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

Mark Norfolk
President, CEO, CWW
Fabrisonic LLC
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

1 TRL Level 9

- Aerospace Aluminum
- Nickel Superalloys
- Titanium
- Stainless
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?
Questions