

JTEG Technology Forum: Cold Spray & Additive Repair



Agenda

1300-1309: Welcome and Overview – Greg Kilchenstein (OSD)

1309-1310: Administrative Notes – Debbie Lilu (NCMS)

1310-1330: Cold Spray for Structural Items – Vic Champagne (ARL)

1330-1350: Laser Engineered Net Shaping (LENS) – Robert Kestler (NAVAIR, FRC-East)

1350-1410: DMG-Mori – Hybrid Additive & Subtractive Repair – Dr. Greg Hyatt

1410-1425: Laser Additive Manufacturing Repair – H-60 Oil Cooler Assembly & T-700 Gas Turbine Shaft – Wesley Cass (CCAD)

1425-1440: NAVSEA Cold Spray Overview – Janice Bryant (NAVSEA)

1440-1455: USAF Cold Spray Capability Overview – Mike Froning (USAF)

1455-1500: Wrap-up and JTEG Principals Comments

JTEG Forum Minutes

Event: On 31 January, 2017, the Joint Technology Exchange Group (JTEG), in coordination with the National Center for Manufacturing Sciences (NCMS), hosted a virtual forum on “Additive Repair Supporting Maintenance Operations”.

Purpose: The purpose of the forum was to examine several additive repair capabilities existing within DoD and industry that allow the actual repair of worn or damaged parts by adding material through a number of different processes, and exchange information and ideas about

what is next in the world of additive repair technology.

Welcome: Greg Kilchenstein (JTEG Co-Chair), welcomed everyone to the forum, thanked the presenters and all the listeners for their attendance, briefly described the purpose of the JTEG technology forums.

Administrative: This was an open forum. The presentations, along with questions and answers, were conducted through Adobe Connect. A separate audio line was used. Approximately 60-70 participants from across DoD and industry joined in the forum.

Cold Spray for Structural Items – Vic Champagne (ARL) described cold spray as a consolidation process capable of producing small structures needed for repairs. He explained the Army cold spray vision and road map, the DMS&T program, and several cold spray repair examples. Vic finished with a description of the 2017 Cold Spray Action Team (CSAT) Meeting 14-15 June.

Laser Engineered Net Shaping (LENS) – Robert Kestler (NAVAIR, FRC-East) provided a brief on “Additive Manufacturing for Repair of High Value Assets”. He talked about additive manufacturing implementations at FRC-E and the application space. He described the F-402 low pressure compressor (LPC) 2nd stage rear seal ring project and how FRC-E went ahead to develop and demonstrate AM repair qualification and certification procedures on this targeted, high-priority component.

DMG-Mori – Hybrid Additive & Subtractive Repair – Dr. Greg Hyatt talked about the democratization of AM. Requirements include cost reduction through faster deposition, larger work, building on existing structures, the integration of subtractive processes, precision AM, bimetallic builds, ease of use, and robust machines for the factory floor. He also stated that the AM market is segregated between solutions for rapid-prototyping, and production.

Laser Additive Manufacturing Repair – Wesley Cass (CCAD) discussed aircraft repair qualification emerging technology areas: Cold spray, Laser Additive Manufacture (LAM) (Laser powder deposition), Direct Metal Laser Melting (DMLM) (LAM – Powder Bed), Selective Laser Sintering (SLS), and Fusion Deposition Modeling (FDM). He then described an effort involving T55-GA-714A No.4-5 Bearing Housing LAM Repair.

NAVSEA Cold Spray Overview – Janice Bryant (NAVSEA) provided an overview of cold spray in NAVSEA explaining how cold spray is a part of NAVSEA’s comprehensive Additive Manufacturing & Repair (AM&R) plan. NAVSEA started cold spray in 2013 with projects at NUWC Keyport and Puget Sound Naval Shipyard and is growing fast. She described successful repairs at Puget to include an acceptance of cold spray repair on a main circulation water pump. She also informed the group that a milBook site has been established for information and knowledge sharing.

USAF Cold Spray Capability Overview – Mike Froning (USAF) described a range of USAF cold spray activities to include an FY12 USAF Rapid Innovation Fund project which repaired surface and structural wear using cold spray, implementation of cold spray at Ellsworth AFB in the form of an additive manufacture rapid repair facility, and future implementation across the enterprise to include a USAF Enterprise Cold Spray Implementation Plan, organic CS capability, CS standards, materials specs, and process specifications, and CS systems operation training.

Closing Comments: Greg Kilchenstein thanked the presenters for their contributions and the audience for their participation. He commented on the quality of the presentations and the great variety of capabilities discussed by the presenters.

Action Items:

1) Obtain “public release” versions of the presentations and post to the JTEG website. These meeting minutes, the Q&A, and those briefing slides approved for public release, will be posted on the JTEG website at <http://jteg.ncms.org/> . (All presenters, LMI, NCMS)

Next JTEG Meeting: The next JTEG virtual forum is 28 February, 1:00 – 3:00 pm EST. The topic is “Asset Visibility; What, Where, and Condition”.

Forum Q&A

Cold Spray for Structural Items – Vic Champagne (ARL)

Q1. Can you explain consolidation vs coating?

A1. Consolidation means I can make things up to 12” thick and 2 ft wide. Actually create structures. It is not a coating.

Q2. Is the VRC system and process the defacto DoD standard?

A2. Well, it is becoming that. VRC was actually developed by ARL in 2004. The Army needed a field deployable system. It is hand-held, and is going in the field. So, yes, it will probably become the standard.

Q3. Is Army ARL providing the resources to develop and issue the CS handbook?

A3. Yes

Q4. You addressed TRLs. What about Manufacturing Readiness Levels (MRL) status?

A4. We are punching out parts now.

Q5. How can other DoD activities leverage the ARL CS expertise and capability during the repair development phase?

A5. Call Vic Champagne

Q6. What is the greatest impediment to wide-spread adoption to CS repair?

A6. 1) DoD is not setup to easily implement new technology. There is not a standardized process to transition technology ... i.e. “The Valley of Death”. 2) It is human nature to resist change. “It wasn’t invested here.”

Q7. Why is America Makes Roadmap irrelevant?

A7. I like to see progress. I don’t see the roadmap as an activity creating progress.

Laser Engineered Net Shaping (LENS) – Robert Kestler (NAVAIR, FRC-East)

Q1. Does blown metal powder process damage the substrate material? What is its advantages

over cold spray?

A1. No, it does not. We see better adhesion with this process and we do need fusion.

Q2. Is x-ray sufficient NDI technique? Do you ever need to use CAT scan?

A2. Correction, CT scan was used.

Q3. Are you limited to which materials that can be LENS repaired?

A3. No. Several different alloys were used.

DMG-Mori – Hybrid Additive & Subtractive Repair – Dr. Greg Hyatt

Q1. This is just a comment: Cold spray can deposit about 21 pounds per hour of 6061Al but adaption for AM is still not as fast as it should be and the cost of 6061Al is only \$30.00/pound so it is quite reasonable so deposition rate and costs are not detriments.

A1. Larger size particles decrease the cost of powder

Q2. Can you describe some applications for this now developed capability?

A2. There are a wide range of applications including aerospace (engines), energy (oil patch), valves, and repair applications

Laser Additive Manufacturing Repair – Wesley Cass (CCAD)

Q1. How does Army aviation engineering leverage the additive repair qualifications that have been completed to more rapidly qualify the next AM repair components?

A1. Crawl, walk, run. 1) Replacing thermal spray (non-structural). 2) Get people used to the idea (conservative), 3) Coupon Testing – establish a database in the command first and record material properties.

Q2. How difficult has it been to qualify your applications within the Army?

A2. We've been working on it since 2004 with LAM. It has been difficult. You must have passion. The proof is in the pudding.

NAVSEA Cold Spray Overview – Janice Bryant (NAVSEA)

Q1. How do you send technical instructions to the workforce?

A1. 1) TDI is done for each specific application. 2) Paper delivery currently. ETWID is in the acquisition stage.

USAF Cold Spray Capability Overview – Mike Froning (USAF)

Q1. What materials will you be focusing on in the future?

A1. Titanium and a lot of aluminum.