

# SERDP and ESTCP Overview and Cold Spray Success Stories

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# DoD's Environmental Technology Programs



## Science and Technology

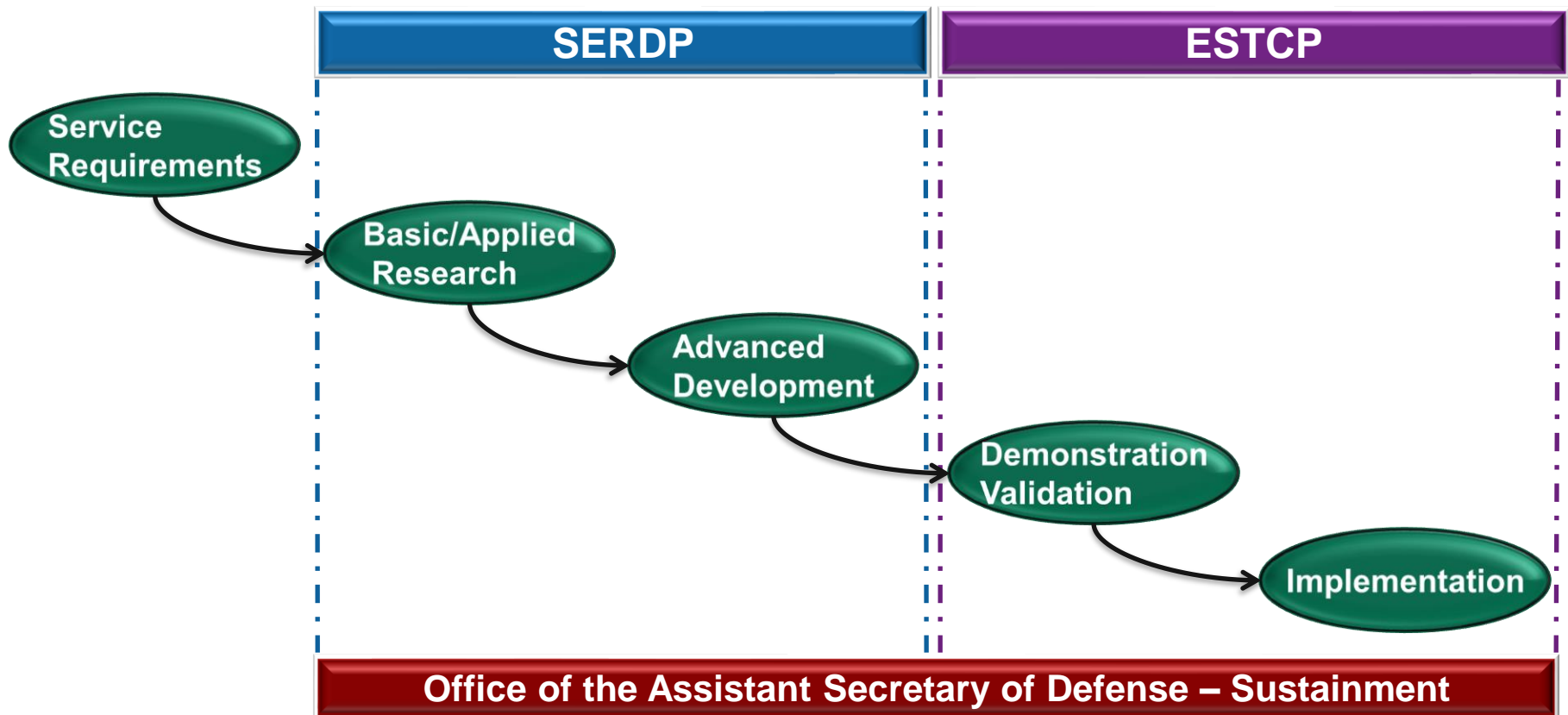
- Statutory Program Established 1991
- DoD, DOE, EPA Partnership
  - ◆ Advanced technology development to address near-term needs
  - ◆ Fundamental research to impact real world environmental management



## Demonstration and Validation

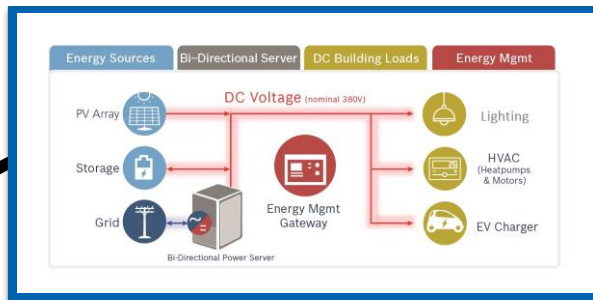
- Demonstrate Innovative Cost-Effective Environmental and Energy Technologies
  - ◆ Transition technology out of the lab
  - ◆ Establish Cost and Performance
  - ◆ Partner with End User and Regulator
  - ◆ Technology Transfer
    - Accelerate Commercialization or Broader Adoption
    - Direct Technology Insertion

# Environmental Technology Development Process



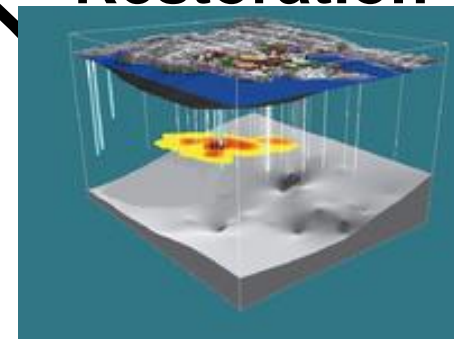
# Program Area Management Structure

## Weapons Systems & Platforms



## Energy & Water (ESTCP only)

## Environmental Restoration



## Resource Conservation & Resiliency



## Munitions Response

# Enhance Materiel Availability

## Corrosion

\$20B/yr problem

Impacts weapons systems availability

Corrosion mitigation = hazardous materials

### Alternative technologies

Less hazardous materials

Better repair

### Accelerated aging studies

Better predict materiel lifetimes

## Sustainable Processes

### Additive Manufacturing

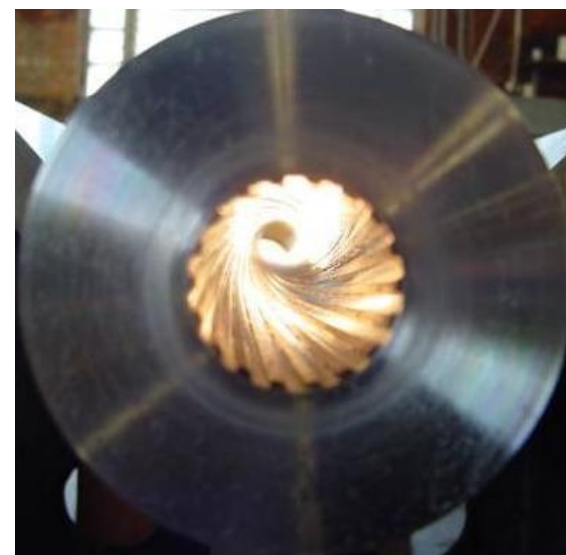
### Energetic Materials

Advanced synthesis methods

Advanced formulation methods

# Weapons Systems and Platforms Concerns

- Regulatory environment
  - TSCA, REACH, ACGIH
- Heavy metals
  - Pb, Cr, Cd...
- Solvents
  - Toluene, methylene chloride, PCBTF (Oxsol 100), Trichloro ethylene....
- Emerging contaminants
  - PFAS, Isocyanates,
  - Waste materials and waste disposal
- Air and other emissions



**Meet regulatory requirements;  
Ensure sustainability of operations; Consider  
lifecycle cost and assessment**

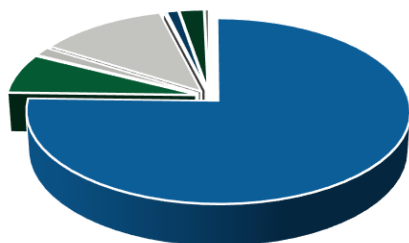
# Weapons Systems and Platforms Focus Areas

- **Manufacturing and Maintenance**
  - Sustainable materials processes and repairs - Depots, Shipyards & OEMs
  - Accelerated aging
- **Sustainable energetics**
  - New ingredients
  - Alternative manufacturing and formulation
- **Emissions**
  - Gas turbine and diesel engines
  - Blast and jet engine noise
  - Weapons and munitions
  - Ship and industrial
  - Firefighting

**Meet regulatory requirements;  
Ensure sustainability of operations; Consider  
lifecycle cost and assessment**



# Cr and Cd Usage on a Military Jet

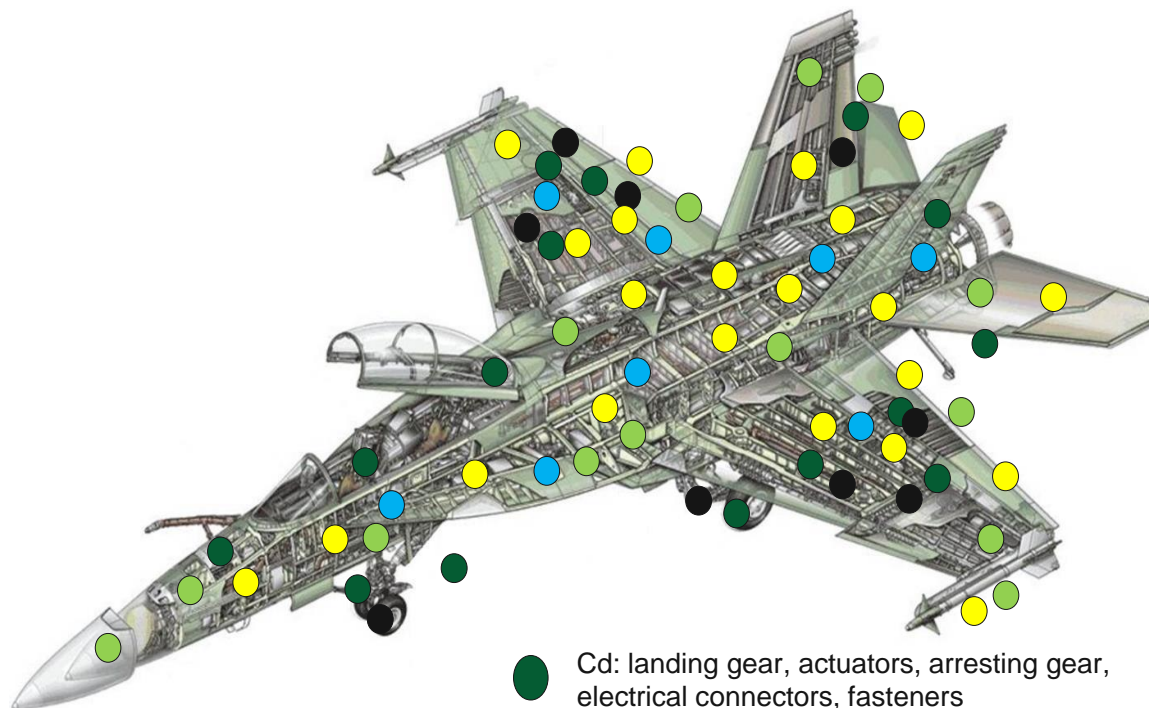


■ Chromated Primers

■ Chrome Plating

■ Chrome Conversion Coatings

75+% of  $\text{Cr}^{6+}$  usage is chromate primers...have to replace chromated primers to meet strategic reduction goals



● Cd: landing gear, actuators, arresting gear, electrical connectors, fasteners

● Hard chrome: landing gear, actuators

● Chromic acid anodize: airframe, components

● Chromate conversion: airframe, skin, electrical enclosures, Cd plating

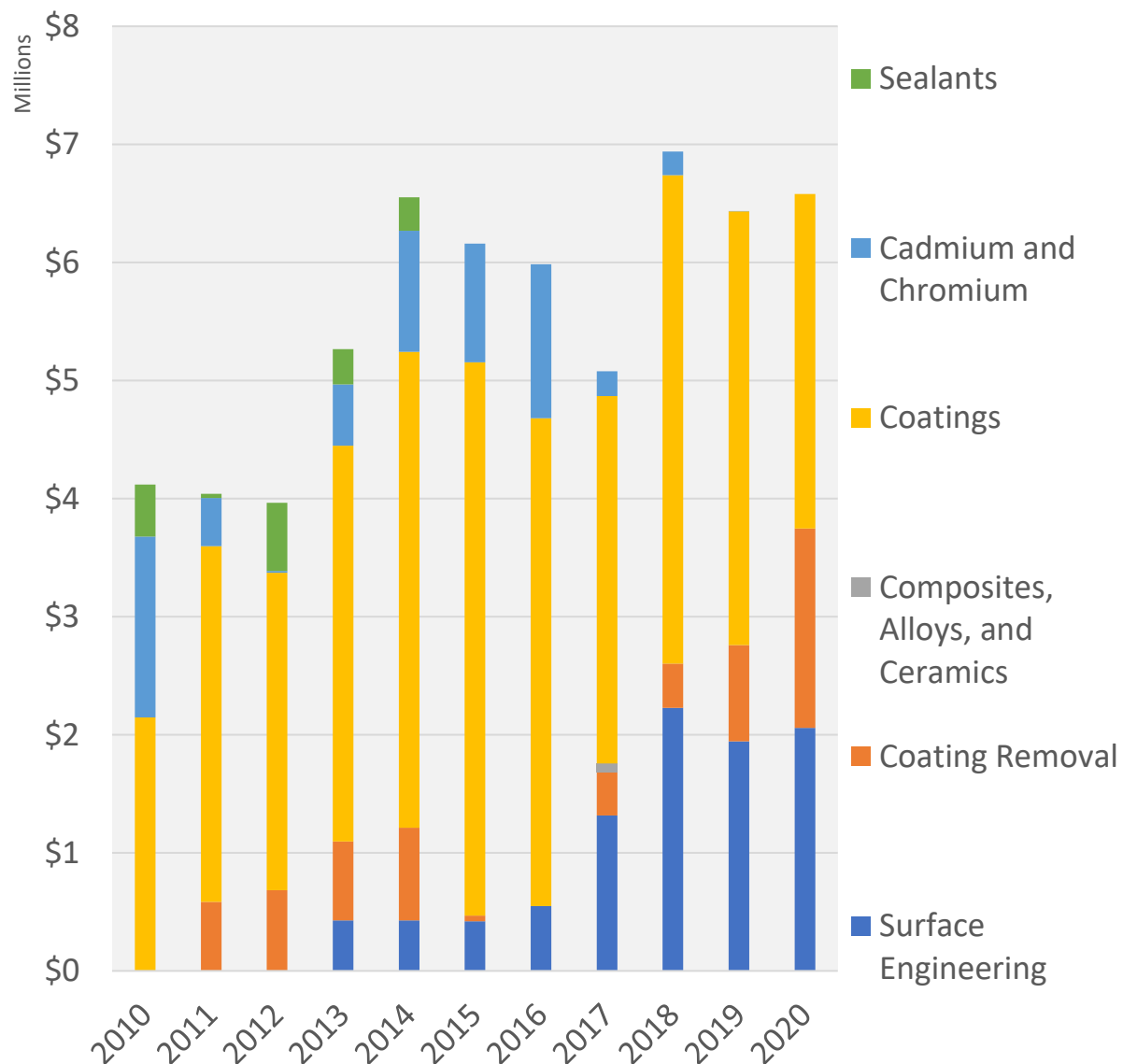
● Chromate primer: airframe, skin, wet install fasteners

# Surface Engineering Efforts

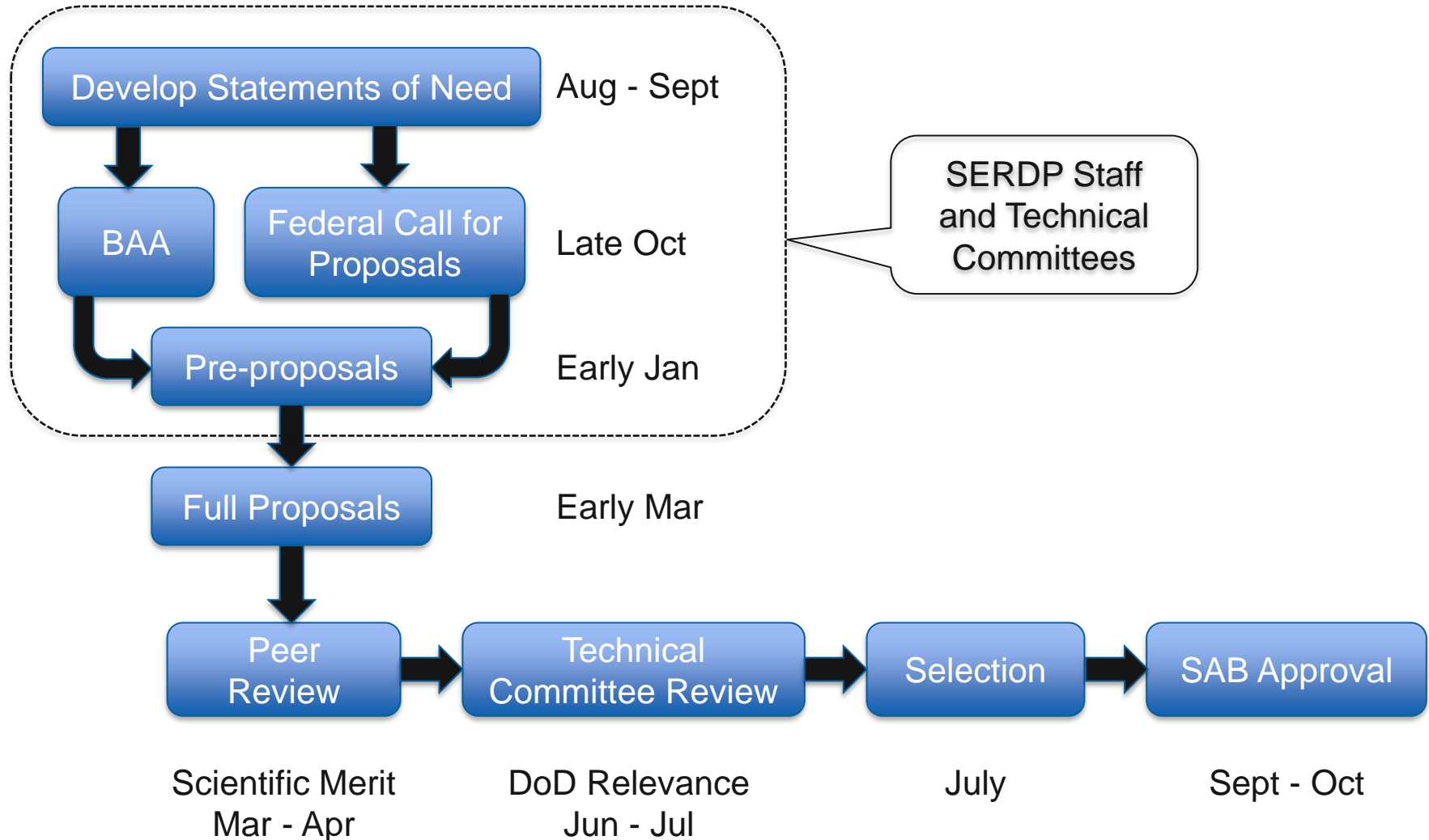
DoD assets are subject to significant degradation due to corrosion, with specific impacts in the following areas:

- **Financial:** \$18-\$22 billion annually
- **Readiness:** Weapons systems routinely out of commission
- **Safety:** Weapon systems mishaps documented

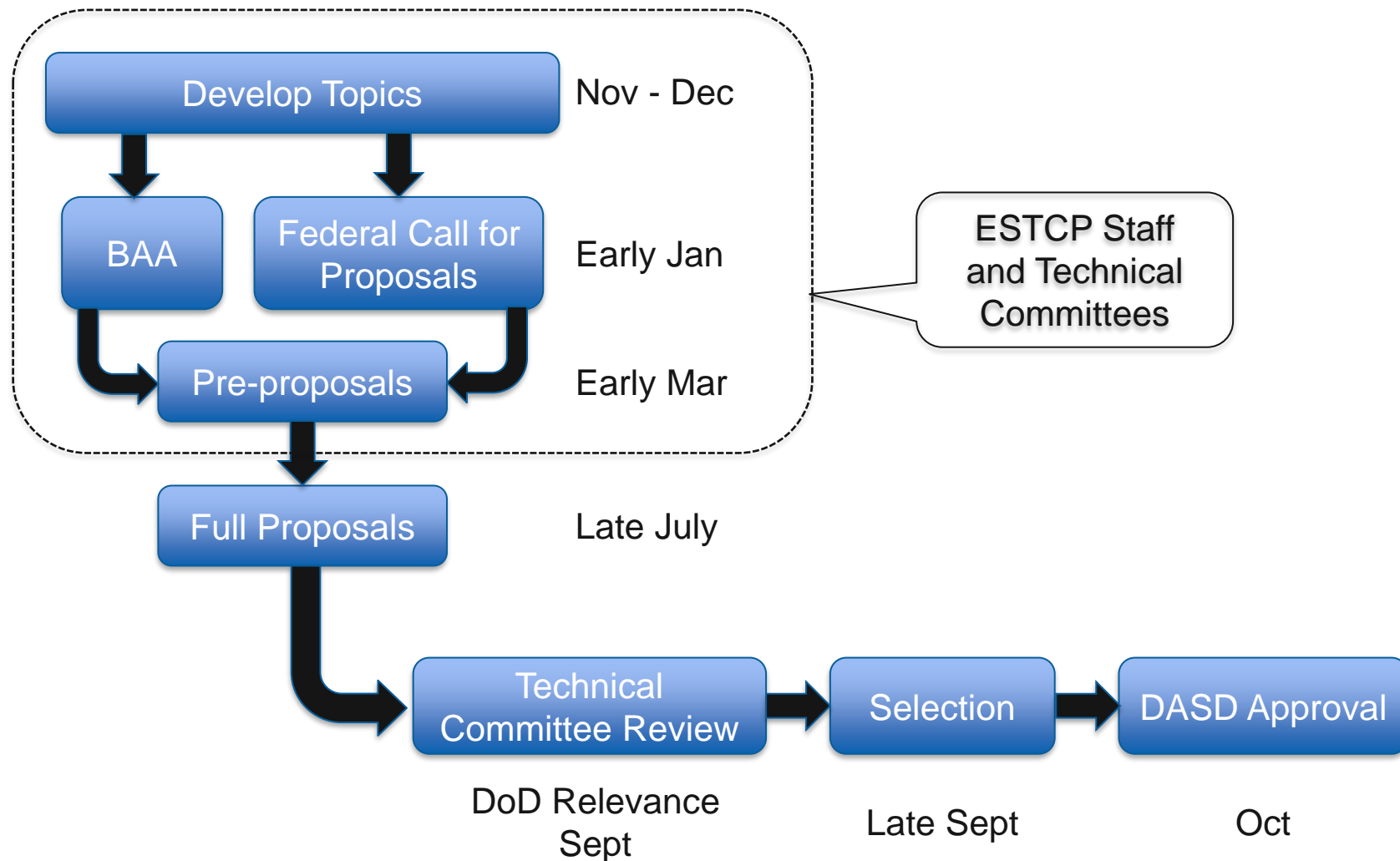
**Many materials used to impart corrosion resistance have environmental and/or worker safety concerns**



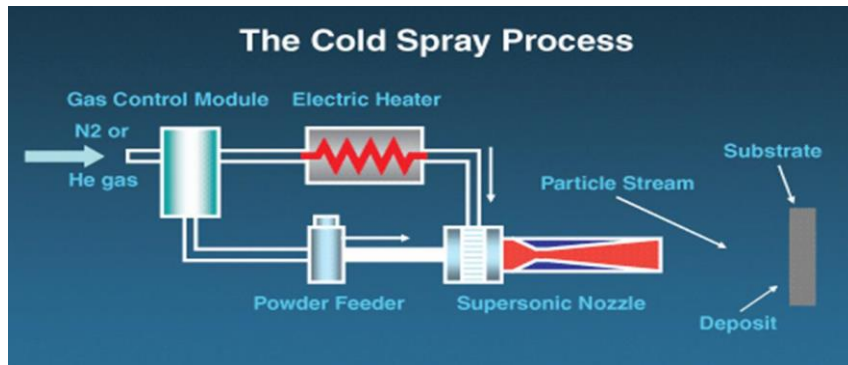
# SERDP Funding Process



# ESTCP Funding Process



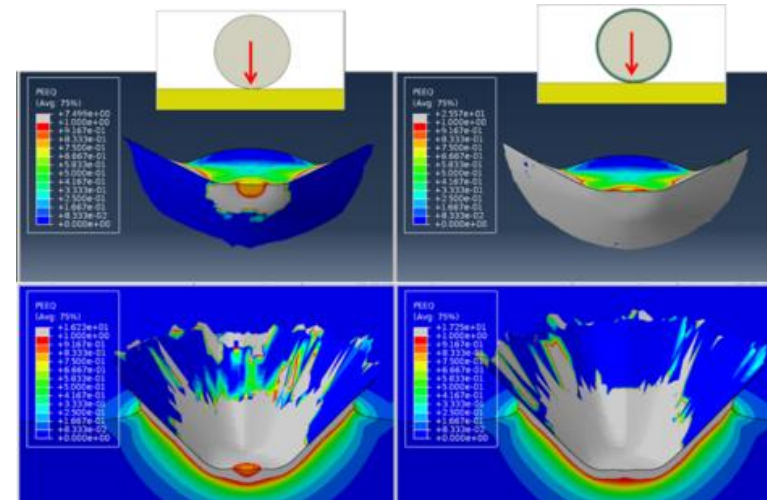
# Cold Spray Success Story 1



- Project ESTCP WP 200620
  - Repair of Mg Aircraft Components
  - 2012 ESTCP Project of the Year
  - Benefit to Cost Study in 2015
    - 13 approved repairs
    - \$23.6 M savings per year
    - High value parts
    - Long lead times
  - Several additional repairs have been demonstrated

## Cold Spray Success Story 2

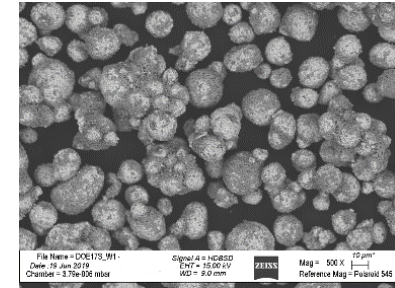
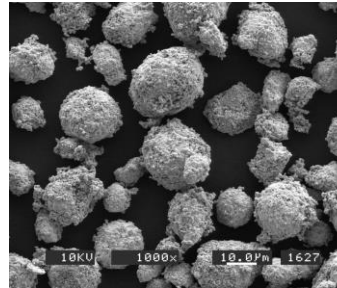
- Cold spray coatings for Cr and Ni plating replacement
- Several powder morphologies were investigated and modeled
- Cold Spray processes optimized
- A Ni process was developed and achieved >400 HV
- A Cr alternative yielded >700 HV



Based on these results an ESTCP project was initiated in FY 19

# Cold Spray Success Story 3

- Cold spray coatings for Cr and Ni replacement
- Transition of specialized powders at Solvus Global
- Design of cold spray nozzles for internal diameters > 2 inches
- Improved impact and wear resistance



<https://www.serdp-estcp.org/asetsdefense>

# ASETSDEFENSE WORKSHOP 2020: SUSTAINABLE SURFACE ENGINEERING FOR AEROSPACE AND DEFENSE-August 4-6, 2020

The 8th Workshop on Sustainable Surface Engineering for Aerospace and Defense will be held virtually.

