The low cost, high quality process route for titanium

Frank Parente
Advanced Manufacturing Park
2,000 years of material innovation

- Advanced Manufacturing Park (AMP) is in the Sheffield City Region.
  - History of innovations over 2,000 years
  - Crucible steel manufacturing
  - Invention of stainless steel
- Pioneering low cost, high quality titanium processing.
AMP Location Slide

- 90 minutes from Manchester International Airport with direct flights to 6 US cities.
- 25 minutes from Robin Hood International airport with links to Europe
- Center of the UK road network
- 40 minutes from rail freight link direct to Europe
Vision

The Advanced Manufacturing Park vision is:

– To enable companies to exploit knowledge and innovation in materials technology with strategic emphasis on Titanium

– To gain and maintain a repetitive advantage

– Create a financial and technology business model that has attracted world class advanced manufacturing companies like Boeing and Rolls Royce

– To provide a business model that protects Intellectual Property Rights
Advanced Manufacturing Park

- World class R&D Associations in Titanium generating repetitive advantage
- Regional strengths – workforce and supply chains
- A prestige location – education/countryside/cultural history
- Flexible facilities including green-field, multi-client and incubation
- Unbeaten funding support for inward investors
- Dedicated account management
- Excellence in investor support
Industry Sectors
AMP MAIN R&D GROUPS

Faster, Better, Less Expensively

- The development and implementation of novel manufacturing techniques to deliver significant improvements in lead times, quality and costs of manufactured products
- Delivered via leading Research and Technology Organisations with complementary expertise, uniquely all on one site:
  - High-performance machining; additive net-shape manufacturing; modelling and simulation
  - High integrity castings; specialised alloy formulation; rapid manufacture; modelling and simulation
  - Materials joining; additive net-shape manufacturing; energy efficient materials processing
  - Application of composites and advanced materials
Global Research Centre devoted to the Research and Development of new means, methodologies, tools and techniques machining and manufacturing technology for titanium.

Some key partners are:
Titanium Fan Disc

Machining times:

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<th>Original</th>
<th>Target</th>
<th>Achieved</th>
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<tbody>
<tr>
<td>Per slot</td>
<td>36mins</td>
<td>18mins</td>
<td>1.5mins</td>
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<tr>
<td>Per disk</td>
<td>26hrs</td>
<td>&lt;2hrs</td>
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Result: Machining time reduced by an order of magnitude!
Messier Dowty
787 Ti Landing Gear

- Project to machine landing gear components from new grade of titanium alloy

  Original time = 54 hrs
  Target time = 27 hrs
  Achieved time = 11 hrs

- AMRC is reducing machining times in major OEMs - (Rolls Royce, Messier Dowty and Smiths have reduced machining times by a factor of 5-40)

- Assisting UK Suppliers to win major orders – Messier Dowty won $2 billion contract for 787
Shaped Metal Deposition (SMD) is an additive process that grows parts by depositing layers of molten metal into complex, fully dense, thin walled shapes with no waste using 3D CAD / CAM models.

Work with Rolls-Royce led to production of a large demonstration piece modelled on the scale and geometric complexity of a large civil engine intercase component.
Shaped Metal Disposition
Cti work with many of the top Formula One and World Rally Championship Teams

Cti has the ability to cast titanium components for gearbox, suspension and braking systems to the **high quality** required by the teams, within the **tight timescales** needed to develop prototypes and the final components
Friction Stir Welding

- TWI patented process - 1991
- Low distortion
- High strength
- Volume production status with aluminium
- Successful laboratory welding of titanium
Friction Stir Welding
• The thermal expansion and electro-chemical potential mis-matches between carbon composites and traditional metals, typically steel, aluminium and magnesium, are further driving the demand for titanium structures. This is perhaps most evident in the Boeing 787 where titanium is replacing aluminium for metallic structural components.

• **Partners include**: Boeing; Smiths Group; Messier Dowty; Rolls Royce; Cytec; Cincinatti Machines; Brookhouse Composites; Renault F1
Regional Technology Infrastructure for Titanium
Center of Excellence for Titanium

- Metalysis is developing a high capacity, low energy continuous production process for titanium
- CTI is investing heavily in vacuum refining and thin wall casting
- Active Metals is developing nano-particulate alloys from titanium
- TWI is expanding the friction stir welding process to include titanium
- The Sheffield University / Boeing AMRC is demonstrating exceptional advances in the machining of titanium.
- Technicut and Lomas are developing cutting tools that are in world-wide demand for working with titanium.
- IFA has a capacity to forge and extrude very large titanium components
- Pro-Roll has the capability to produce rolled titanium bar product to very exacting tolerances
Working with the AMP
Funding Support in South Yorkshire

- Companies investing in South Yorkshire can benefit from significant levels of funding assistance

- Grant support is targeted at companies in the Advanced Manufacturing and Materials Technology sector

- The AMP Team will provide expert assistance in identifying all potential sources of funding assistance, and presenting a strong case for the level of assistance required to allow the project to go ahead
Be at the leading edge

• If you want to:
  – Cast titanium
  – Weld titanium
  – Machine titanium

• To the highest quality,
  – Faster
  – More efficiently
  – With less waste
  – And all in one place

• Then you need to be on the AMP!

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