



**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

# GM-TARDEC Autonomous Safety Collaboration Meeting

January 13, 2010

# Report Documentation Page

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## 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 mgt of vehicles
- Vehicles are very old technology, by automotive stds: very little electronic vehicle controls (bowden cable accel pedal)



# Autonomous Safety Focus Areas



- **Safe operations in Urban Environments**

- Detect & classify people & objects

- Collision avoidance & route planning

- Understanding of environments

- Decision processing / Expected & rational behaviors in new scenarios

- **Collaboration between humans and robots**

- Conduct collaborative missions with mixed manned/unmanned force

- Collaborative air-ground operations



# Technical Approach



## **Safety Design, Assessment, and Certification process for High Speed Autonomous Systems**

- Develop robust, reliable, safety-critical architectures and designs. Deterministic subsystems provide safety “back-up” to overall system (e.g. Brakes, Steering, ETC, etc. ).
- Leverage existing Safety System Development and Certification methods where possible. (E.g. MIL STD 882C, ISO 26262, etc)
- Propose new assessment methods for non-deterministic autonomous behaviors (e.g. “Least Bad” Decision-making on Path Planning, Object Avoidance, etc.)
- Testing methodology to certify autonomous systems “safe for Soldier use” needs to be developed.



## 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**



## Example: Convoy Active Safety Technologies (CAST)



- Provide low cost Robotic Convoy capability for current force Army vehicles
- Provide lessons learned on robotic convoy for FCS(BCT)
- Leverage Robotic Follower ATO and other FCS Technologies
- Provide Robotics capability in CS/CSS community in out-years
- Generate Warfighter requirement for Robotic Convoy
- Drive-by-Wire design for Multi-follower TWV's
- Lessons learned for capabilities of low-cost convoy
- Turnkey operation of Robotic Convoy capability
- Leader-Follower with low dependency on GPS.
- Standard metrics for performance of robotic convoy capability

### Warfighter Payoff:

- Decreased workload on driver
- Increased force protection / Battle Space awareness
- Increased Situational awareness
- Mission planning
- Route Recon
- Decreased fatigue effects



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**Basic Vehicle Controls must meet Safety Critical requirements independent of the complete system, and the complete system composed of these subsystems must meet these requirements, also.**

