Autonomous Mobility Appliqué System (AMAS) JCTD
FY 12-13
Industry Day
(June 23, 2011)

Participants

- **COCOM Sponsor**: CENTCOM (Committed)
- **COCOM Co-Sponsor**: TRANSCOM (Proposed)
- **Lead Service**: US Army (Committed)
- **Oversight Executive**: OUSD(AT&L)DDRE/RFD/CS/Ellen Purdy (Committed)
- **Deputy Operational Manager**: CASCOM (Proposed)
- **Technical Manager**: TARDEC/Bernie Theisen (Committed)
- **Transition Manager**: RS JPO/Aaron Hart (Committed)
- **Other participants/partners**: CASCOM/MCCDC (Proposed Deputy OMs)
# Autonomus Mobility Applique System (AMAS) JCTD

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   Autonomus Mobility Applique System (AMAS) JCTD

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7. **Sponsoring/Monitoring Agency Name(s) and Address(es)**

   US Army RDECOM-TARDEC 6501 E 11 Mile Rd Warren, MI 48397-5000, USA

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10. **Sponsor/monitor’s report number(s)**

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Operational Problem Statement

- Current forces are facing an operational environment based on uncertainty, anti access and aerial denial threat tactics. This environment increases Soldier risk due to interdiction of US Lines Of Communication via hit-and-run and standoff attacks. As a result, these threats increase responsibility of drivers and passengers to maintain situational awareness along unsecured routes.

- Current Operating Environment requires service members to conduct logistic resupplies and operational patrols on specified Main Supply routes.
  - Inherit vulnerabilities that are hard to mitigate
  - Enemy forces are adapting to our convoy operational doctrine, TTPS, and SOPs
  - Speed and distance predictable to execute attacks against the convoys.
  - Majority of IED detection is done through visual means
    - Small Window of detection and evasive action

- Convoys are encountering environmental weather conditions that impact convoy operations leading to reduced logistics through-put and vehicle damage from on and off road accidents.
  - Convoys have been cancelled
    - Impacting Logistic and Operational patrols
  - Accidents due to fatigue and poor visibility
    - Human Limitations Restrict Effectiveness of Force.

- Current forces are operating and navigating vehicles alone over prolonged periods of time.
  - Increasing potential for accidents
  - Degradation of Performance
  - Task Overload

Increased Safety and Situational Awareness
Objective – Improve soldier safety and battlefield distribution for the Ground Distribution fleet by using semi-autonomous Leader/Follower capabilities to increase crew situational awareness and cognition while reducing vehicle collisions and driver fatigue.

Enhanced Soldier Protection
- Increased Situational Awareness
- Reduced Collisions
- Reduced crew driving tasks
- Reduced fatigue
- Increased Driver Cognition

Ground Distribution Benefits:
- Improved Convoy Integrity
- Reduced Convoy Misdirection

Notional Units & Mission

Vehicle Types
- PLS / LHS
- 915 / 1088
- FMTV / 1088
- MTVR
- HEMTT
- USMC Logistics
- Distro Co BSB

PLS Truck
Cargo Truck
Lt-Medium Truck
HEMTT
USMC Logistics
Distro Co BSB
AMAS JCTD
Technical Overview

• Provide scalable autonomy in a single material solution agnostic of platform.
  – Autonomy Kit
    • Autonomous Hardware and Sensors
  – By-wire Kit
    • Vehicle Specific Devices to Retrofit Current Tactical Vehicles
    – Common Interfaces
    – Common Framework

• Scalable and flexible to address multiple task such as convoys, security, reconnaissance, sustainment, maneuver, maneuver support.

• Operational scenario using a secure mixed manned/unmanned platform convoy
  – Year One Platforms - MTVR, LTV, HEMTT, M915 w/trailer
  – Year Two Platforms - PLS, HMMWV, MATV, FMTV w/trailer
  – Demonstrate increased vehicle safety with high op tempo in complex conditions

• Conduct Technical Demos and Operational Demo (CONUS): Manned, Driver Assist, Remote Control, and Semi- Autonomous Leader/Follower.
AMAS JCTD
Technical Approach

Year One

**Integrate and Deploy Appliqué System:**
- Define and Integrate Appliqué System
  - Autonomy Kit and Vehicle By-wire Kit
  - 2 Each MTVR, LTV, HEMTT, and M915 w/trailer.
- **Capability**
  - Driver Assist Functionality
  - Leader/Follower
- **Technical Deliverables**
  - Open Architecture and Interfaces
  - Standardized Metrics and Test Procedures w/ATEC
  - Framework for Validation of Realistic Requirements
  - LRU plug and play with limited adjustments
  - Fieldable Prototypes

Year Two

**Increase levels of Autonomy and Expand Platforms:**
- Extend Kit Capability
  - MATV, HMMWV, PLS, and FMTV w/trailer
- **Increase Capabilities in Autonomy Kit**
  - Enhanced Driver Assist
  - Limited Tele-Operations
  - Semi Autonomous Leader
- **Technical Deliverables**
  - Refine Year One Technical Deliverables
  - Scalable Autonomy
  - Self Calibrating LRUs
  - Improved Standardized Metrics and Test Procedures w/ATEC
# Core Technologies

## Technology Readiness Levels

<table>
<thead>
<tr>
<th>Technology</th>
<th>Pre-JCTD</th>
<th>Post-JCTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Following (Cameras, LADAR, Comms)</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Road / Lane following (improved &amp; un-improved –Camera and LADAR)</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Obstacle detection &amp; avoidance</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Communications Networking / Redundant Comms</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Vehicle localization/Navigation (GPS/Non GPS) (Scene matching and Dead Reckoning)</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Rear-End Collision Detection &amp; Avoidance (Camera, RADAR, and LADAR)</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Advanced Convoy Behaviors (Randomized Spacing and Speed, Splits and reformations)</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Hardware/Software Framework</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Integrated Driver Assist Technologies (Lame Departure, Collision Avoidance, Blind Zone warning, Brake Assist)</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

Open Standard Interfaces providing a foundation for Scalable Autonomy on Multiple Platforms/Variants
### Capabilities of Scalable Autonomy

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Driver Assist</strong></td>
<td><strong>Automated Driving</strong></td>
<td><strong>Convoy Behaviors</strong></td>
</tr>
</tbody>
</table>
| • Increase Situational Awareness  
  • Environment and Surroundings  
  • Vehicle Capabilities and Configuration  
• Improved Safety  
  • Collision Warnings  
  • Lane Departure Warnings  
  • Tip Over Warnings  
  • Stability Control  
• Reinforces Experienced drivers  
• Increase Capabilities of inexperienced Drivers | • Active Intervention  
  • Maintain Lane Control  
  • Tip-Over Prevention  
  • Collision avoidance and mitigation  
  • Stability Control  
• Enables operator to focus on other convoy mission tasks while the vehicle safely operates itself. | • Leader/Follower Capabilities  
  • Increase Operational Tempo  
  • Run faster with disciplined spacing  
  • Increased convoy capacity through unmanned vehicles  
• Increase throughput and efficiencies  
• Dynamic planning and re-planning  
  • Flexibility in convoy composition and routing  
  • Re-acquire route after dispersal  
  • Re-plan route to alternate |
## AMAS JCTD Key Metrics

<table>
<thead>
<tr>
<th>Capability</th>
<th>Tasks</th>
<th>Metric</th>
<th>Threshold</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOC 09-08 Soldier Support</td>
<td>Operator Interventions</td>
<td>Hours</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Joint Land Ops</td>
<td>System Operation Range</td>
<td>Distance in meters</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>FOC 09-04 Operational Tempo</td>
<td>Speed</td>
<td>Kph</td>
<td>Max&gt;40kph Min &lt;5kph</td>
<td>Max&gt;80kph Min&lt;1kph</td>
</tr>
<tr>
<td>Battle space Awareness</td>
<td>Obstacle Avoidance</td>
<td>Size in cm^3</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>FOC 07-01 Protect personnel</td>
<td>Situational Awareness</td>
<td>Sighting increase %</td>
<td>Target sighting increase 10%</td>
<td>Target sighting increase 20%</td>
</tr>
<tr>
<td>FOC 07-01 Protect personnel</td>
<td>Emergency braking</td>
<td>Operator Interventions per hour</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Tactical behaviors</td>
<td>Multi-vehicle capability</td>
<td>Vehicles</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Collaborative Operations</td>
<td>Leader / follower swap</td>
<td>Transition time in seconds</td>
<td>Less than 30 seconds</td>
<td>Less than 10 seconds</td>
</tr>
<tr>
<td>FOC 09-04 Operational Tempo</td>
<td>Controlling Platform</td>
<td>Distance from Operator</td>
<td>LOS 2 km</td>
<td>NLOS 1 km</td>
</tr>
</tbody>
</table>
Overall Demonstration Strategy & Plan

Schedule

- **Year One: Refinement and Integration**
  - Develop Common Appliqué Kit
  - Technical Demo Across Four Platform Variants
    - 2 Each MTVR, LTV, HEMTT, and M915 w/trailer.
  - Develop CONOPS / TTP and Finalize

- **Year Two: Operational Assessment and Transition**
  - Limited User Assessment
  - 2nd Technical Demonstrations
    - Four Additional Platforms for 16 Total
      - 2 Each MATV, HMMWV, PLS, and FMTV w/trailer
      - 2 Each MTVR, LTV, HEMTT, and M915 w/trailer.
  - Operational Utility Assessment
  - Final OUAR

Tech Demonstrations and Operation Assessment

- **Convoy Operations**
  - Limited MSRs/ASRs
  - Long / Short Haul Duration
  - High Speeds/Low Speeds

- **Operating conditions**
  - Visibility/Terrain
  - Threat/Extreme Climates
  - Night Movements

- **Full Spectrum Operations**
Transition Strategy

**AMAS JCTD**

**Year One**
- Contract Award
- 1st Tech Demo
- ATEC Reports

**Year Two**
- 2nd Tech Demo
- Operation Utility Assessment (OUA)
- ATEC Reports

**Risk Reducers:**
- Push AMAS Program Schedule to the Left
- Accelerate Technical Maturation
- Provide Open Architecture and Interfaces
- Standardized Metrics and Test Procedures
- Framework for Validation of Requirements
- Lessons Learned

**AMAS CDD/CPD**

**Year One**
- CDD Staffing

**Year One**
- AROC/JROC Approval
- POM Line Establishment
- MDD Preparation

**Year Two**
- MDD
- AOA Study Guidance
- Solicitation Preparation and Acquisition
  Strategy for CDD
  OR
  - Development of CPD

**Year Three (Transition Year)**
- Milestone B
- EMD Contract Award(s)
  OR
  - CPD AROC/JROC Approval

The AMAS JCTD will provide Risk Reduction to the AMAS Program
## AMAS Schedule and Cost

<table>
<thead>
<tr>
<th>Major Tasks</th>
<th>Year 1</th>
<th>Year 2</th>
<th>COST ($k)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation Directive (ID) (60 Days after CDB)</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>RFP/Contract negotiations (RTC Contract 105 days)</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>Management Plan (60 Days After JCTD Start)</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>Develop CONOPS / TTP and finalize</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>Develop and update Design and Plans</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>Integrate &amp; Deploy Software/Hardware Components</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>Install Integrated System</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>Technical Demonstrations</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>ATEC Limited Safety Release and Assessment</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>Limited User Assessment</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>Operator Training</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>Operational Demonstration and Assessment</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>Operational Utility Assessment Reports</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
<tr>
<td>Note: Start is contingent on funding availability.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Program Total: XXX
<table>
<thead>
<tr>
<th>Risk Factors (JCTD)</th>
<th>Risk Assessment</th>
<th>Mitigation Strategy</th>
<th>Expected Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational</td>
<td></td>
<td>Work via OM, Service Staff to garner support and identify applicable units</td>
<td>Multiple units will be identified that can conduct demonstrations</td>
</tr>
<tr>
<td>Identify units</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soldier Assessment</td>
<td>Medium</td>
<td>Begin working early with ATEC to get limited Safety release</td>
<td>Limited Safety Release</td>
</tr>
<tr>
<td>Technical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrate hardware/software</td>
<td>Low</td>
<td>Identify installation points for Army/USMC Tactical Wheeled Vehicles</td>
<td>Create database of engineering drawings/specs that identify installation points</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and procedures for TWV</td>
</tr>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of components</td>
<td>Low</td>
<td>Utilizing Commercial off the Shelf Components with Open Source Architecture and Interfaces</td>
<td>Mature components with higher reliability at lower cost</td>
</tr>
<tr>
<td>Funding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Funding level for the JCTD</td>
<td>High</td>
<td>Work with various agencies in the services to identify potential funding sources</td>
<td>Capture adequate funding to support JCTD</td>
</tr>
<tr>
<td>Schedule</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schedule – Demonstration and</td>
<td>Medium</td>
<td>Build upon outcomes of prior programs. Coordinating with ATEC to ensure timely testing deliverables.</td>
<td>OUA(S) scheduled to support concurrent development with acquisition documentation</td>
</tr>
<tr>
<td>Assessments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource commitment to</td>
<td>Low</td>
<td>Develop detailed Plan and Technology Transition Agreement. Obtain resource commitment.</td>
<td>Transition is funded and immediately implemented following OD pending satisfactory OUA</td>
</tr>
<tr>
<td>transition capability</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## JCTD Partnerships

<table>
<thead>
<tr>
<th>Partner/Specific Organization</th>
<th>Status</th>
<th>Impact (Funding &amp; Operational)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CENTCOM</td>
<td>On Board</td>
<td>XXX</td>
</tr>
<tr>
<td>TRANSCOM</td>
<td>In Discussions</td>
<td>XXX</td>
</tr>
<tr>
<td>CASCOM</td>
<td>On Board</td>
<td>XXX</td>
</tr>
<tr>
<td>RS JPO</td>
<td>On Board</td>
<td>XXX</td>
</tr>
<tr>
<td>JGRE</td>
<td>On Board</td>
<td>XXX</td>
</tr>
<tr>
<td>TARDEC</td>
<td>On Board</td>
<td>XXX</td>
</tr>
<tr>
<td>ARL</td>
<td>In Discussions</td>
<td>XXX</td>
</tr>
<tr>
<td>ONR (Navy Surface Warfare Center)</td>
<td>In Discussions</td>
<td>XXX</td>
</tr>
<tr>
<td>CECOM/CERDEC</td>
<td>In Discussions</td>
<td>XXX</td>
</tr>
<tr>
<td>SPAWAR</td>
<td>On Board</td>
<td>XXX</td>
</tr>
<tr>
<td>MCWL</td>
<td>In Discussions</td>
<td>XXX</td>
</tr>
<tr>
<td>ATEC</td>
<td>In Discussions</td>
<td>XXX</td>
</tr>
<tr>
<td>PEO Land Systems USMC</td>
<td>In Discussions</td>
<td>XXX</td>
</tr>
</tbody>
</table>
Summary

• Technical idea: Provide scalable autonomy in a single material solution agnostic of platform. The material solution would provide a Autonomous Mobility Appliqué System (AMAS) comprised of a scalable Autonomy Kit and a Vehicle By-wire kit. The Autonomy kit would provide scalable autonomy ranging from Driver Assist functionality through autonomous behaviors. The Vehicle By-wire kit would provide the actuation and interface for the Autonomy kit’s capabilities.

• Demonstration Approach:
  • 2 Technical Demonstration 4th Qtr First Year/2nd Qtr Second Year
  • 1 Limited User Assessment 1st Qtr Second Year
  • 1 Operation Utility Assessment 3rd Qtr Second Year

• Deliverables:
  • Year 1: AMAS w/common interfaces defined and driver assist capabilities.
  • Year 2: AMAS applied to additional platforms and additional levels of autonomy.
  Potential CPD

• Transition: FY14 with Milestone B and EMD Contract Award(s) OR CPD AROC/JROC Approval

• Recommendation: Approve $ _____ Commitment of OSD/RFD Funds:
# RFD Assessment Matrix

<table>
<thead>
<tr>
<th>Project: (Name of JCTD)</th>
<th>RFD Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevance</td>
<td>Go/No-Go</td>
</tr>
<tr>
<td>Speed to Delivery</td>
<td>Go/No-Go</td>
</tr>
<tr>
<td>Executability</td>
<td>Go/No-Go</td>
</tr>
<tr>
<td>Technology</td>
<td>Green/Yellow/Red</td>
</tr>
<tr>
<td>Transition</td>
<td>Green/Yellow/Red</td>
</tr>
<tr>
<td>Management</td>
<td>Green/Yellow/Red</td>
</tr>
<tr>
<td>Funding</td>
<td>Green/Yellow/Red</td>
</tr>
<tr>
<td>ASD(R&amp;E) Checklist</td>
<td></td>
</tr>
<tr>
<td>- Does it fit DoD Mission Space</td>
<td>Yes/No</td>
</tr>
<tr>
<td>- Does it fit ASD(R&amp;E) Imperatives</td>
<td>Yes/No</td>
</tr>
<tr>
<td>- Does it fit RFD Mission</td>
<td>Yes/No</td>
</tr>
<tr>
<td>- Is it Free of Operational Activity</td>
<td>Yes/No</td>
</tr>
<tr>
<td>- Is it Free of Title 50 Activity</td>
<td>Yes/No</td>
</tr>
<tr>
<td>- Is it R&amp;D or O&amp;M Funded</td>
<td>Yes/No</td>
</tr>
<tr>
<td>- Are Success Criteria Clearly Defined</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>

Note: Assessment matrix should be developed in conjunction with RFD and updated as a result of CNB.
Back-ups
Operational Problem: The current and future force will face an operational environment based on uncertainty, anti access and aerial denial threat tactics. This environment increases Soldier risk due to interdiction of US Lines Of Communication via hit-and-run and standoff attacks. As a result, these threats increase responsibility of drivers and passengers to maintain situational awareness along unsecured routes.

Requirement:
- Appliqué for current Light, Medium and Heavy Wheeled vehicles
- Levels of autonomy including Waypoint Navigation, Leader/Follower, Supervised Autonomy, Driver Assist, Remote Control.
- Behaviors to include Collision Avoidance, Lane Departure, ODOA, Vehicle Tracking, Road/Lane Following, Semi Autonomous Convoying, Adaptive Cruise Control
- Operate within CREW Environment and Spectrum
- Operate in Day, Night (black out), inclement weather, dust and limited visibility environments
- Increased safety, situational awareness

Competing Technology:
- CAST, CAMS, ANS, MARTI, Blind driver, TerraMax

Specifics:
**Year 1 Integrate and Deploy Appliqué System**
Operation: Convoy w/2 Each MTVR, LTV, HEMTT, and M915 w/trailer. Capability: Driver Assist, Leader/Follower
Technical Deliverables: Open Architecture and Interfaces, Standardized Metrics and Test Procedures, Framework for Validation of Realistic Requirements, LRU plug and play with Limited Adjustments

**Year 2 Increase levels of Autonomy and Expand Platforms**
Operation: Extend to MATV, HMMWV, PLS, and FMTV w/trailer Capability: Enhanced Driver Assist, Limited Tele-Operations Semi Autonomous Leader
Technical Deliverables: Scalable Autonomy, Self Calibrating LRUs, Improved Standardized Metrics and Test Procedures, Conduct operational utility assessment

Transition: Transition Manager – RS JPO
FY13 MDD/AOA Study Guidance
  Solicitation Preparation and Acquisition Strategy for CDD OR Development of CPD
FY14 (Transition Year)
  • Milestone B
  • EMD Contract Award(s) OR • CPD AROC/JROC Approval

Funding:

<table>
<thead>
<tr>
<th>ORG</th>
<th>Year One</th>
<th>Year Two</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>JCTD Participants</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
</tr>
<tr>
<td>OSD/RFD</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>XXX</td>
</tr>
</tbody>
</table>
## AMAS JCTD Key Metrics

<table>
<thead>
<tr>
<th>Capability</th>
<th>Tasks</th>
<th>Metric</th>
<th>Threshold</th>
<th>Objective</th>
</tr>
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<tbody>
<tr>
<td>FOC 07-01</td>
<td>Protect personnel</td>
<td>Collision Warning</td>
<td>Type 1 Error (False Positive) Type 2 Error (False Negative)</td>
<td>1/1000 miles 5% Failures</td>
</tr>
<tr>
<td>FOC 07-01</td>
<td>Protect personnel</td>
<td>Lane Departure Paved Roads</td>
<td>Type 1 Error (False Positive) Type 2 Error (False Negative)</td>
<td>1/1000 miles 5% Failures</td>
</tr>
<tr>
<td>FOC 07-01</td>
<td>Protect personnel</td>
<td>Curve Speed</td>
<td>Type 1 Error (False Positive) Type 2 Error (False Negative)</td>
<td>1/1000 miles 5% Failures</td>
</tr>
<tr>
<td>Joint Land Ops</td>
<td>System Op Range</td>
<td>Distance in meters</td>
<td>100 meters</td>
<td>1,000 meters</td>
</tr>
<tr>
<td>FOC 09-04</td>
<td>Operational Tempo</td>
<td>Speed</td>
<td>Kph</td>
<td>10kph</td>
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<tr>
<td>FOC 09-04</td>
<td>Operational Tempo</td>
<td>Video</td>
<td>Bandwidth</td>
<td>1MBS</td>
</tr>
<tr>
<td>FOC 09-04</td>
<td>Operational Tempo</td>
<td>Controlling Platform</td>
<td>Distance from Operator</td>
<td>LOS 2 km</td>
</tr>
</tbody>
</table>
Desired Capabilities

• Facilitate increased convoy protection and safety
• Maximize Truck Capability
  • Human Limitations minimized
• Improve Situational Awareness
  • Focus concentration on a single set of operations
• Increase Safety and Security
  • Disciplined speeds, proper distance between vehicles
  • Accident / Rollover Avoidance
  • Improved operations in no/limited visibility conditions
• Increase operational efficiency and effectiveness to support distribution operations
  • Reduces impact of human error
• Scalable Levels of Autonomy
• Retrofit Existing Platforms
• Modularity and Interoperability
Notional Autonomous Mobility Appliqué System (AMAS)
Notional Autonomy Kit

Autonomy Kit

Autonomous Behaviors Computer

Autonomy Level 2
- Level e. Waypoint Navigation
- Level d. Leader and Level c. Follower
- Level b. Supervised Autonomy
- Level a. Driver Assisted

Autonomy Level 1
- Remote Control (RC)

By-Wire Kit

Handheld Device

RC Interface
Notional By-Wire Kit