



Kinetic Metallization (KM) for Dimensional Restoration

Inovati

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2015 Navy Opportunity Forum

Repairing High-Value Components

- Critical need: repair high-value aircraft parts
- Worn components scrapped
- New parts procured
 - Low volume, expensive
 - Excessively long lead times
- Decreased operational readiness



Potential Beneficiaries of KM Repairs

- Fleet Readiness Centers
 - FRCSW
 - FRCE
 - FRCSE
- Navy Aviation Enterprise
- Air Logistics Centers
- Army Depots
- Commanders addressing aircraft mission availability



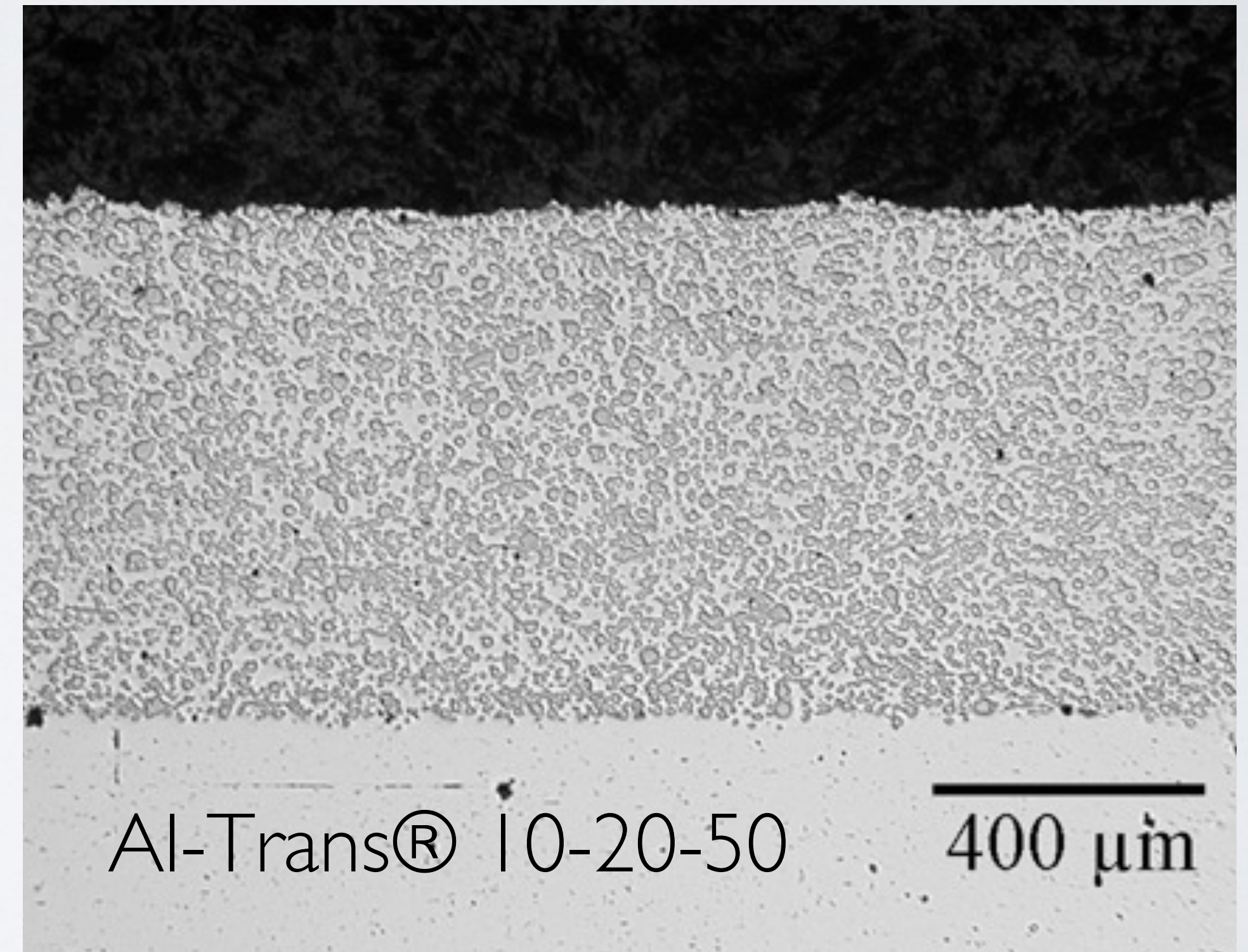
Current Repair Processes

- Many parts replaced
- Some repaired once
- Limited repairs with
 - Flame spray
 - Welding
 - Hard chrome replacement
- Attempts made to use standard cold spray



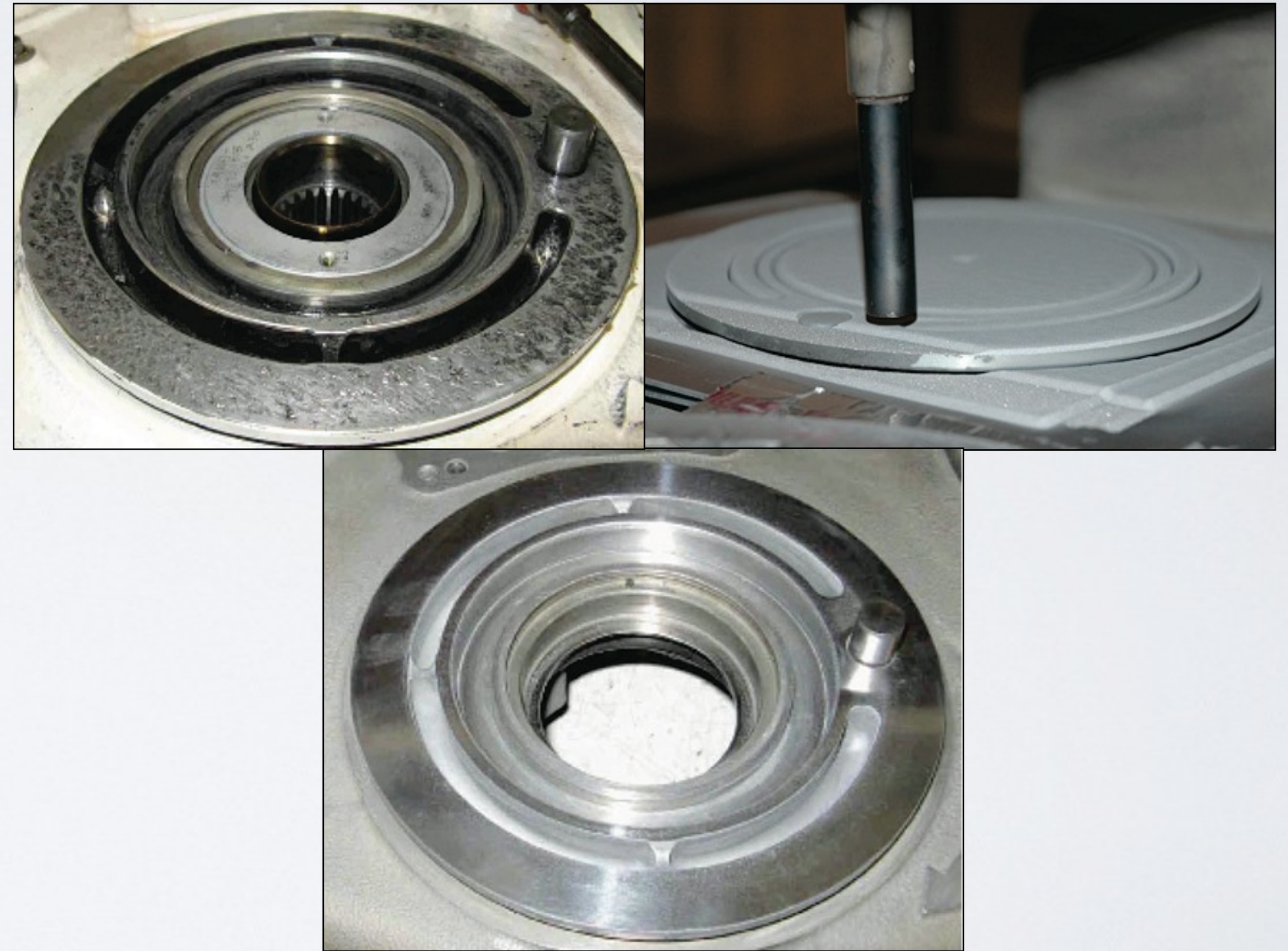
Repair Requirements

- Restore dimensions to original specifications
- Environment Health & Safety compliant
- Repair adhesion, material and mechanical properties, machinability
- Corrosion, wear, and erosion resistance



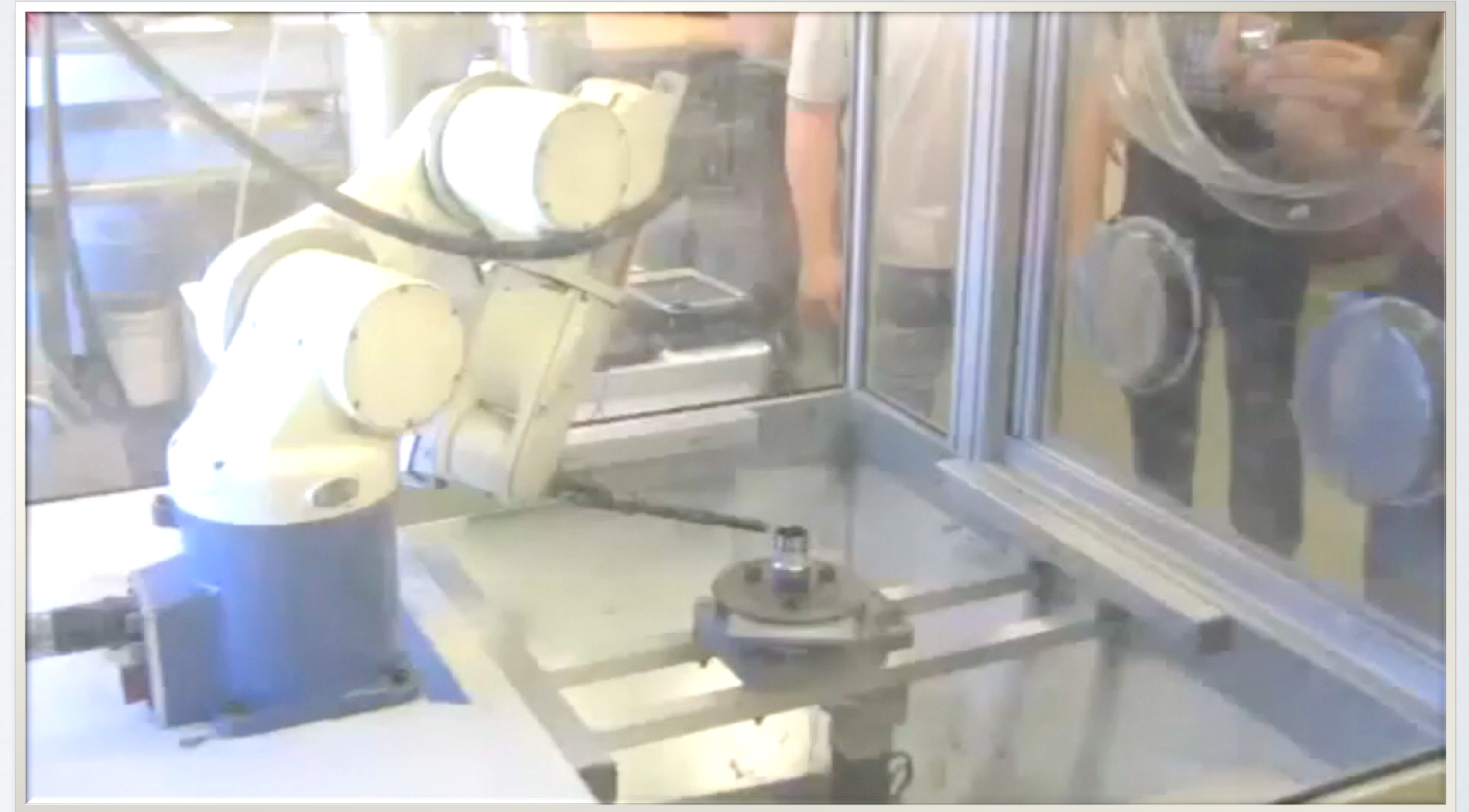
Kinetic Metallization

- Metal Deposition Process
- Low pressure and temperature
- Meets environmental standards
- Cost-effective
- Dimensional restoration of high-value aircraft components



Kinetic Metallization

- Repairs various component materials
 - Aluminum
 - Magnesium
 - High-strength Steels
- Applies various repair feedstocks
 - Aluminum Alloy
 - WC-Co
 - Nickel Alloy






Kinetic Metallization

Features	Advantages	Benefits
Low Temperature Operation	Enables the repair of components previously not thought possible	Greater availability of parts
KM Sonic Nozzle	Uses less gas	Low consumable costs
Custom Powder Formulations	Repairs can be tailored to any application	Meet specific performance requirements
Robotic Control	Enables automated repairs	Consistent quality parts



Quality Assurance

- Data Integrity
- Historical records
- System health monitoring



Run Details

Operator		Customer	
Date	3/10/2015	Project	
Time	16:46:19	Task	

Substrate

Material Group	Steel	Bond Coat	none
Alloy	-	Preheat Temp	0
Surface Prep	80 grit SiC by hand	Thickness	0.25
Surface Roughness	118		
Substrate Comment	2"x2.5"x0.25" 165.1g		

Powder 1

Material Group	-----	Drying Method	-----
Alloy	-----	Preblend?	---
Powder ID	-----	Set Point (%)	0
Sieve	---	Feed Rate (g/min)	0
Powder 1 Comment	-----		

Powder 2

Material Group	Nickel	Drying Method	Vacuum + Heat
Alloy		Preblend?	No
Powder ID	0106-77	Set Point (%)	9
Sieve	40	Feed Rate (g/min)	12
Powder 2 Comment			

Nozzle

Type	Raster	Serial Number	0
Throat Diameter (in)	0.06		
Nozzle Comment			



KM vs. Standard Cold Spray

He, 250C, Cu alloy		Kinetic Metallization 100psia	Coldspray (e.g., CGT) 300psia
Gas Consumption	SCFM	11	135
Powder Feedrate	g/m	30	34
Deposition Efficiency	%	90	90
Deposition Rate	g/m	27	30
Repairs Flying on Navy Aircraft		Yes	No

Current State of Development

- Where we are now
 - Developing tooling, procedure, and feedstock for five F/A-18 components (TRL8)
- What is next
 - Installation of a KM system at NAVAIR FRCSSW (TRL9)
 - Additional component repairs for F/A-18 and other aircraft platforms





Current State of Development

Part	Airframe	Repair	Savings
AMAD	F/A-18 A-D	Main Housing, external	
	F/A-18 E/F	Main Housing, External and Internal	
AMAD Hydraulic Gearshift	F/A-18 E/F	Seal Surface	
Main Wheel	F/A-18 A-D	Bearing Bore	
Brake Carrier	F/A-18 A-D	External	
		Est. Annual Savings	\$1,800,000



Transition to Fleet

TRL	Milestone	Estimated Date
8	Develop repair of F/A-18 main wheel	July 2015
8	Install KM System at NAVAIR FRCSW	July 2015
9	Develop KM repair procedures, tooling and, test protocols for F/A-18 components	March 2016
8	Develop KM repair procedures, tooling and test protocols for additional components for F/A-18 and additional aircraft	TBD
9	KM Systems installed for broad range of component repairs at FRCs	TBD

Partners Sought

- Fleet Readiness Centers
- Air Logistics Centers
- Army Depots
- Providers of Logistics Support Services





Inovati's Role

- Manufacture, installation, leasing, and sales
 - KM Systems
 - KM Feedstock
- Contract component repair
- Applications development, training and customer support
- System and repair demonstration





About Inovati

- Founded 1989
- Manufacturing, production and R&D facilities
 - Santa Barbara, California
- Customers
 - Navy, Air Force, DOE, NASA
 - GE, Chevron, Boeing, others





Visit us at Booth

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