*Army TARDEC Leader-Follower demonstration*

# Developing Army Autonomous Trucks

## Implementation of Autonomous Technologies for Tactical Convoys

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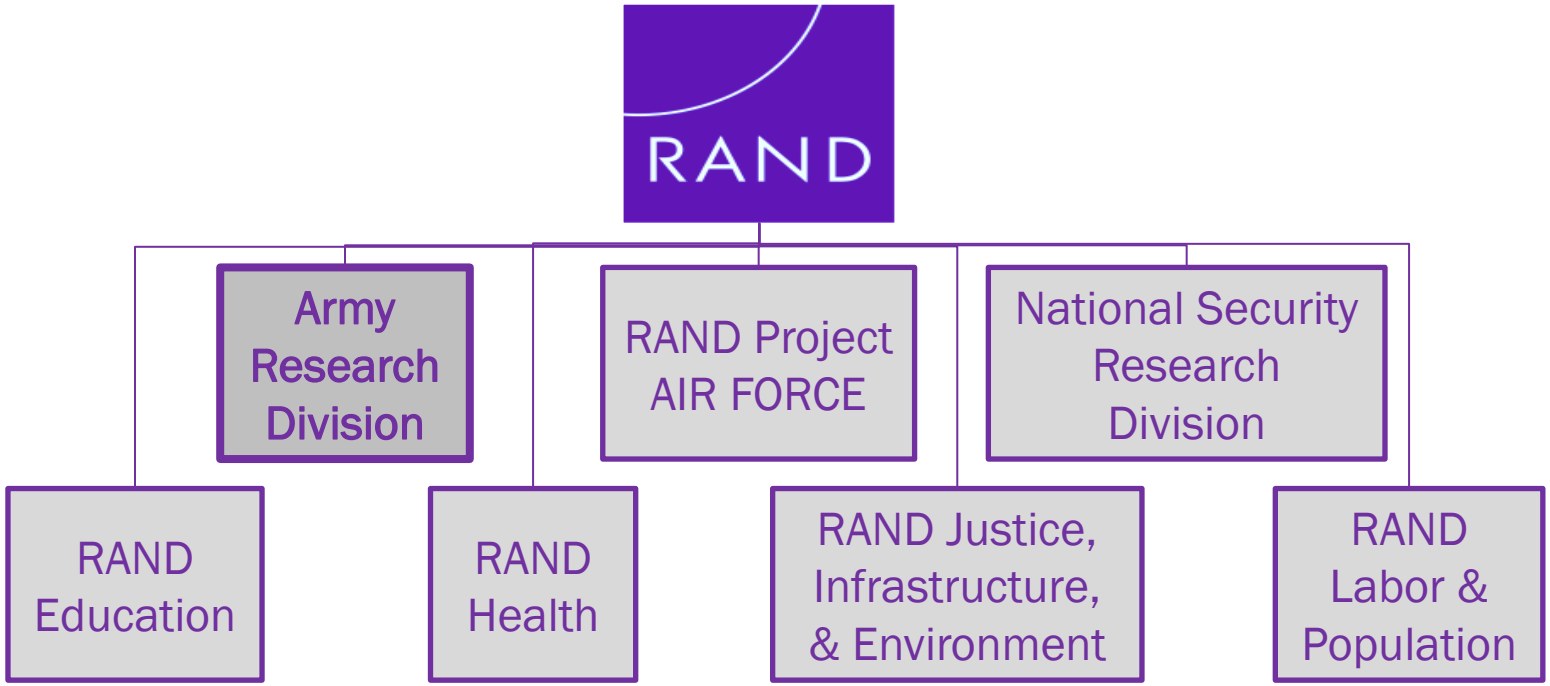
# Briefing Agenda

- Overview of ongoing research to guide Army development of Automated Trucks (ATs)
- Technical considerations for developing a tactical AT capability
- Identifying organizational impacts of ATs for the Army
- Next steps for current AT research

# RAND is a Non-Profit Research Organization that Provides Objective Public Policy Analysis

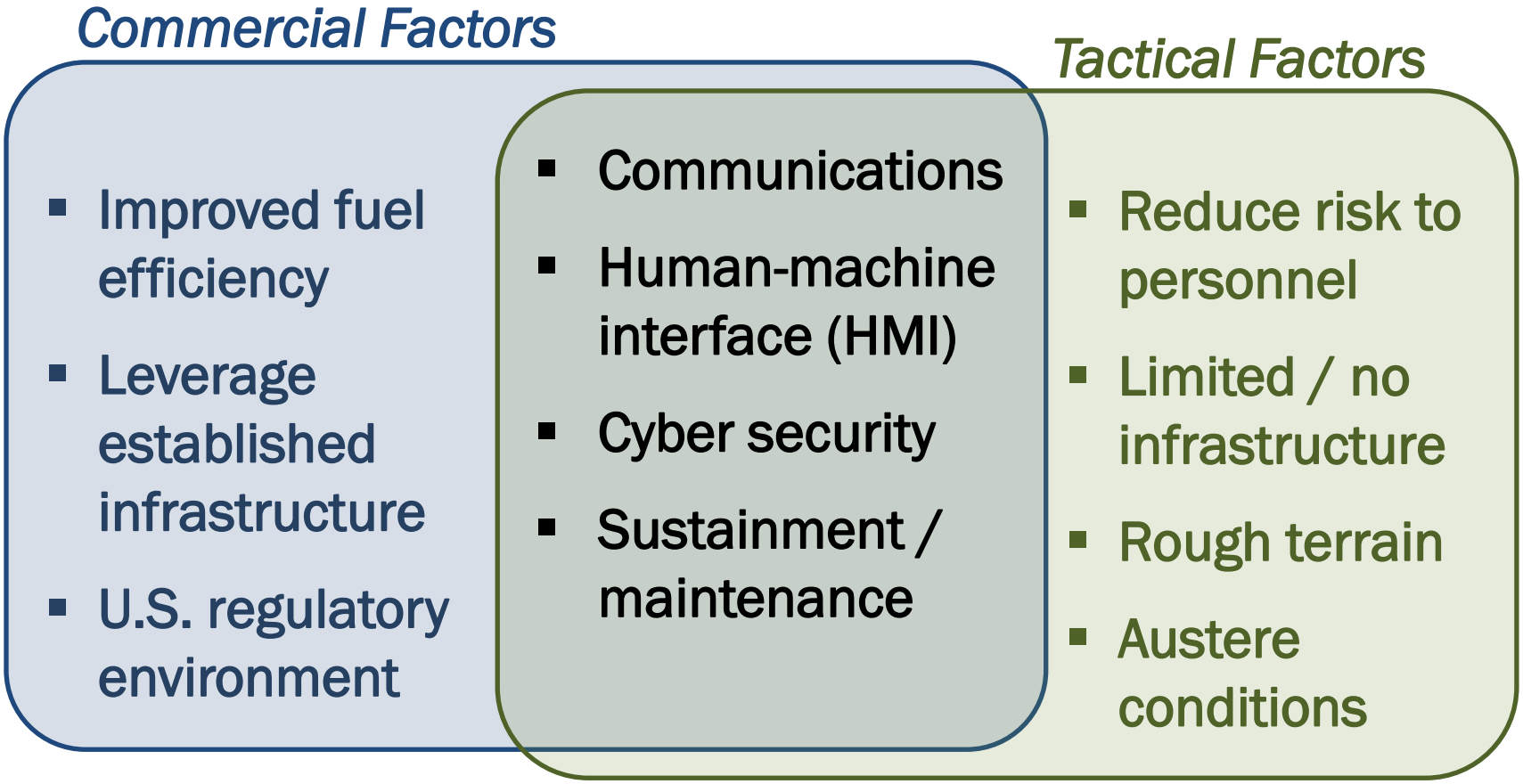



- **RAND operates three Federally-Funded Research & Development Centers (FFRDCs)**
  - The current AT study being conducted within Army Research Division
- **RAND provides research to address a broad range of technical and policy issues related to autonomous vehicles**
  - All unclassified studies are available for free download at: www.rand.org

# Overview of Ongoing RAND's FY16 Autonomous Truck Study for the Army

- **Client:** Army Program Executive Office for Combat Support & Combat Service Support (PEO CS&CSS)
  - Responsible for the lifecycle management of diverse systems spanning the Army's transportation, engineer, ordnance, and quartermaster portfolios
  - Includes transportation systems and other logistics systems
- **Study Purpose:** Provide analysis to inform Army strategy for implementing automated & autonomous technologies in combat logistics operations, to include:
  - Status of applicable current & emerging AT technologies
  - Implications for Army organizations (training, personnel, policy, etc.)
  - Key risk areas for combat application of autonomous trucks (ATs)

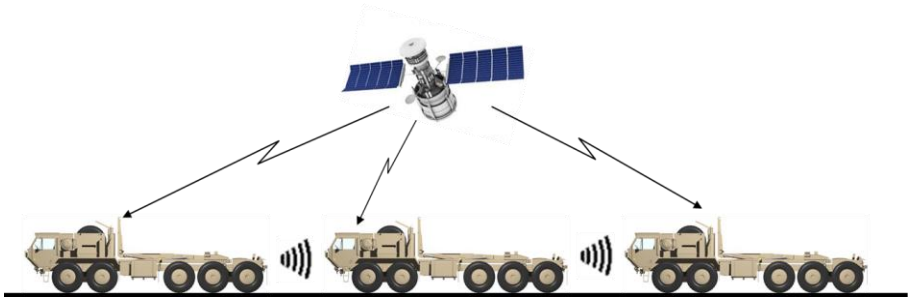
# Key Factors Influencing Commercial Versus Tactical AT Development




Despite many similarities, not all tactical technology demands are being fully addressed by commercial AT development

# Priority Concerns for Tactical AT Development (1/2)

## Vehicle Communications



- Comms connectivity central to tactical AT concepts
- Positioning information is a fundamental requirement
  - Multiple options: GPS, vehicle-to-vehicle, etc.
- Redundant / robust comms needed for degraded operations

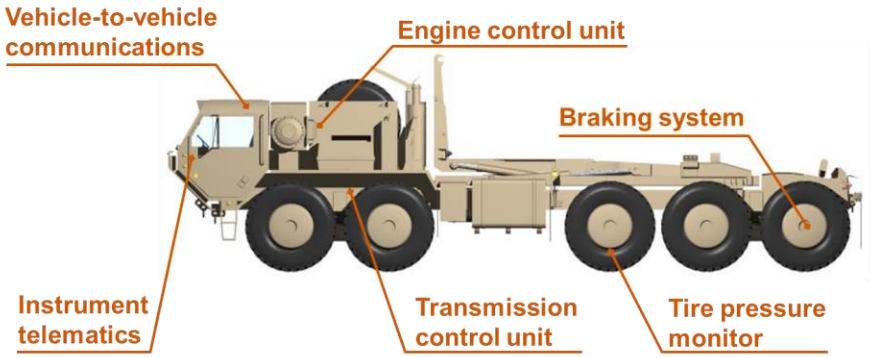
## Human-Machine Interface

*Note: Representative illustration, not actual PLS cab interior*

- Initial applique systems must allow for optional driver operation
- Requires leader or remote guidance of ATs
- Tactical design requirements constrain usable space in cab

# Priority Concerns for Tactical AT Development (2/2)

## Cyber Security



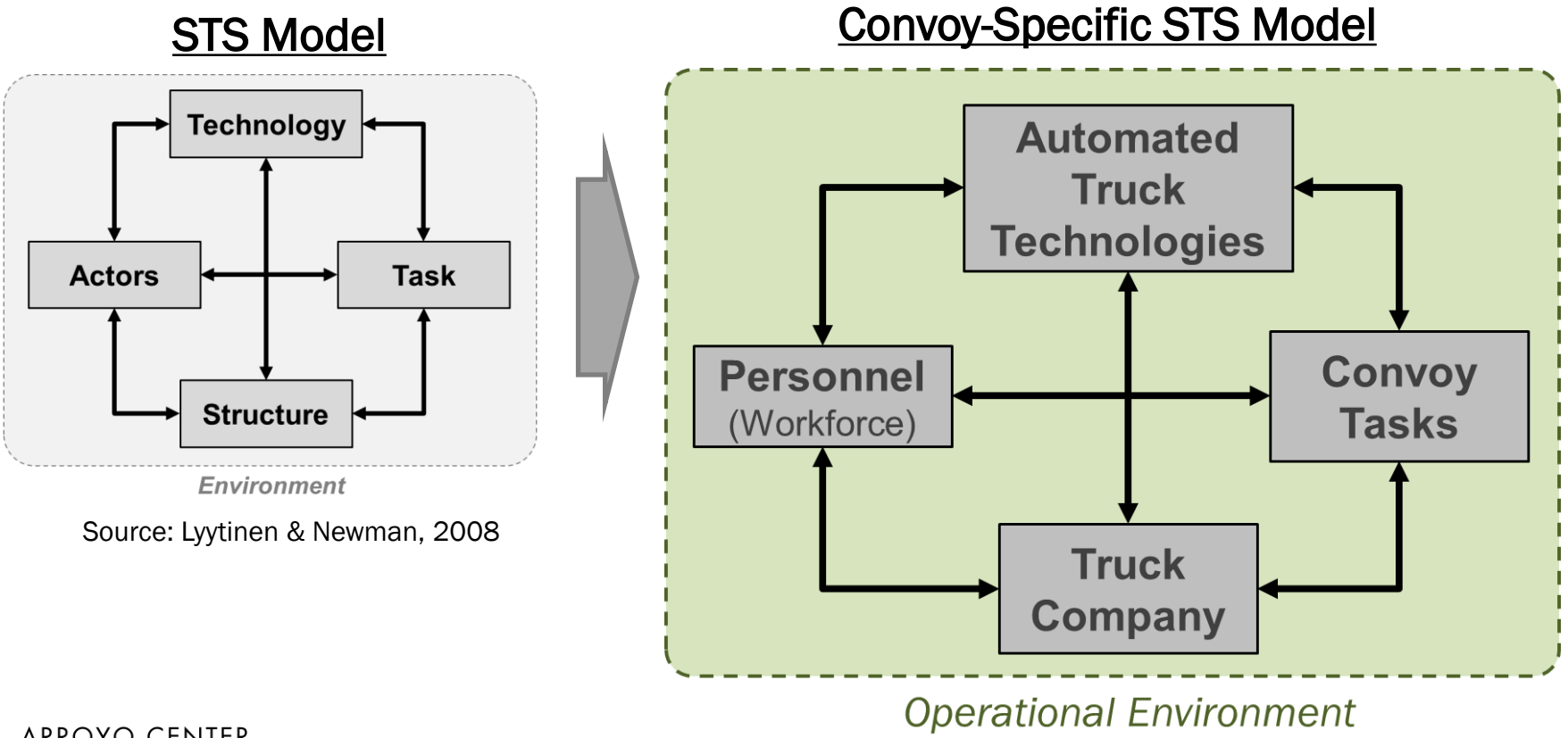

- Almost all new vehicles present significant "threat surface" for potential cyber attack
  - Recent examples illustrate potential concerns (Jeep, etc.)
- Sensors and comms for autonomous systems increase potential threat surface

## Sustainment / Maintenance

- Mission availability (dependability) of systems a primary concern
  - Especially in austere conditions
- Likely demand new competencies for Army maintainers / technicians

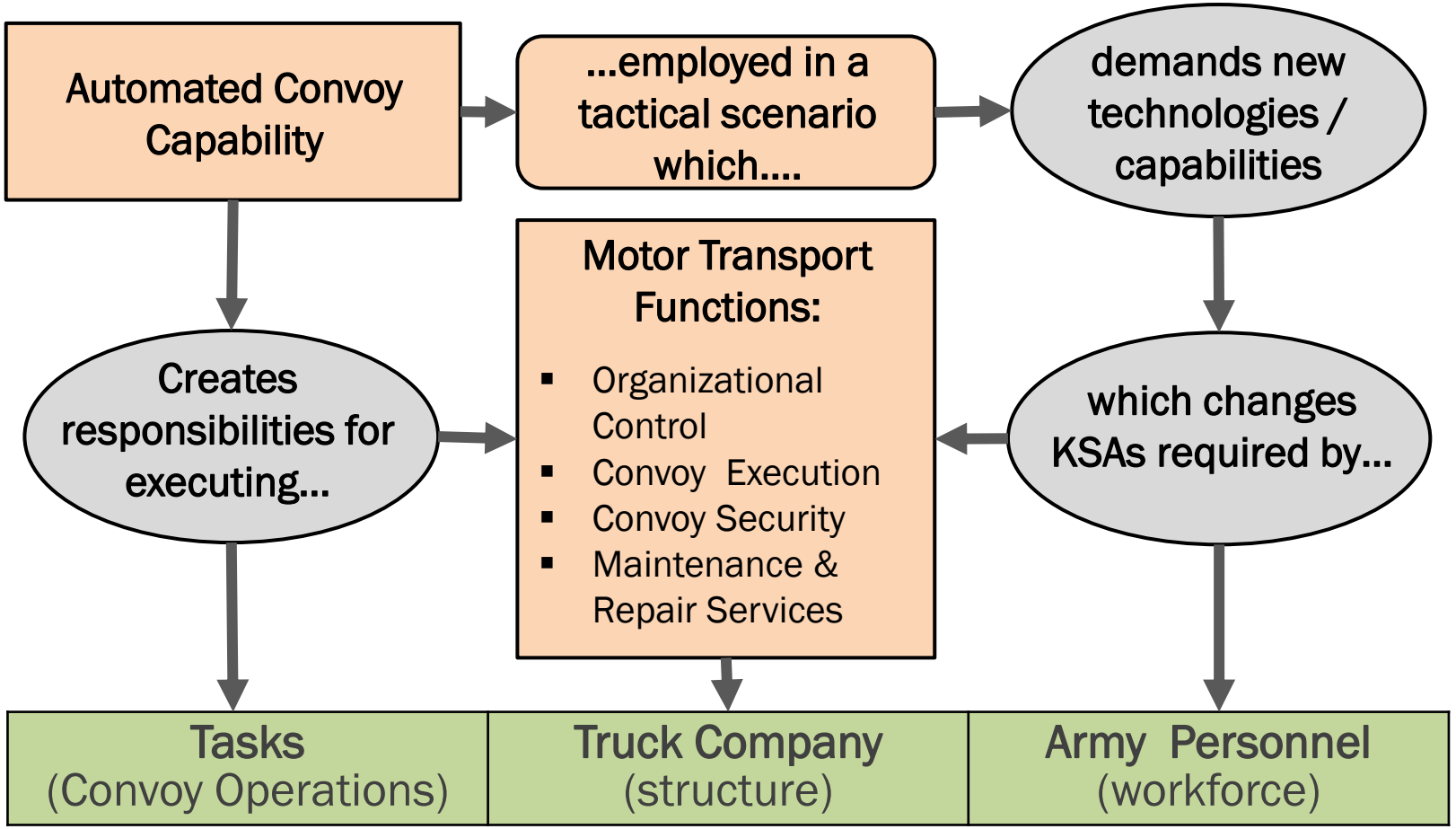
# We Are Examining the Convoy as a Socio-Technical System to Identify Likely Changes

- **Research Approach:** Apply socio-technical systems (STS) approach to identify key implications of autonomous truck technologies for Army forces




Source: Lyytinen & Newman, 2008

# Relationship of STS Elements Associated with Automated Tactical Convoy Operations

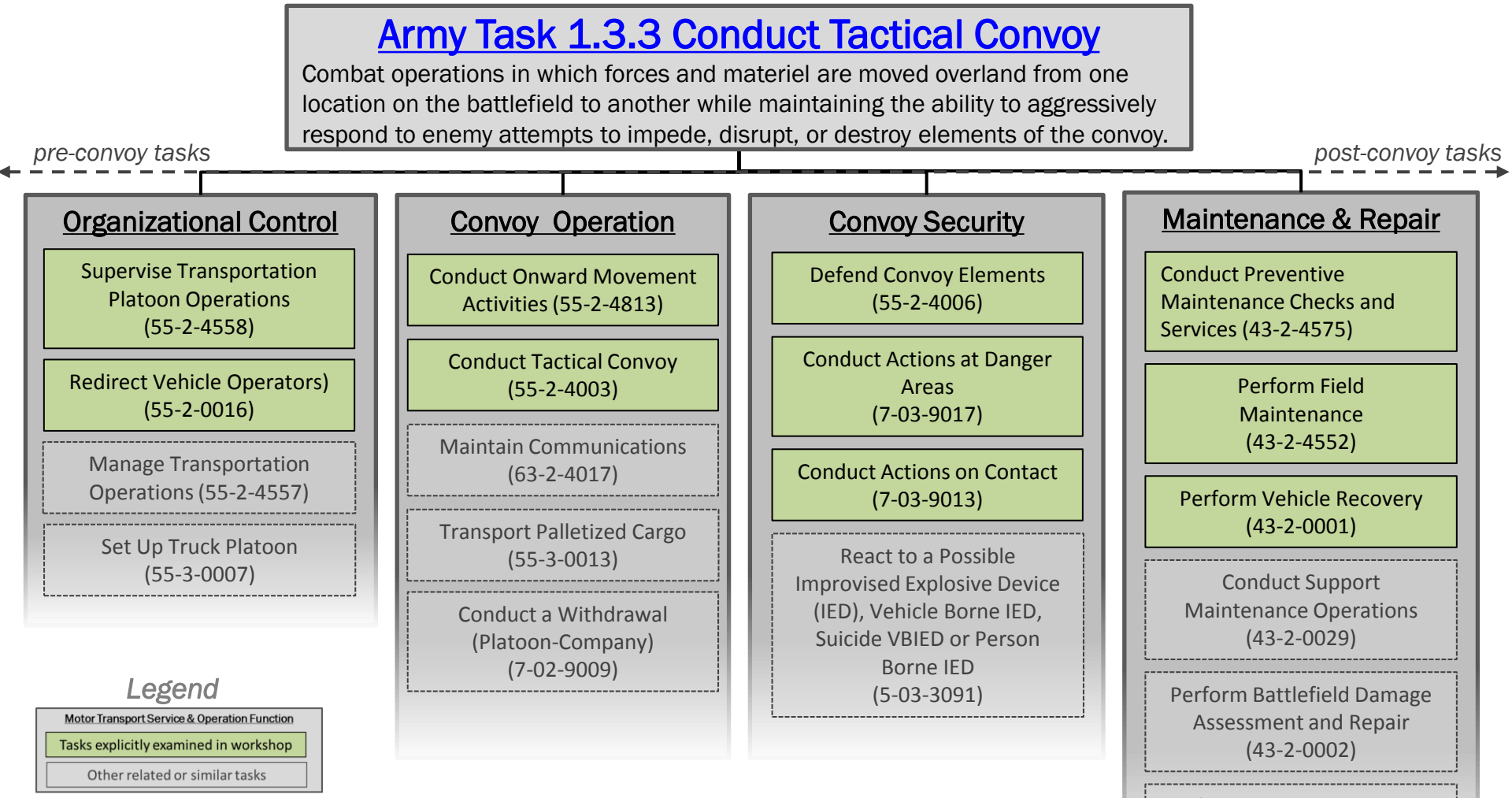



Derived from: Strain & Eason, 2000.

RAND-provided inputs for practitioner workshop

Areas of practitioner consideration in workshop

# RAND Analysis is Examining How Convoy Tasks & Functions Will Likely Change with AT Technologies




Source: U.S. Army Combined Arms Training Strategy

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# RAND Used Systematic Approach to Guide SME Assessment of Impacts from AT Technologies

*RAND Practitioner Workshop*

Functional areas & representative convoy tasks that AT technologies will likely impact

*Workshop Collection Framework & Key Questions*

| | Collective Task | Convoy Operation (Task) | PLS Truck Company (Structure) | Unit Personnel (Actors) | Other Impacts / implications |
|---|---|---|---|---|---|
| Organizational Control | Supervise Transportation Platoon Operations | 1 → | 2 → | 3 → | 4 |
| Organizational Control | Redirect Vehicle Operators Using Movement Tracking System (MTS) | *Key questions:* • *Does this task or its execution change with AT capability?* • *Are there new task conditions or actions required?* | *Key questions:* • *Are changes to company or platoon structure required to execute task with ATs?* • *Are additional organizational capabilities required to support AT implementation to this task?* | *Key questions:* • *Are current Truck Company personnel sufficient to conduct task?* • *Are changes to MOSs / MOS-levels required?* • *Are new MOSs or MOS skills required?* | *Key questions:* • *Are their other major implications for convoy execution?* • *What are the larger impacts to the Army force?* |
| Convoy Execution | Conduct Onward Movement Activities | | | | |
| Convoy Execution | Conduct Tactical Convoy | | | | |
| Convoy Security | Defend Convoy Elements | | | | |
| Convoy Security | Conduct Actions at Danger Areas | | | | |
| Convoy Security | Conduct Action on Contact | | | | |
| Repair & Maintenance | Conduct Preventive Maintenance Checks & Services | | | | |
| Repair & Maintenance | Perform Field Maintenance | | | | |
| Repair & Maintenance | Perform Vehicle Recovery | | | | |

# Some Likely Organizational Implications Army AT Implementation Will Need to Consider

| STS Area | Potential Organizational Implications |
|---|---|
| Tasks | • **Changes to Major Tasks:** High-level tasks generally unchanged<br>• **Function Re-Allocation within Tasks:** Need to systematically determine re-distribution of actions / functions within tasks |
| Truck Company | • **Command & Control:** Likely increased management burden, responsibilities, & span of control<br>• **Vehicle Manning:** 2-to-0 reduction approach particularly challenging |
| Personnel | • **Training:** Adaptation of current driving techniques for platooning<br>• **Recruitment:** KSAs required for "AT operator" vs. traditional driver<br>• **Maintenance Personnel:** New skills required to replace / repair AT components<br>• **Job / Job Level Classification:** Likely will require some incremental changes to related Army occupational specialties and levels |
| Other Implications | • **Interoperability:** Ability to integrate with existing fleet, other vehicles, & supporting key design consideration |

Successful implementation of AT technology will require some discovery and iteration after system development, but the Army can anticipate and address many organizational concerns in advance to minimize adverse impacts.

# Next Steps for RAND Autonomous Trucks Study

- Identify AV technology areas likely requiring Army/DOD emphasis and support
  - Technology demands not readily addressed by commercial development
- Identify and prioritize likely organizational implications for further analysis & consideration
  - Based on changes in task allocation after implementation of ATs
  - Further analysis of key areas of concern identified by practitioners
- Identify priority threats and hazards for use of ATs in future combat environments
- Provide findings and recommendations to guide Army materiel development and implementation
  - ~ October 2016

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