Intelligent Ground Systems
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Advanced Planning Briefing for Academia (APBA) Presentation. The original document contains color images.
Intelligent Ground Systems Overview

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
TARDEC Robotics

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

Technology Components

Demonstrators

Military Relevant Test & Experimentation

Transition and Requirements Development

Integration Technology Development Lessons Learned to Enable Early Technology Insertion

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
Enabling Technologies

**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 easier to use**

**Today**: Robot control requires specialized equipment and training

**Vision**: Robots that are intuitively easy to command and control

**Making the robots**

**Today**: Robot operations confined to limited environments

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

Advancing Fielded Capability
Hard On and Off Road Problems

- 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
Examples of what Co-op Students are doing in Intelligent Systems

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