

16183

# **Ceramic Material and Nondestructive Evaluation/Test (NDE/NDT) Needs for Future Vehicle Platforms**

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# Report Documentation Page

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## U nmanned Ground Vehicles

- Armed Robot Vehicle (ARV)
- Multiple Utility Logistics Equipment Vehicle (MULE)
- Small Unmanned Ground Vehicle (SUGV)

The Advanced Tactical System (ATS) is a networked package that will be brought on line via MULE and ARV to provide a mobile sensor network, capability and on the basis of provide a greater network capability.



## U nmanned Aerial Vehicles

- Class I (Platoon)
- Class II (Company)
- Class III (Battalion)
- Class IV (Brigade)



## U nattended Sensors and Munitions

- Non-Line-of-Sight Launch System (NLOS-L)
- Unattended Ground Sensor (UGS)
- Intelligent Munitions System (IMS)

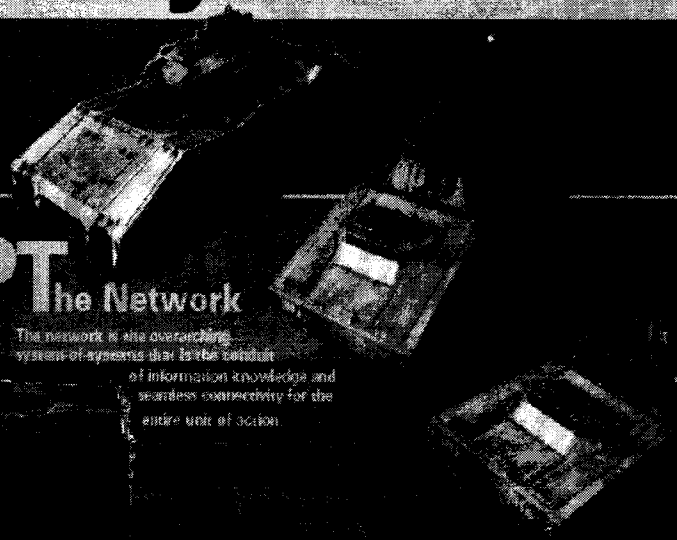


# FCS Family of Systems



## M anned Ground Vehicles

- Infantry Carrier Vehicle (ICV)
- Command and Control Vehicle (CCV)
- Mounted Combat System (MCS)
- Reconnaissance and Surveillance Vehicle (RSV)
- Non-Line-of-Sight Cannon (NLOS-C)
- Non-Line-of-Sight Mortar (NLOS-M)
- FCS Maintenance and Recovery Vehicle (FMRV)
- Medical Vehicle (MV) (includes MV-Treatment and MV-Evacuation)



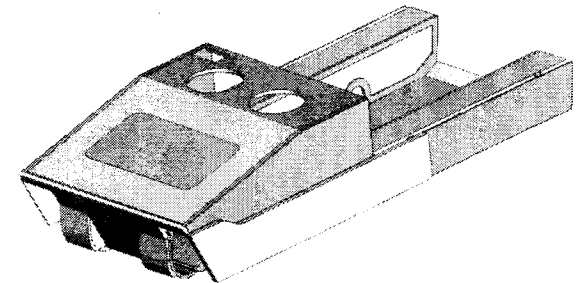
## The Network

The network is the overarching system of systems that is the catalyst of information knowledge and seamless connectivity for the entire unit of action.

# Future Vehicle Platform

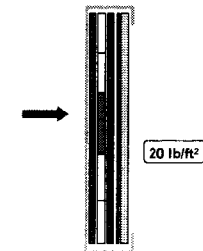
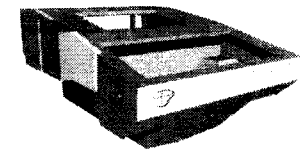
## Requirements Definition

- **Lightweight**
- **Structurally Capable System Platform**
- **Blast, Kinetic, and Energetic Threat Capable**
- **Serviceable and Repairable**
- **Upgradeable and Spiral Development Friendly**
- **Other: EMI Shielding, Low Flammability, Heat Dissipating, etc.**



## Structures/Armor Technologies & System Design

- **Low Cost Titanium**
- **Low Cost High Strength Aluminum**
- **Blast Dampening Composite Structures**
- **Ceramic/Polymer Composite Materials**
- **Ceramic/Titanium Materials**
- **EM Armor &/or other Energetic Threat Solutions**
- **System Integration Methods**
- **Standard Approach to Transition**



## Mfg Technologies & MTO Project Plan

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# Armor Manufacturing Technology Objective (MTO)

- Funded Program (FY03 – 09) \$120M
- Integrated Process Team (IPT)
  - *RDECOM/INDUSTRY*
  - *Boeing/GDLS/UDLP*
- Identify Manufacturing Technology Research
  - Transition to Production for Future Vehicle Platform

# Manufacturing Challenges (FY04-09)

- Joining Major Structural Sections of Different Materials i.e. Composite & Metallic
- Integration of Ceramic Armor on Structure
  - Tile Confinement
  - Bonding Tiles to Composite & Metallic
- Metallic Portion of Structure Fabrication Less Significant
  - Still Investigate Unique Joining & Inspection Techniques
  - High Productivity Machining Techniques

# Structure IPT Status

- Vehicle Platform Concept in Development
  - Composite floor, mine driven
  - Metallic sidewalls (Ti or Al)
  - Ceramic tile for ballistic protection
  - Mission module (s)
- Composite and/or Metallic
- Material Trade Study in Process

# Structural Armor Estimates

- Ceramic Tile Requirements
  - Common Chassis with Mission Module
  - 3K to 5K lbs per vehicle
- Program Requirements
  - Vehicle Production Example

2006	2007	2008	2009	2010	2011	2012	2013
32	31	1	79	78	191	294	588

- *First year 96,000 – 160,000 lbs*



# Ceramic Needs Future Vehicle Platforms

- Cercom Inc. PAD SiC-N Best Performing Material to Date
- Ceramic Tile Manufacturing Challenges
  - Continuous rather than batch processing
  - Production capacity
  - Inspection technique (s)
  - 60% cost reduction
- Focused Effort within Armor MTO to Meet Ceramic Mfg Challenges

# Inspection Techniques for Ceramic Tiles

- Silicon Carbide (SiC)
  - Standard 4" x 4" x 1"
  - Processing Defects

# Background Slides

# FCS-X1 Survivability Configuration

