GM-TARDEC Vehicle Intelligence Collaboration Meeting

December 16, 2010
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<td>Andrea Simon</td>
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Form Approved
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Mission

- Provides full life-cycle engineering support and is provider-of-first-choice for all DOD ground combat and combat support vehicle systems.

- Develops and integrates the right technology solutions to improve Current Force effectiveness and provide superior capabilities for the Future Force.

Ground Systems Integrator for the Department of Defense

Responsible for Research, Development and Engineering Support to 2,800 Army systems and many of the Army’s and DOD’s Top Joint Warfighter Development Programs
Key Focus Areas for Intelligent Ground Vehicles

• High speed mobility
  Improved high speed, high accuracy perception & actuation
  Reliable, scalable data fusion

• Safe operations
  Safety Assessment and Certification for Autonomous Systems
  Detect & classify stationary people & objects
  Collision avoidance & route planning

• Design for tactical behavior flexibility
  Understanding of environments
  Decision processing & workload management
  Expected & rational behaviors in new scenarios

• Collaboration
  Conduct collaborative missions with mixed manned/unmanned force
  Collaborative air-ground operations
  Low latency, High Bandwidth Communications
Technical Approach

• Develop the tools, techniques, and autonomy “kits” to maximize mounted and dismounted control of UMS and optimize Soldier-robot and robot-robot ground & air teams.
• Use of Benchmarking and Design to Requirements.
• Focus on “affordable” technologies- sensors & sensor fusion, actuators, autonomy & by-wire conversion kits as well as information sharing with other vehicles & assets.
• Focus on robust, reliable, safety-critical architectures and designs.
Near –Term Discussion Topics

General Topic Areas for discussion:

• Connected Vehicle Technologies & Ad Hoc Vehicle Networks
  - High Bandwidth Communication Latency reduction techniques and methods

• Safety Critical Systems Design & Assessment
  - Testing methodology to certify autonomous systems “safe for Soldier use” needs to be developed.

• Conversion of existing platforms to UMS (By-Wire)

• Sensing Technologies
  - “Negative” Object Detection and Avoidance, etc

• HMI issues for manned/unmanned vehicle control
  - User monitoring, workload management, etc.

Unclassified: Dist A. Approved for public release
• Army “market” is different from automotive
  – Quantities much smaller: hundreds, thousands, tens of thousands of vehicles
  – Unit cost is much less important
  – Maintenance and “sustainment” costs are important
  – Supplier relations are more regulated and much more difficult
  – Unique requirements
    • Shipping by C130
    • Air drop
  – Many add-on systems in the field, little configuration mgmt of vehicles
  – Vehicles are very old technology, by automotive stds: very little electronic vehicle controls (bowden cable accel pedal)
## Advanced Antennas

### Tactical Network & Communications Antennas
- **LOW COST OTM COMMS**
  - WNW/SRW TRI - BAND
  - PLATFORM ANTENNA REDUCTION
  - 2-PORT LOW PROFILE
  - REDUCED VISUAL SIGNATURES
  - WNW HIGH GAIN
  - IMPROVED LINK CONNECTIVITY
  - BODY WEARABLE
  - IMPROVED MANEUVER TACTICS & WIDEBAND COMMS

### Directional Antennas
- **Tactical Network & Communications Antennas**
Ad Hoc Vehicle Networks

• Issues
  – Poor communications environment
    • Lack of frequency regulation in some foreign countries
    • Jamming and active countermeasures
    • Cluttered, urban terrains
    • Many different communication devices on vehicles, little coordination between devices
  – Available power on vehicles is usually limited
  – Robustness and maturity of technology
• Local Vehicle to Vehicle Communications
  – Road conditions
  – Road Hazards
  – Emergency vehicle maneuvers
  – Distressed vehicle
  – Other local situational awareness items that can reduce the risk of other vehicles.
Issues:

– Measurement and definition of safety considerations
  • Need to develop methods to perform standardized Safety Assessment and Certification for Autonomous Systems
– Mix of analog, digital, and mechanical controls on vehicles
– Different vehicle configurations in the field – many unknowns
– Interaction of vehicle safety and survivability
– Interaction with Army Safety organizations
• **Issues**
  
  – Measurement and definition of “autonomy”
    
    • ALFUS
    
    • Future Combat Systems
  
  – Robustness of autonomous technologies
  
  – Robustness of robotic platforms
  
  – Trust in automation
  
  – Lack of a detailed Army plan or strategy for development and introduction of technologies to the field
Human-Machine Interaction

• HMI issues for manned/unmanned vehicle control
  - Soldier workload is increasing as additional functions
    and technologies are being introduced
  - Multiple platforms & multiple functions per platform
    may exceed operator ability to control. Monitoring
    and managing workload is necessary, along with
    simplifying control and display data.
  - Motion sickness is also a consideration in many
    teleoperation/autonomy functions.