



# DoD Wide Cold Spray Technology Roadmap

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# DoD Wide Cold Spray Technology Roadmap



- Facilitated by the America Makes Institute & The Barnes Group Advisors



Cold spray application



Corroded part

Part repaired via cold spray

Total Historical Cold Spray Service Investment: ~\$181M



# Objectives & Approach



## Objectives

- Identify current state, common needs & actions
- Identify investment gaps & priorities
- Prevent duplication of effort when closing gaps

## Approach

- Service Reviews – review & categorize activities, plans, applications
- Service Workshops
  - ID & prioritize needed capabilities
  - ID & prioritize gaps needing closure to achieve capability
  - ID gap closing activities, including commonality
- DoD Integration Workshop
  - Concurrence on common & unique gaps (by Service)
  - Concurrence & prioritize areas for DoD-wide collaboration, collaboration type & recommended funding org
- Develop Roadmaps (3 levels): DoD, High-level Service, Detailed Service



# Status



- Army, Navy & Air Force Reviews ✓
- Army, Navy & Air Force Workshops ✓
- DoD Integration Workshop ✓
- ID common & specific challenges to adoption ✓
  - Unified voice seeking resources
  - Increased collaboration & sharing of best practices
  - Prioritized collaboration opportunities
- DoD review of draft Interim Report ✓
- Deliverables (Distribution A & D versions):
  - Roadmaps – DoD level & Detailed Service level
  - Interim/Final Roadmap & Final Report – Spring/Summer 2020



# Accomplishments



- Service Reviews & Workshops ID'd:
  - >35 needed capabilities
  - >25 gaps
- Draft detailed roadmaps populated with >500 activities
- Draft DoD & Service roadmaps submitted for review



40+ Cold Spray SMEs at the Navy Workshop



# Preliminary Findings



- Services are collaborating to establish initial cold spray applications for non-structural repairs
  - All Services have developed & fielded repairs
  - ROIs are extremely positive
- Long & short-term needs, gaps & Service collaborations ID'd & prioritized

#	Name	GAP Description	COMMON			SOW TYPE	ROM (\$M)
			Votes	Rating	Term		
103	Common Database & Taxonomy for Data	Property (physical, mechanical, metallurgical, corrosion) dataset covering coupons to parts and taxonomy, to support structural and non-structural repairs, Fixturing, CSP, unique solutions, lessons learned	9	H	S	R&D Engineering	<1
101	Training and Certification Standards	Standards and certifications for engineer and technician training	6	H	S	Training	1-10
102	Safety Planning & Approval Data	Data package to support facility safety planning and approvals	4	M	S	Facilitation Working Group	<1
101	A DOD-wide culture of collaboration & data sharing to drive CS adoption	Activity to encourage (possibly incentivize) collaboration across DoD including enhanced communication, technical exchanges, joint-service roadmapping and technical committees, working groups, etc. and IT support for data sharing.	3	M	S	R&D Engineering	<1
119	Evolving Cold Spray supply chain	Development of robust supply chain. DoD or Industry Controlled equipment and powder specifications that are insensitive to supply chain changes.	3	M	S,L	R&D, Eng, DB	1-10
110	Nondestructive Testing & QA	Demonstrated & validated NDT methods for validating quality of deposit, bondline, and integrity of substrate Common requirements/specifications/procedures for when & what	8	H	L	R&D Engineering	>10
115	Material/Process/Property relationships	Includes: How properties, residual stresses, and flaws evolve in substrate & deposit as a function of parameters and time. Impacts on thin substrates. Statistically-based model correlating process parameters with defect type and distribution, invariant of material and geometry. Advanced Software for modeling & prediction of CS process including microstructure and defect prediction, CAM, physics based modeling, etc.	6	H	L	R&D Engineering	>10
114	Identified and agreed list of critical process parameters	Includes: Feedstock and Process (spray and thermal) Parameters Deposit, Interface, and Substrate Properties (physical, mechanical, metallurgical, and corrosion) Part and substrate residual stresses and distortion Machine to machine variation and drift Link with modeling and simulation	3	M	L	R&D Engineering	>10



# Preliminary Findings



- Short-term gaps include:
  - Common Database & Taxonomy for Data – Property database covering coupons to parts to taxonomy
  - Training & Certification Standards – Standards & certifications for technicians & engineers
  - Safety Planning & Approval Data – Data package to support facility safety planning & approval
  - DoD-wide Culture of Collaboration & Data Sharing – Activity to encourage collaboration across DoD, i.e., enhanced communications & technical exchange
- Long-term gaps include:
  - Non-Destructive Testing & QA – Demonstrated & validated NDT & QA methods for quality of deposit, bondline, & integrity of substrate
  - Materials/Property/Process relationships & Agreed List of Critical Process Parameters – Fundamental knowledge how properties, stresses & flaws evolve in a substrate & deposit as a function of parameters & time
  - Evolving Cold Spray Supply Chain – Robust supply chain, including DoD or industry-controlled equipment & powder specifications