The Expanded Use of Titanium in the Services
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Agenda

• Who Is ARDEC
• ARDEC Warfighter Support
• Development of Titanium in Army Systems
• One Area of Titanium Investment within the Department of Defense (DoD)
• Manufacturing Technology Program (ManTech)
• Summary
ARDEC at a Glance

- Established track-record supporting transition of technologies to the field
  - 40 Full Materiel Release (FMR) FY08-FY11
  - 70 Urgent Materiel Release (UMR) FY08-FY11
  - Enabled fielding of 217 New Ammunition, Weapons and Equipment since 9/11

- Streamlined product development by extensive Modeling and Simulation and Systems Engineering

- Partnered with Industry, Academia, and other Government agencies – 126 CRADA

- Steward of Government Data Rights and Intellectual Property
  - 215 Invention Disclosures FY09-FY11
  - 176 Patent Applications FY09-FY11
  - 89 Patents Issued FY09-FY11
  - 18 Active Patent License Agreements

“Center of Mass” for Armament Systems and Munitions for Joint Services

AT4 CONFINED SPACE  M982 EXCALIBUR BLOCK IA-1 PROJECTILE  XM110 SASS  XM135 CROWS

Distribution Statement A: Approved for public release; distribution is unlimited.
ARDEC Mission:
Total Warfighter Support

M240B 7.62MM
Machine Gun

M900 Armor
Piercing Cartridge

CROWS Lightning

XM25 Grenade Launcher

Lightweight Handheld Mortar Ballistic Computer

M211/M212 Aircraft Countermeasure Flares

Mine Roller Brackets/Extensions

M777A2 Lightweight 155mm Howitzer

Electro-Magnetic Gun

M110 Semi-Automatic Sniper System

40mm Multi-Shot Launcher

Lightweight Dismounted Mortar

Excalibur

M829A3 AFPSDS-T
120mm

Gunner Protection Kits

Small/Cannon Caliber Ammunition

Advanced Crew Served Weapon

Total Lifecycle Support
Research
Development
Production
Field Support
Demilitarization

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ARDEC Development of Titanium in Army Systems

120mm Mortar Base Plate  M777 Lightweight Howitzer Parts  M240L Lightweight Parts  FCS Blast Hull  Stryker Mortar Carrier Variant (MCV) Doors

Abrams Tank Reactive Armor Tiles  Excalibur CAS Components  Stryker Cupola Shield  Lightweight Trailer  HMMWV Ballistic Doors

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TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
The Evolution of Warfighter Protection

- Special Operations Command (SOCOM) requirements have been instrumental in driving recent titanium-based warfighter protection improvements (USASOC GPK, Titanium Tactical Seat)
- ARDEC has continued to demonstrate the benefits of titanium with the development of the prototype, lightweight Titanium Protective Crew Compartment
Titanium Warfighter Protection Makes Sense for US Armed Services

• Titanium warfighter benefits:
  – Light weight for transportability
  – Superior ballistic qualities for survivability
  – High corrosion resistance for durability

• High titanium production costs have traditionally delayed more widespread adoption

• ARDEC prototyping and rapid response manufacturing projects have demonstrated the feasibility of titanium-based defense solutions

• A range of other titanium programs, across the services, are funded and administered as part of the Department of Defense’s (DoD’s) Manufacturing Technology (ManTech) Program*

*ManTech Program initiatives do not represent the entire scope of DOD titanium investment
One Area of DoD Investment in Titanium: ManTech

ManTech anticipates and closes gaps in manufacturing capabilities, allowing for affordable, timely and low-risk development, production and sustainment of defense systems.
ManTech Program oversight is through the Joint Defense Manufacturing Technology Panel (JDMTP)

Titanium-related projects coordinated through Metals Subpanel

Subpanel members include Army, Navy, Air Force, Defense Logistics Agency (DLA) and other government agencies

Subpanel meets annually to evaluate project portfolios:

- **Review**: Review and rate projects
- **Analysis**: Ensure no conflicts, identify best-in-class
- **Recommendations**: Enterprise-level investments
ManTech titanium programs focus on reducing costs, improving manufacturability, developing new processes, and testing new alloys, to increase applicability and affordability across the services.

**Additive Manufacturing:** electron beam, laser-engineered net shaping (LENS), laser cladding

**Improved Processes:** near net shape technologies, forging, casting, low-cost powders, advanced machining

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Recent Examples of DoD Titanium ManTech Investment

Army ManTech Program

Development of low-cost powder and processing for near-net shape weapons parts

- Ti Metal Matrix Composite armor plates for combat vehicles
- Low-cost Ti armor for Stryker O-GPK shields
- Low-cost Ti extrusion billets for appliqué armor attachments
- Laser engineered net shaping for repair of Ti bearing housings
Recent Examples of DoD Titanium ManTech Investment

Advanced Ti machining for V-22/H-1

Low-cost roll-compacted sheet from Ti powders

Near-net-shape reduced cost Ti warheads

Cost reductions for Ti coupler housing manufacture

Laser additive manufacturing in the repair and inspection of Ti compressor blades

Non-destructive inspection for electron-beam additive manufacturing of Ti

Reduced cost Ti exhaust ducts for LCS

Laser cladding of Ti for repair and coating of RBP cylinders

Titanium-ceramic encapsulated armor

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Recent Examples of DoD Titanium ManTech Investment

Air Force ManTech Program

Electron Beam additive manufacturing of Ti aircraft parts

Advanced Ti Alloy microstructure and Mechanical Properties Modeling

Use of Ti alloys in structural/thermal protection systems

Ti components for F135 engines

Forgings of affordable, solid-state titanium

Ti 5553 alloy manufacturing development
• Titanium is a key material to meet Armed Services needs for higher strength, lower weight, better ballistic performance and corrosion resistance in structural and armor components
• A range titanium programs, across the services, are funded and administered as part of the Department of Defense (DoD) Manufacturing Technology (ManTech) Program
• Each service has a portfolio of programs that include titanium affordability efforts