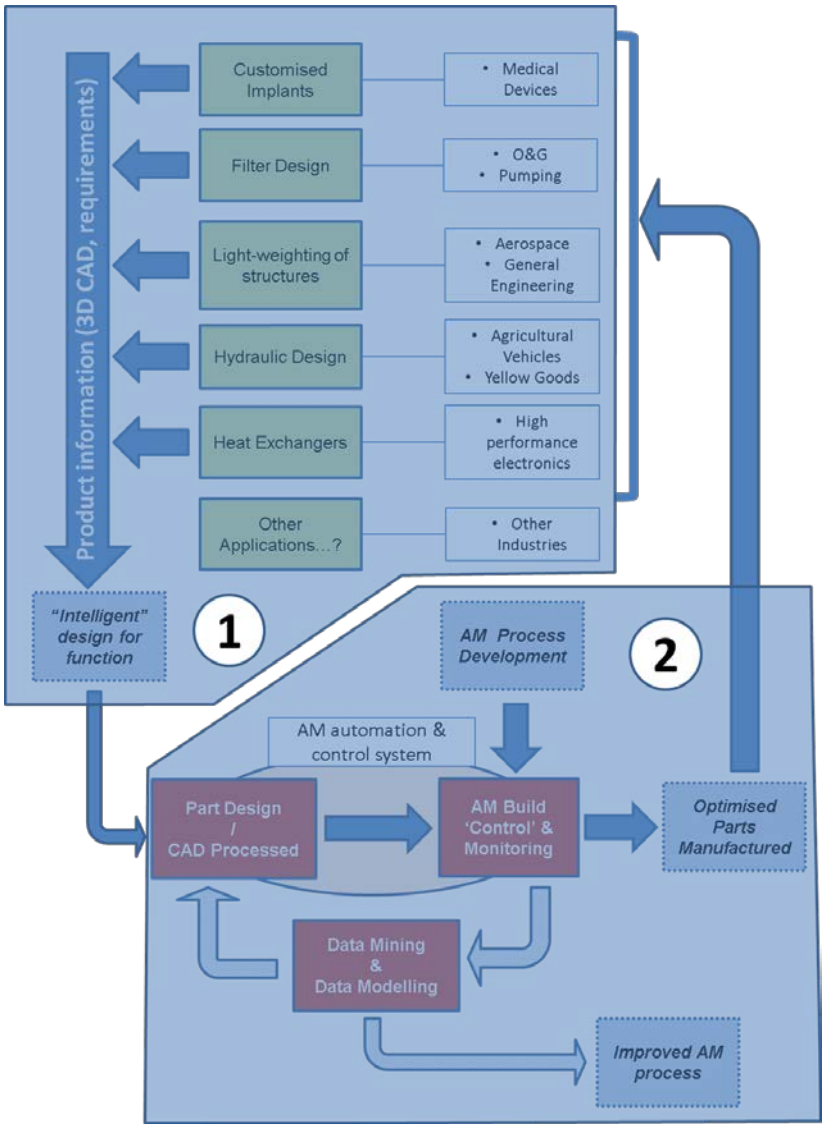
SmartAM – FoF-8

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SmartAM – FoF-8

- **Integrated modelling, simulation and information management systems benefiting from recent advances in ICT**
  - *New methods for design to take advantage of AM*
  - *New robust AM processing using data collection and analysis*

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A Project of 2 halves:

Smart design tools (Software interfaces) for designing parts and components to take advantage of AM

- Customised Medical Implants
- Filters & Hydraulic Components
- Light-weighting of structures
- Heat Exchangers
- Others…

Robust AM manufacturing approach

- ERP-style planning for manufacture
- Reproducible process across machines
- Data sharing / Learning for optimised build parameters

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Interest / Required

- **We are looking for Partners:**
  - Who could **develop a new design system for optimising part using AM**
  - **End-Users**; who would like to see a specific implementation of AM for their sector
  - **AM capable partners** who could help develop / implement **QA standards for AM builds**.

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Thank you

Chris Dungey
christopher.dungey@twi.co.uk
www.twi-global.com



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