



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.



Intelligent Ground Systems

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Report Documentation Page

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Furthering Unmanned Systems Autonomy

- Unmanned Ground Vehicle Platforms
- Vehicle Intelligence and Control
- Mission Payload Integration
- Embedded Simulation



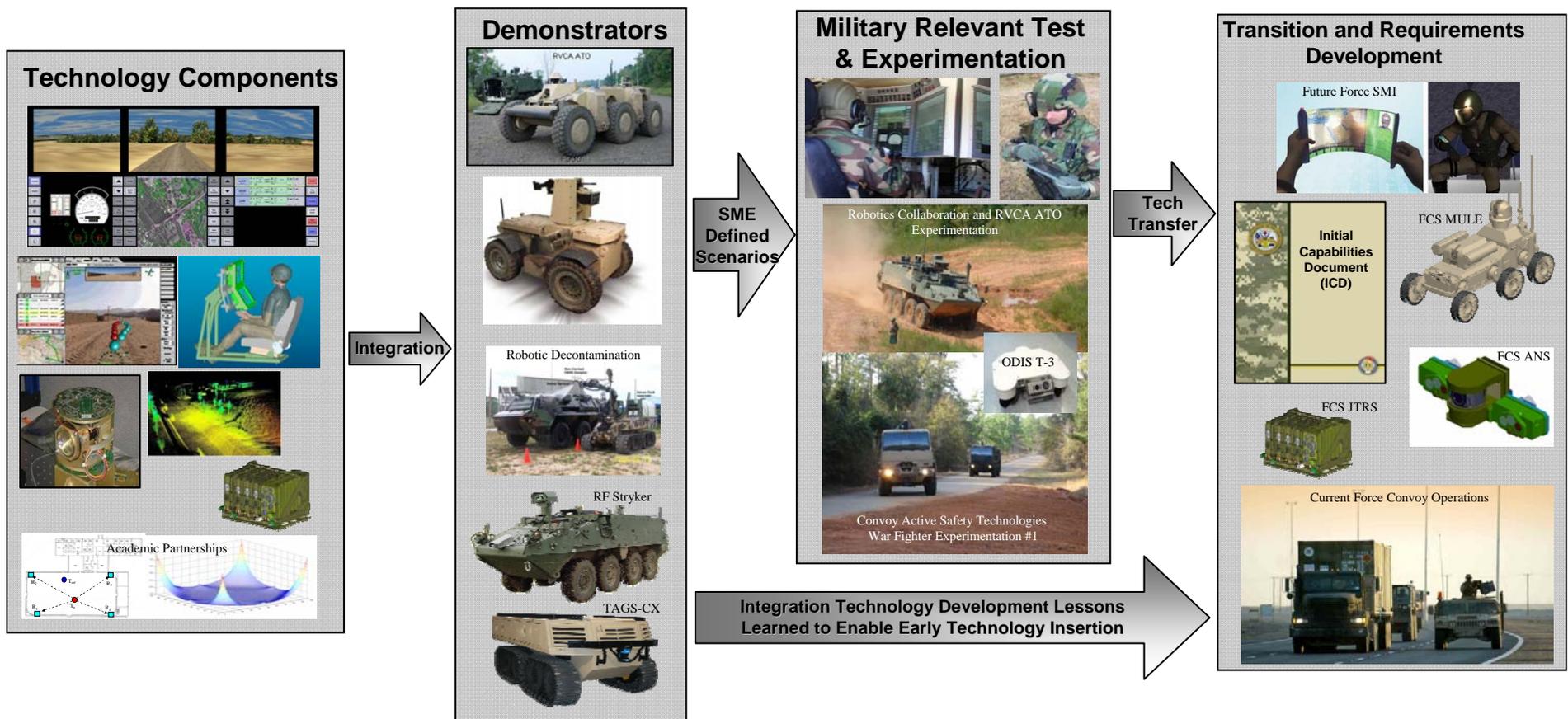
Increasing Crew Interface and Control Capabilities

- Human-Robot Interaction
- Advanced Soldier Machine Interfaces
- Embedded Simulation



Mission

Integrate, Explore, and Develop Robotics, Network and Control Components with a Focus on Customer Driven Requirements to Provide Full System Solutions to the War Fighter



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Making the robots work well with others

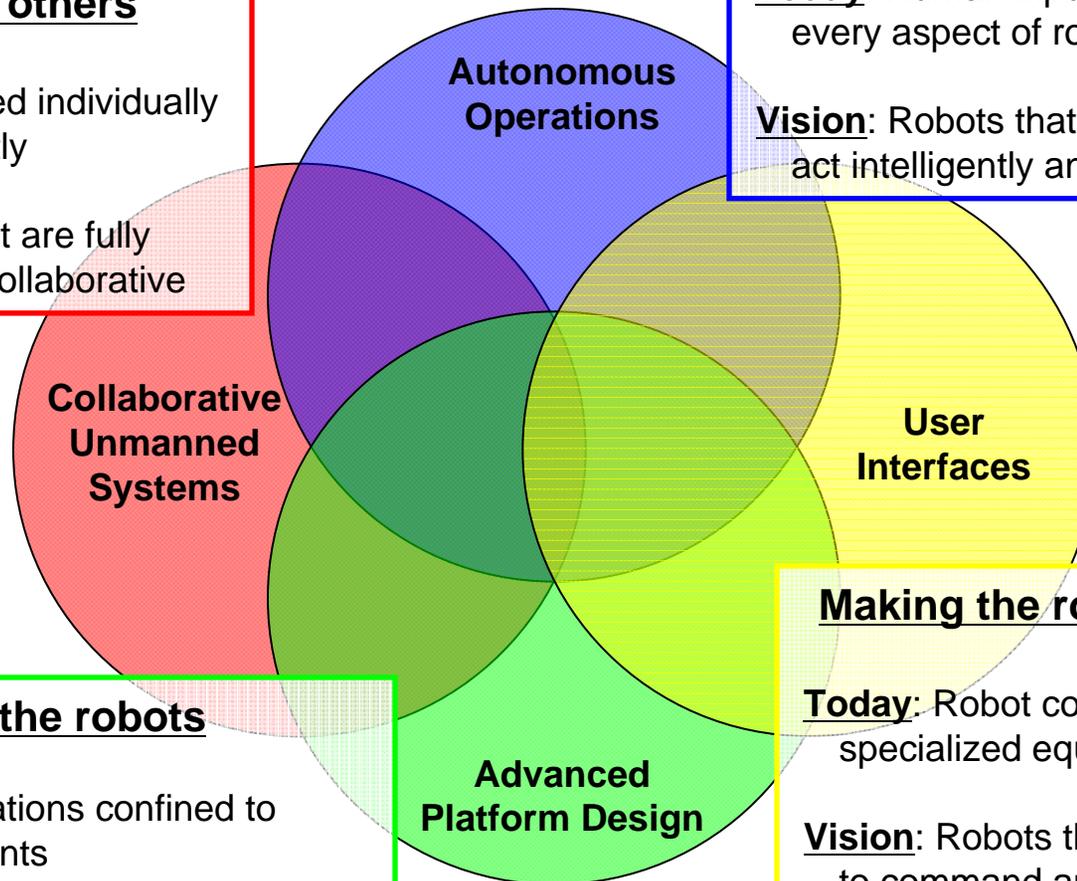
Today: Robots used individually and independently

Vision: Robots that are fully networked and collaborative

Making the robots smarter

Today: Human input required to control every aspect of robot

Vision: Robots that are able to think and act intelligently and independently



Making the robots

Today: Robot operations confined to limited environments

Vision: Robots that are able to operate in any environment at any time

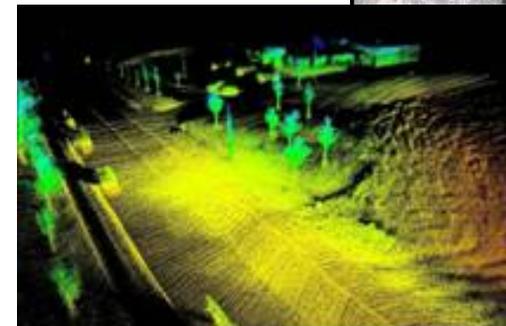
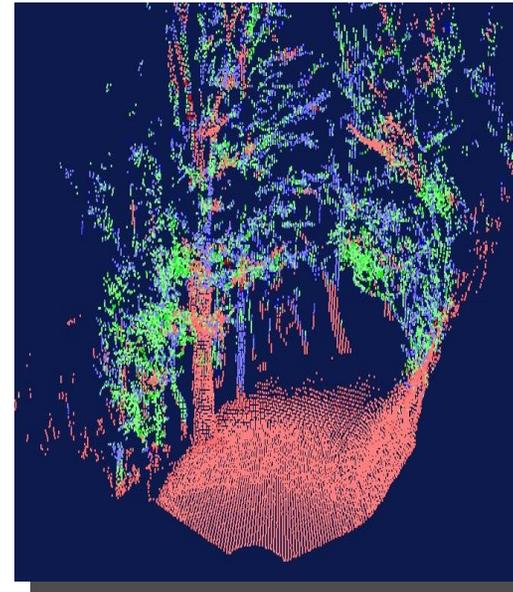
Making the robots easier to use

Today: Robot control requires specialized equipment and training

Vision: Robots that are intuitively easy to command and control

Research Topics – Potential Shortfalls

- Sensors – extended range & resolution
- Sensors – all weather sensing/obscurants
- Sensors – reduced size
- Software – Terrain classification, especially at extended range
- Software – Feature classification, especially at extended range
- Software – Detection, classification, tracking of moving vehicles, people, & animals from a moving vehicle (object association/partial obscuration)
- Software – Detection of moving & stationary people, often partially obscured or camouflaged
- Software – Stand-off classification of mud or water – estimate of surface supportability/trafficability



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Research Topics – Potential Shortfalls

Vehicle Intelligence

- Ability to adapt to changing environment & learn from prior experience or act based upon general guidance
- Ability to project future activity or courses of action by others and plan accordingly
- Ability to understand vehicle health and modify plans accordingly

Tactical Behavior

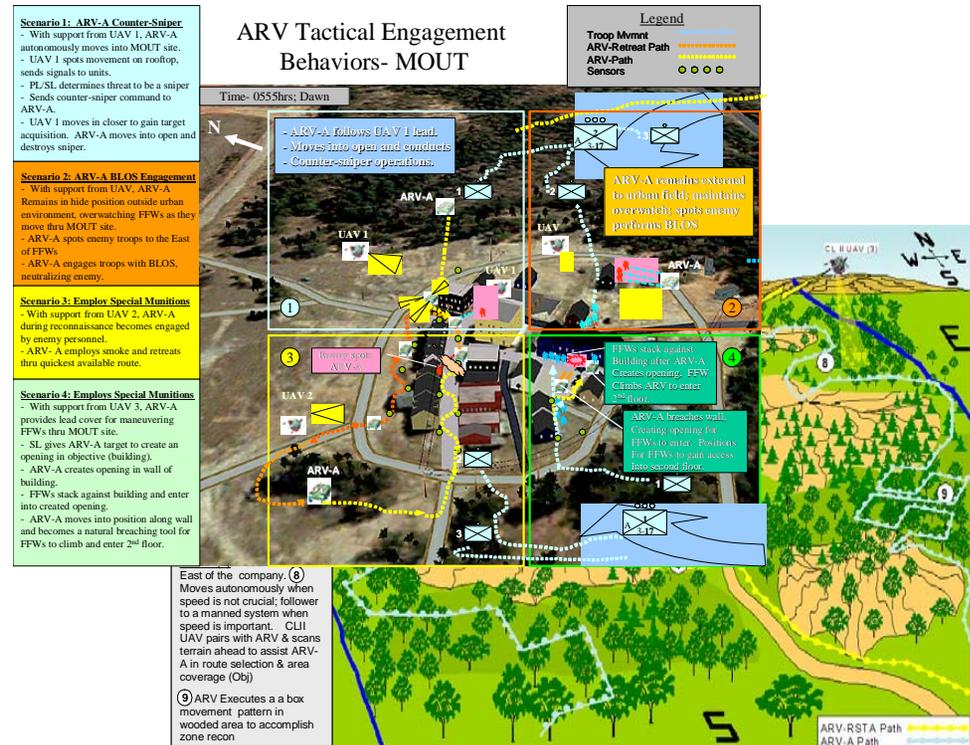
- Mimic the behavior of Soldiers under similar conditions
- Continue autonomous operation during prolonged communications outages
- Self-protection

Collaboration

- Shared situational awareness
- Teaming – robot/robot and robot/Soldier

Mission Specific Behaviors

- RSTA
- Force Protection
- Material handling/delivery



Research Topics – Potential Shortfalls

Operator Control

- Situational awareness of what's going on around the robot/operator intervention
- Scalable interfaces – from MGV to dismount
- Operator workload in realistic tactical environments
- Operator span of control
- Alternative control modes (voice/gesture)
- Hands free, heads up display and control

Command Integration

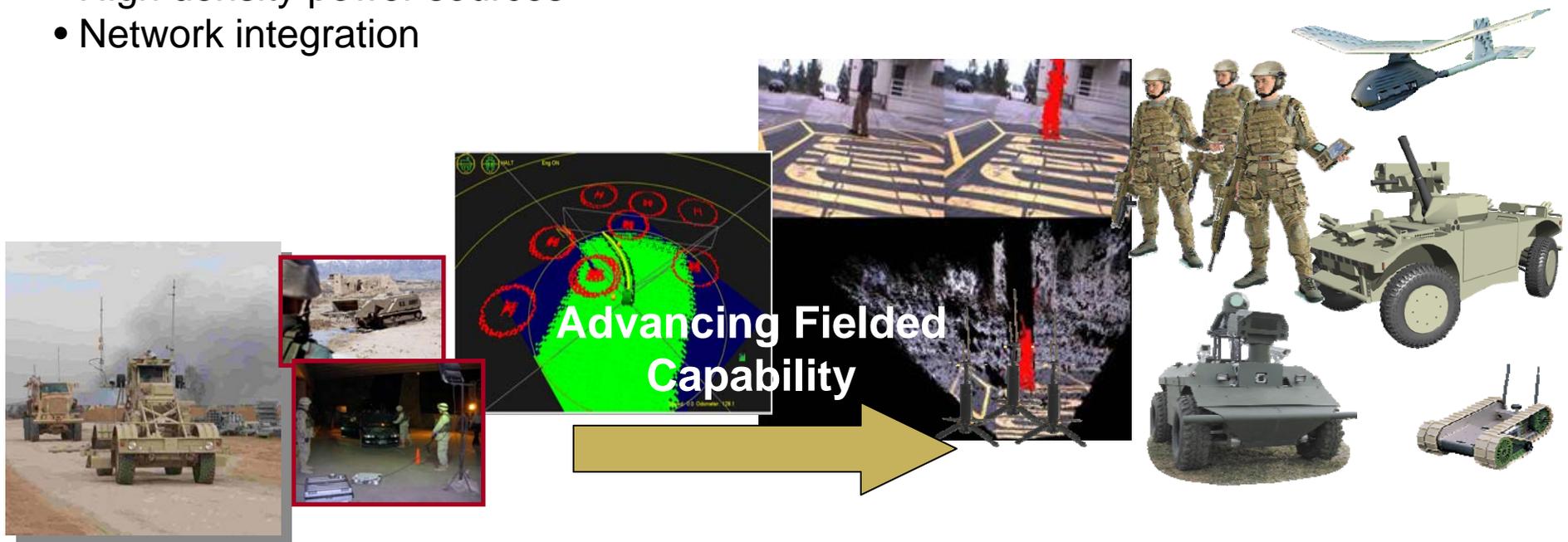
- Fusion of local situation awareness information with the Common Operating Picture



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Research Topics – Potential Shortfalls

- Autonomous Vehicle safety
- Autonomous Weapon safety
- Platform – modularity; shape shifting; micro/miniaturization; bio-mimetic; health maintenance/ prognostics/ self-healing;
- Low SWAP, high bandwidth data links
- High density power sources
- Network integration



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- Very busy environments
- Potholes
- Other vehicles
- Poor lane markings
- Traffic signals
- Pedestrians
- Animals
- Road work
- Deep water
- Very cluttered environments
- Mud, ice, snow, gravel and other traction problems
- Sharp rocks, rebar and curbs
- Tank traps
- Wire, posts and fences
- Hidden hazards, e.g. rocks and holes
- Fog, dust, smoke, rain

- Operator Control Units
- Hyperspectral Scene Segmentation
- Head Mounted Display
- Human Detection and Localization
- Novel Platform Development
- Robotic Path Planning

