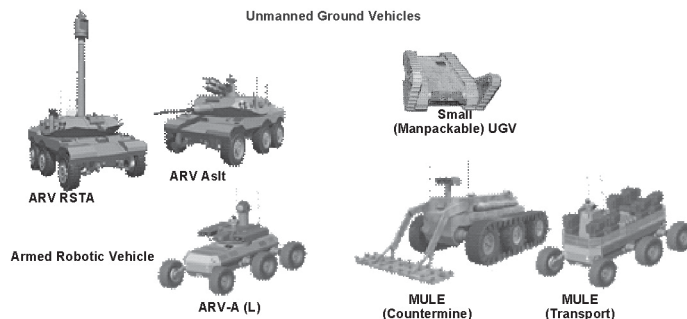


Future Combat Systems Unmanned Ground Vehicles (UGVs)

SUMMARY

- Unmanned Ground Vehicle (UGV) prototypes will not be available for testing until FY08-FY09.
- Experiments by the Army Research Lab to assess mobility technologies show that current UGVs can travel cross-country at only one-fourth the speed of manned vehicles.
- During FY04, the Defense Advanced Research Projects Agency (DARPA) funded the Grand Challenge cross-country race to assess mobility technologies. No vehicle completed more than 8 miles of the 142-mile course.
- The Army must develop and refine the Concept of Operations and technology for mobility, tactical behaviors, and command and control.



The UGVs within the Future Combat System program consist of three categories or classes: Class I – light vehicles, Class II – medium vehicles, and Class III – heavy vehicles.

SYSTEM DESCRIPTION AND MISSION

The UGVs within the Future Combat System (FCS) program consist of three categories or classes: Class I – light vehicles, Class II – medium vehicles, and Class III – heavy vehicles. The Class I system is the Soldier UGV (SUGV). These robots typically weigh about 30 pounds and will be carried in a soldier's backpack. This class of UGVs may have up to 10 inter-changeable payloads (e.g., mine detection, Reconnaissance, Surveillance, and Target Acquisition (RSTA), Explosive Ordnance Disposal (EOD) removal). The Army plans to produce up to 1,215 SUGVs at a projected cost of approximately \$30K per system.

There are four systems in Class II, all of which are based on the Multi-function Utility/Logistics and Equipment (MULE) chassis. These include the MULE Transport (MULE-T), MULE Countermine (MULE-CM), MULE Retrans for relay of communications, and the Armed Robotic Vehicle-Assault (Light) (ARV-AL). These robots will weigh 5,000-7,000 pounds, and will operate with dismounted troops. The ARV-AL will carry two Javelin missiles and a .50 Caliber machine gun. The other utility vehicles will be equipped with appropriate sensors for various missions. The Army plans to produce approximately 1,200 MULES, with approximately 300 designated for the assault configurations, and the remainder as transport, communications, or countermine systems.

The two systems in Class III are the ARV-Assault and the ARV-RSTA, expected to be 10,000-20,000 pound vehicles, measuring about 12 feet in length. The Army plans to arm the ARV-A with four Javelins (or Joint Common Missiles) and a 30mm gun. The ARV-RSTA will have a suite of surveillance payloads. Both configurations are to be CH-47 sling-loadable and air-droppable from a C-130 aircraft. The Army plans to procure a total of 675 of these systems for the FCS program, at a cost of approximately \$5M each for the basic platforms, not including weapons and payloads.

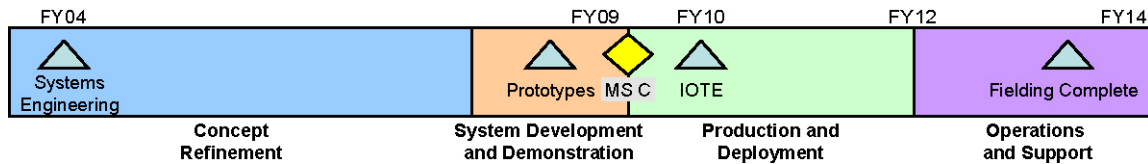
The Army initially deferred Class III systems from FCS Increment I because of affordability. Class III UGVs were moved forward into Spiral 1 as part of the Army's acceleration strategy. The current schedule calls for these systems to remain in the Science and Technology phase as a DARPA/Army program through 2006. The Class III systems may enter System Development and Demonstration after FY06.

In addition to the individual UGV developments, there is a separate development program for a shared Autonomous Navigation System (ANS) for use by all classes of UGVs. ANS will consist of a Laser Detection and Ranging and a camera, which together make up the Laser Detection and Ranging Image Processing Module.

ARMY PROGRAMS

In support of a rapid fielding request from U.S. Central Command for an EOD capability in Iraq and Afghanistan, three vendors deployed systems into that theater. These were the Vanguard Talon, Packbot Matilda, and the Mini-Andros. System assessments of their performance are on going.

TEST AND EVALUATION ACTIVITY



There has been no testing of full-up prototypes, as these systems are not expected to be available until the FY08-FY09 timeframe. Instead, in recent years there have been several low-level research efforts directed at particular aspects of the UGV development problem. During 2002 and 2003, the U.S. Army Research Laboratory (ARL) conducted experiments to assess the maturity of autonomous mobility technologies of FCS Block I ARV concepts using experimental unmanned vehicles as surrogates. These experiments were designed to address two key issues:

- The level of maturity of currently available autonomous mobility technology.
- The cognitive workload placed on the operator directly controlling the vehicle.

Results indicate that with current technology, UGVs can successfully navigate over various deserts and snow covered courses, but require manual intervention approximately once every 2 kms or roughly every 20 minutes. Data from these tests show current UGVs are only capable of traveling cross-country during the day at one-fourth the speed of manned vehicles.

TEST AND EVALUATION ASSESSMENT

The Army's developmental testing and field experience indicate that, while small semi-autonomous vehicles (e.g., Packbots in Iraq) have demonstrated some capability, the larger vehicles have considerable challenges to overcome to become viable. The Class I SUGVs have had successes in Iraq and Afghanistan in exploring caves and in EOD, and the FCS program identified them as the "easy" class among the three UGV families. Major issues with this class relate more to operational concepts (e.g., ownership and transport of up to 10 interchangeable payloads) than to technological developments. For Class II and Class III UGVs, technology for mobility to keep up with troops – mounted and dismounted – over rugged, diverse terrain remains the most overarching challenge as demonstrated in ARL experiments and the DARPA sponsored Grand Challenge. Tactical 'behaviors' in unexpected situations (e.g., how to escape, actions when systems loses communications, situational awareness to avoid fratricide), remain technological challenges. Concepts or methodologies to tests such technical capabilities once they are developed remain challenges for the test community.