NDIA 2017 Tactical Wheeled Vehicle Conference

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RR: Providing Autonomous Mobility to the DoD

1994

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Army Leader/Follower Capability

Leader/Follower with Supervisory Operator Follower Vehicles (Reduced Crew)

Available Today

Autonomous Mobility Applique System (AMAS) JCTD

Common Attributes

L/F Convoy Size	3 - 7 Follower Vehicles
Roads Traveled	Primary and Secondary Roads
Command and Control	Ability to designate vehicles as either leaders or followers
Following Divergence	50 centimeters
Gap Range	20 meters to 100 meters
Obstacle Detect/Avoidance	Avoid static and dynamic obstacles in front of vehicles
Software Library	Government Purpose Rights

Leader/Follower with Unmanned Followers (No Crew Required)

Available Sept 2017

Automated Ground Resupply (AGR) STO Spiral 1

Different Attributes

Reduce Crew Size from 2 to 1 *Comparable to commercial systems (Otto (Budweiser) or Freightliner) which still require operator fail-safe*	**Operator Design**	Reduce Crew Size from 1 to 0 *Exceeds current commercial system manning requirements*
Optionally Driven Vehicle *Requires soldier in the vehicle but provides "auto pilot" capability*	**Vehicle Category**	Optionally Manned Vehicle *Platform can be driven by a soldier or operated completely unmanned*
Fail Safe / IOP V2 *Requires operator for emergency situations*	**Architecture Design**	Fault Tolerant / IOP V3 *Redundant systems for emergency situations*

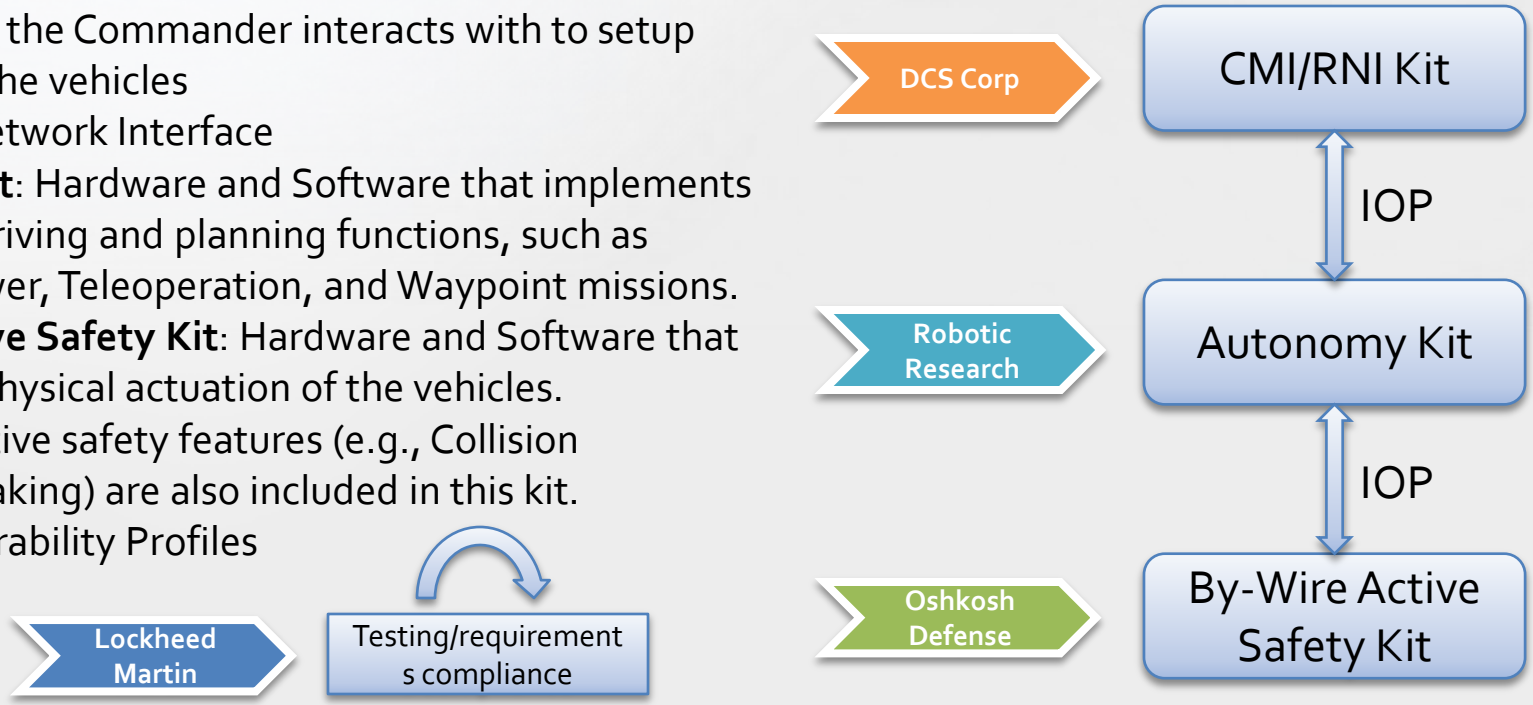
Most L/F performance attributes common between platforms except the fault tolerance of the architecture enabling unmanned operation… AGR delivers this Sep 2017 with an open software architecture

Autonomous Ground Resupply (AGR) – Sustainment Operations (SO)

- While the AGR program as a whole is focused on automation of the full logistics chain, Sustainment Operations (SO) is specifically focused on the support of convoy operations for the Brigade level and above
- SO goals
  - Develop and demonstrate a system that meets the needs of the Leader/Follower and Automated Convoy Operations (ACO) Programs of Record
  - Develop a fault-tolerant, modular, and open architecture

Tier 1 Architecture Promotes Interoperability

CMI: Commander Machine Interface. Hardware and Software that the Commander interacts with to setup and monitor the vehicles
RNI: Radio Network Interface
Autonomy Kit: Hardware and Software that implements higher level driving and planning functions, such as Leader/Follower, Teleoperation, and Waypoint missions.
By-Wire Active Safety Kit: Hardware and Software that controls the physical actuation of the vehicles. Additional active safety features (e.g., Collision Mitigation Braking) are also included in this kit.
IOP: Interoperability Profiles



Utilizing standard IOP interfaces between the kits ensures a modular system. For example, the same Autonomy Kit could be installed on multiple vehicle types, as long as the By-Wire Kit on each vehicle adhered to IOP.

Challenges and Solutions for LF

Challenges	*Solutions*
• Sensing at high speed (negative obstacles in particular)	• We have a manned leader
• Sideways separation distances in GPS denied areas	• Throwing the kitchen sink: accurate INS, LADAR registration, visual registration, radar, ranging radio, etc
• IOP v2 incomplete	• IOP v3 being improved
• Cost	• Lower costs in numbers
• Smooth transition to ACO	• Developing for LF with ACO in mind
• Safety approval without anybody onboard	• RR got safety approvals in the past to deploy without anybody onboard (not POR). This is still going to be the biggest challenge.