3D Printing at Room Temperature (or "Do we really need to scrap that?")

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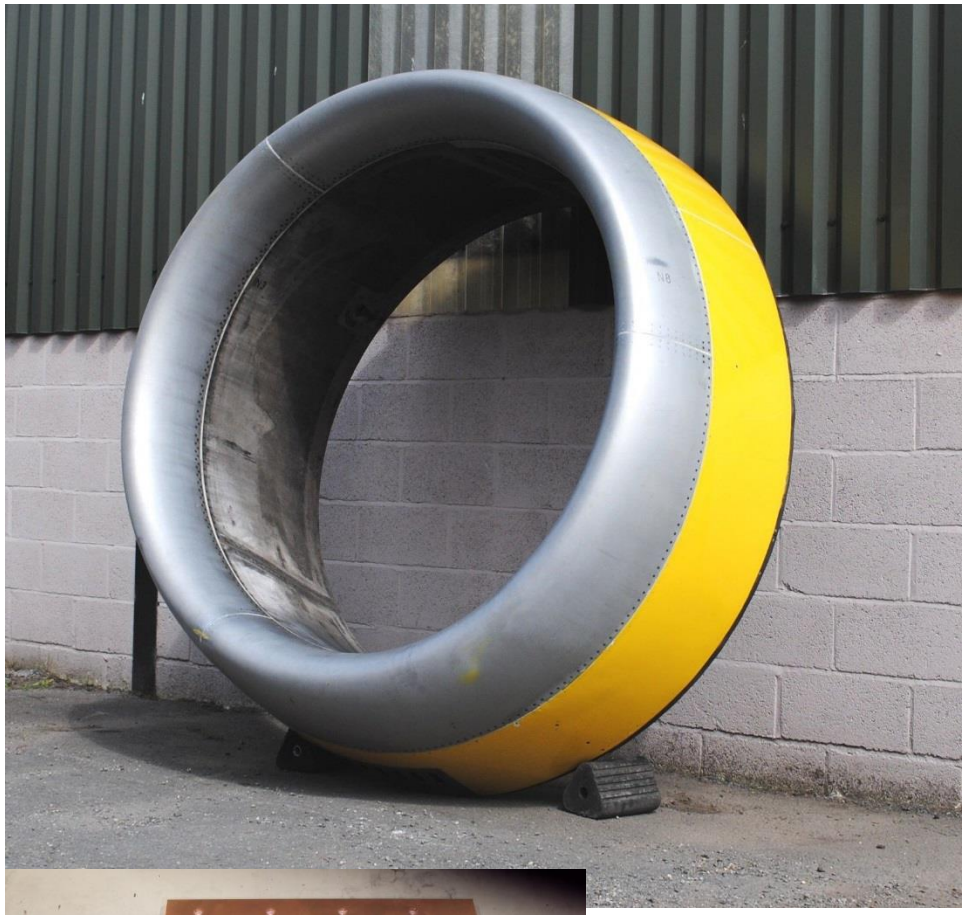
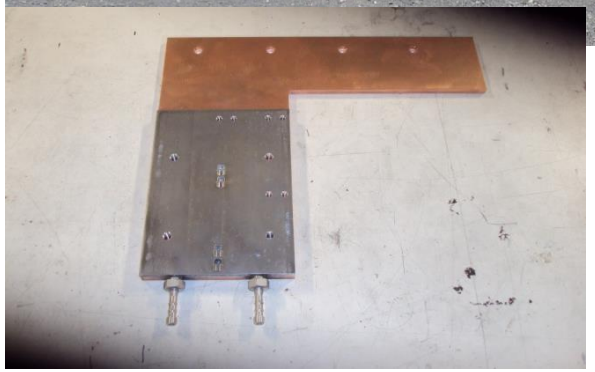
Problem

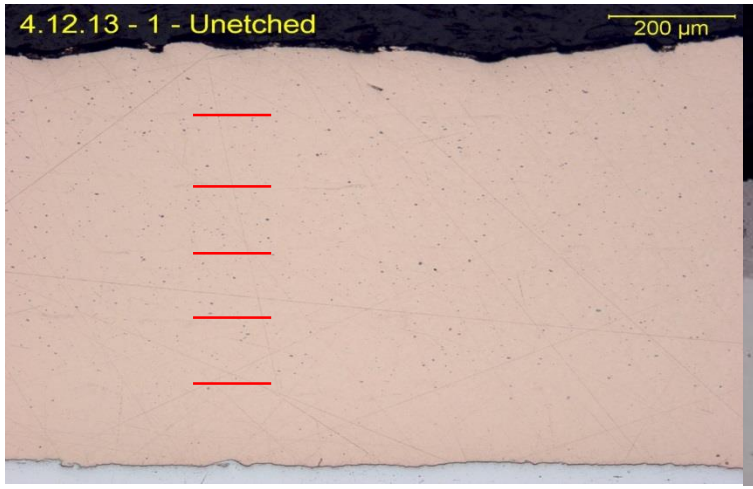
- How can we repair 'impossible' parts
- High value tight tolerance components are being scrapped due to erosion, wear, and damage
  - Traditional weld repair requires complex post weld heat treatment that may not be viable due to size
  - Highly engineered products with several dissimilar metals
  - Component size can range from inches to feet
- $100's of millions of aerospace parts scrapped due to lack of suitable repair techniques
  - 7075 intake, 5052 impeller, 6061 strut

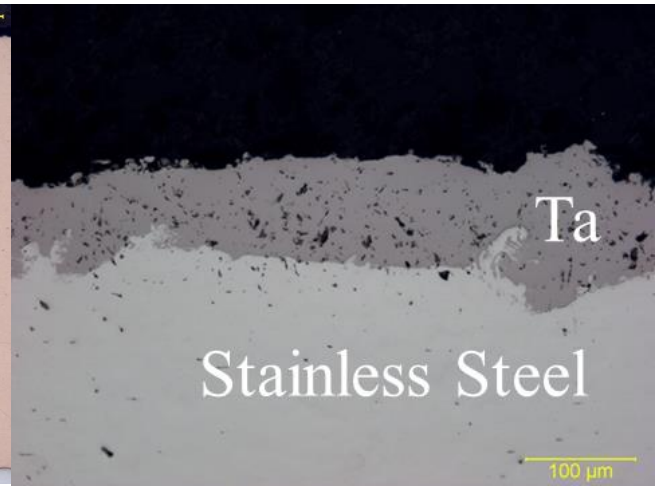




Ultrasonic Additive Manufacturing – Solid State 3D Printing

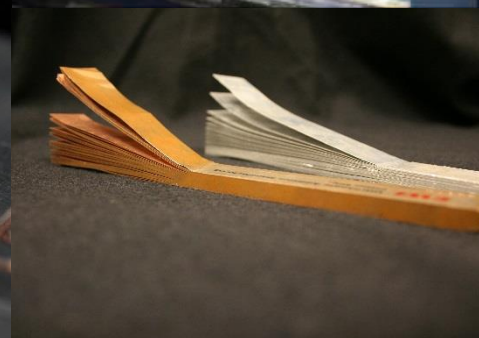
- UAM is a solid-state (no melting) metal 3D printing process
- The process can:
  - weld PH aluminum and copper alloys
  - large work envelope (6’ x 6’ x 3’)
  - join dissimilar metals
  - integrate temperature sensitive electronics into metals (sensors, etc)
- Process has been commercialized and patented (TRL 9)
- Operates on standard CNC G-code





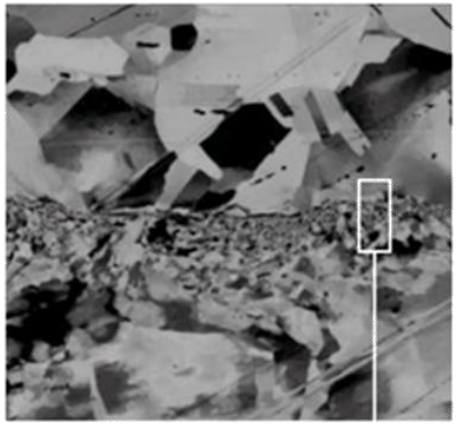
Repair "impossible" parts

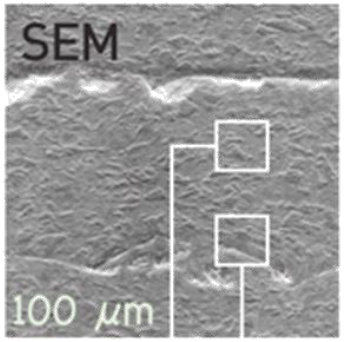
- Repair instead of scrap
- No melting enables:
  - Repair without heat treatments
  - joining of dissimilar metals
- No special atmosphere:
  - large working envelope
  - complex geometries
- Integrated CNC milling:
  - tolerance of 0.0005"
  - 5 axis welding capability

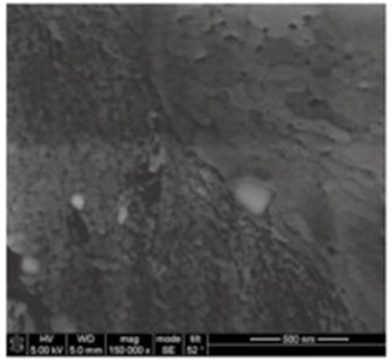


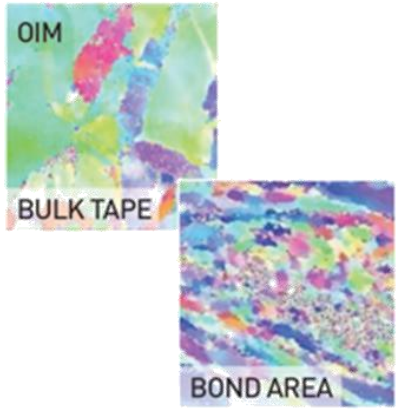
3D Printing – Miles and Miles of Welds

- UAM technology driven by commercial customers
- Certification is the ELEPHANT in the room
  - How do you generate allowables with new weld tech
  - Hundreds of needed materials
  - Classify as a weld repair or new manufacturing tech
- UAM relative unknown in military circles
  - DoD focused on powder bed fusion 3D Printing
  - Commercial aerospace moves at a faster pace



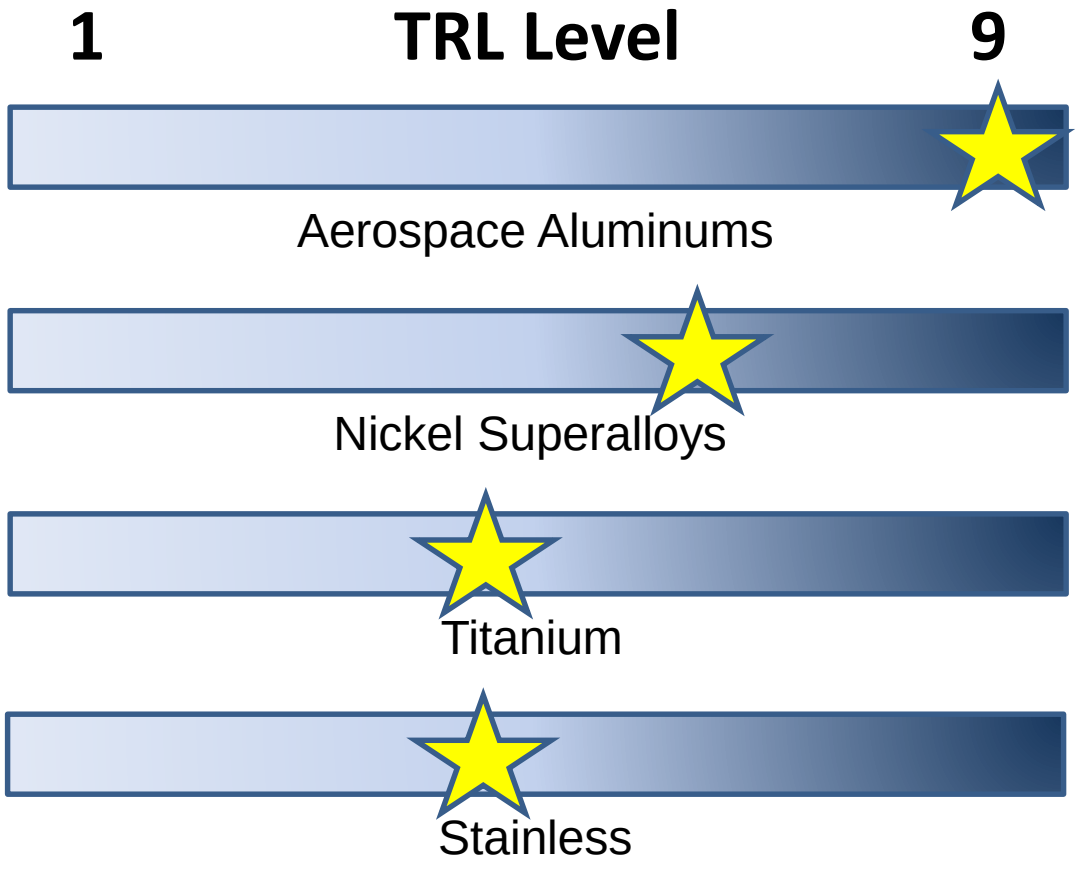






Innovation Status

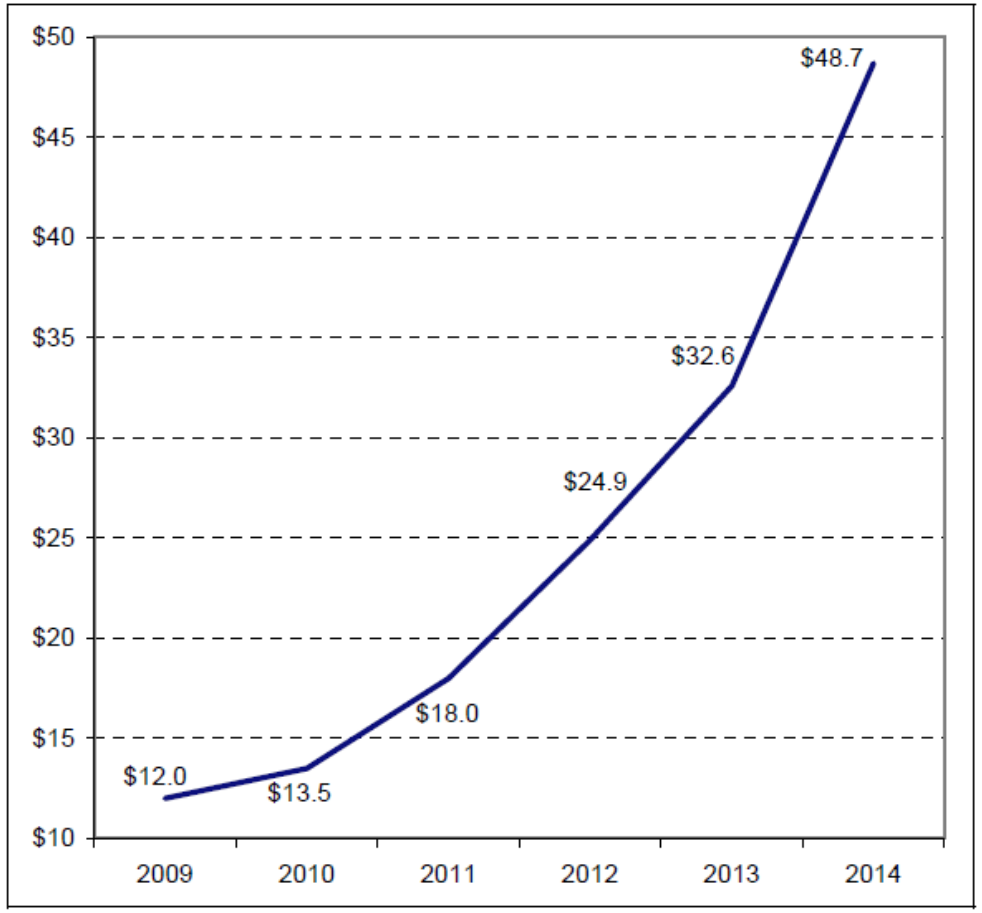
- First insertion should focus on high $$ PH aluminum 'scrap' parts
- Seed funding would allow demonstration articles for evaluation and education
- Process is patented and available
- Alternatives:
  - Cold Spray
  - Little overlap with fusion based 3D printing



Vision / Final Thoughts

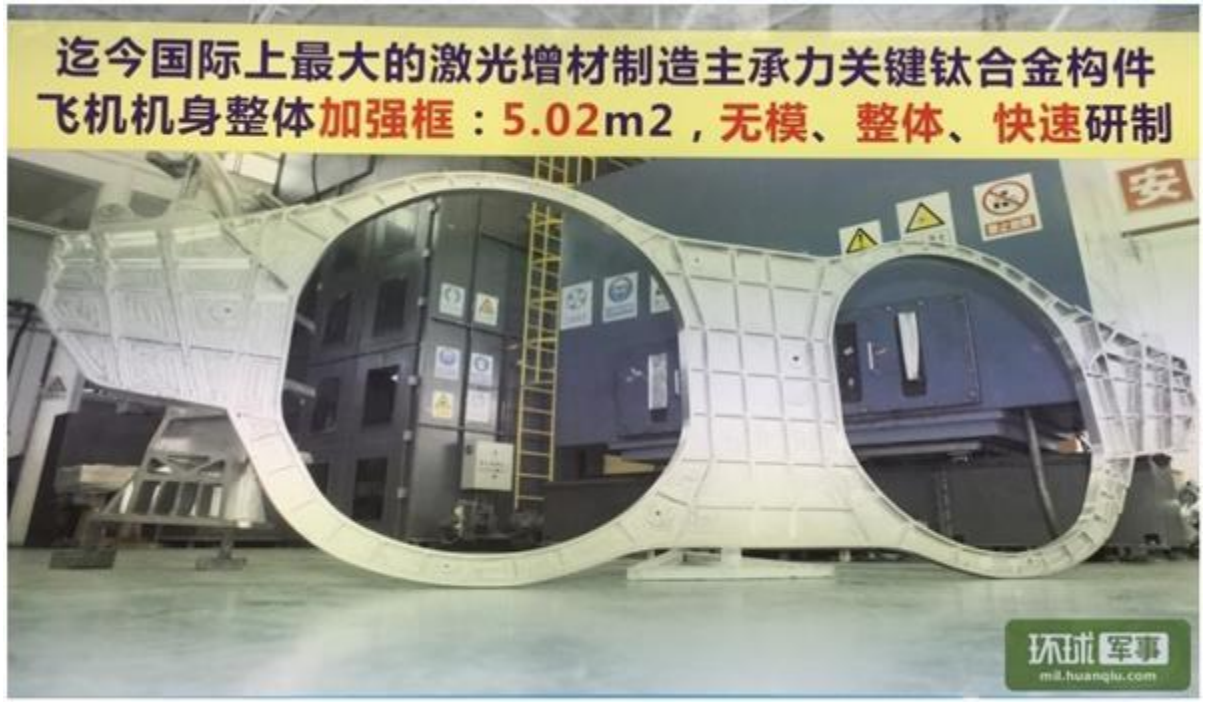
- Metal 3D Printing needs integration at depot level
  - Depot warrant holders are key to quick implementation
  - Depots can identify high value targets and feed use cases up stream
- 3D printing is coming. Is DoD ready?

Metal 3D Printing Growth



Source: Wohlers Associates, Inc.

Questions


迄今国际上最大的激光增材制造主承力关键钛合金构件
飞机机身整体加强框：5.02m2，无模、整体、快速研制
环球军事