



One System... Many Missions

The HDT Protector robot is a utility vehicle for dismounted infantry. It carries 1,000 pounds (500 kg) of logistics 60 miles (100 km) on internal fuel. Less than a three feet (1 m) wide, the robot goes wherever infantry goes, climbing 45° slopes, fording streams, and navigating narrow trails.

Like the Jeep and HMMWV before it, the robot is simple, tough, inexpensive and adaptable. A wide variety of mission kits already exist for it.

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The HDT Protector Robot

The HDT Protector robot supports dismounted infantry. The base vehicle is simple, strong, and inexpensive. A wide variety of mission kits lets one robot perform many missions, giving 'leg' infantry greater freedom of maneuver, operating range, endurance, force protection, and lethality.

The Protector robot is designed for an expeditionary future, supporting forced-entry operations in austere locations. The robot is small – less than three feet wide (about 91 cm). Five Protector robots fit on the same pallet as one HMMWV, and those five robots weigh less than a single unarmored HMMWV.

The highest possible density of combat power is essential when everything has to fit on an aircraft, helicopter, or landing craft. The Protector provides significant capability in very little cube.



HDT Protector robot. 91 cm wide, carries 1,000 pounds (500 kg) of gear, provides 2 kW of electrical power, runs on both diesel and JP8, 60 miles (100 km) range on internal fuel. Shown with route clearance flail and logistics trailer.

The HDT Protector robot shows how one system can fulfill a wide variety of needs:

- Squad – Mission Equipment Transport (S-MET)
- Combat Engineers
- Direct fire support
- Mortar carrier (81mm and 120mm)
- Anti-armor
- Tethered aerial surveillance & comms relay
- CASEVAC
- Amphibious operations.

Small, dismounted units gain greater force protection and endurance. By reducing the need for airdropped resupply, distant operations can be supported with a smaller footprint, at reduced costs.



CROWS. The Protector robot can fire on the move with: M2, Mk19, M240B, and Javelin. Live firing was demonstrated at Fort Benning.

Squad - Mission Equipment Transport (S-MET)

The heavy loads currently carried by dismounted infantry cause more injuries than hostile action. These loads slow down infantry, robbing them of agility and often ceding the unit's initiative to the opposing force. Even with these heavy loads, mission endurance is now measured in hours, rather than days.

The purpose of the S-MET robot is not to turn dismounted infantry into a mechanized mounted force, but rather to give leg infantry a simple tool to lighten their load and extend their mission endurance. With an S-MET robot, each squad member only has to carry their fighting load, and their mission endurance is extended to three days.

In order to achieve this goal, the S-MET robot has to carry between 500 and 1,000 pounds (250 and 500 kg) of gear 60 miles (100 km) across terrain that is too difficult for mounted infantry (otherwise, the mission would have been done using vehicles).

To achieve this performance, the robot must be powered by diesel/JP8, which has 100 times the energy density of the best available batteries. Electrical power is simply not practical. In addition, the robot must be tracked, in order to match as closely as possible the rough terrain capability of legged infantry. Finally, the robot has to be narrow and small, so it can fit on goat paths and jungle trails, as well as get through narrow openings in walled compounds.

These key requirements drove our design of the HDT Protector robot: diesel/JP8, tracked, less than one meter wide, and carry 1,000 pounds (500 kg) more than 60 miles (100 km). In addition, the robot generates over 2 kW of electrical power and recharges the BB-2557 and BB-2590 batteries carried by infantry.



Logistics. Carrying 1,000 pounds (500 kg) of gear during testing of our "follow-me" mission kit at Fort Benning.

HDT Global has also developed a "follow-me" semi-autonomy kit, shown in the photo to the left during testing at Fort Benning. This kit has an optional satellite communications link that provides worldwide remote operations.

In addition, HDT Global has designed a larger 'heavyweight' version of the Protector, able to carry 2,000 pounds (1,000 kg) at speeds up to 35 mph (50 kph), with a vehicle width of 54 inches (1.35 m).

Combat Engineers

Most Combat Engineering missions are not possible dismounted. The weight of the mission-specific equipment, in addition to the standard approach march load, is far too heavy for a person to carry.

Combat Engineers, however, need to be able to operate dismounted. For this reason, the US Army Combat Engineers are developing a Dismounted Engineer Mobility System (DEMS).



Testing at Fort Benning. The HDT Protector robot won the JIEDDO Dismounted Route Clearance Challenge, proving its endurance and its ability to disrupt buried IED's. The rotector's effectiveness has been tested at Fort Benning and Yuma Proving Grounds. It has also successfully undergone blast testing at Aberdeen, demonstrating the robot can survive a large blast and continue to operate.

Similar to the S-MET, the DEMS must match the cross-country capability of leg infantry, while carrying at least 1,000 pounds (500 kg) of equipment. The DEMS must also generate hydraulic power for tools and attachments, as well as electrical power.

As with the S-MET, these needs are best answered by a small, tracked vehicle, driven by a diesel/JP8 engine and hydrostatic transmission. A hydraulic power take-off must also be included.

The HDT Protector robot's powertrain is deliberately oversized – it can provide eight gallons (30 liters) per minute of hydraulic flow at 3,000 psi (200 bars), while carrying a full load uphill at 10,000 (3,000 m).

Route Clearance

The Protector robot has sufficient power to drive a hammer flail, clearing a path for leg infantry. The flail excavates a trench that clears any anti-personnel pressure trigger devices. A month of testing at Yuma against over 2,000 simulated targets showed this flail is more effective than any other mechanical route clearance system. Well over 90% of the devices were disrupted or detonated.

In addition, the HDT Protector robot can push a SPARK roller. Testing at TARDEC showed the Protector could push this roller up a 60% incline in wet, muddy conditions.

Mine Roller/Rake. The weight of the rollers detonates anti-personnel pressure triggered devices. The rakes scrape through the earth for command wires.



Manipulator

The HDT Protector robot can mount one or more of HDT Global's Adroit® manipulators. The single arm version can lift over 50 pounds (20 kg). The dual arm version can lift 150 pounds (65 kg). The Adroit manipulator's dexterous 'hand' can pick up and use almost any hand tool used by Combat Engineers.



Manipulator Arms.

HDTs Adroit manipulators provide increased capability for the HDT Protector robot, including loading and unloading a marsupial robot.

Force Protection

Constructing a Combat Outpost currently takes the efforts of over half of the unit's manpower for three months. By the time the unit can begin actively patrolling, the local opposing forces have already fully adjusted to new situation. These outposts are too small and remote for heavy equipment, but filling Hesco barriers with entrenching tools is very time consuming.

The Army Corps of Engineers funded our development of a backhoe/loader kit for the HDT

Protector robot. With this kit, a small unit can build an outpost in less than two weeks, while almost all of the personnel can begin their primary mission right away.



Backhoe/Loader. *Digs 1.5 m deep. Lifts a hundred kilograms of soil to a 2.75 m dump height to fill double-stacked Hesco barriers.*

Direct Fire Support

The firepower of a dismounted infantry unit is limited by the weight of the weapon and the amount of ammunition that they can carry. With a HDT Protector robot, a dismounted squad has much greater lethality, and they can deliver it remotely.

The Protector robot can carry the standard M-153 Common Remote Operated Weapon Station (CROWS), which can fire a M240B, M2, or Mk19, while on the move. The CROWS can also be equipped with a Javelin missile, in addition to the primary weapon.



CROWS. The HDT Protector robot shown above is carrying an M-153 CROWS with an M2 12.7 mm heavy machine gun, which can be remotely aimed and fired, even while the vehicle is moving across rough terrain. The CROWS can also carry an M240B, M134 mini-gun, and Mk19. A Javelin missile can be mounted coaxially with the main gun. An armor kit is available for the robot.

The US military has over ten thousand M-153 CROWS in inventory, any of which can be mounted on a HDT Protector robot.

A live fire demonstration of the robot and CROWS with an M240B was conducted at Fort Benning.

Pedestal Mount

While there are advantages to being able to remotely operate a mobile direct fire weapon system, many infantry soldiers and marines have requested the simpler and lighter-weight option of manually operating a weapon that is pedestal-mounted on the back of the robot.

The images below show the robot with the frontal armor portion of its armor kit. The pedestal mount also has an armored gun shield.



Pedestal Mount. With a simple pedestal mount, armored gun shield, and vehicle front armor, the HDT Protector robot provides a safe mobile weapons emplacement for dismounted infantry. Units as small as a squad can carry a much larger weapon and far more ammunition than they normally could.

Anti-Armor and Hardened Target

Forcible entry expeditionary operations have a greater risk of dismounted infantry encountering opposing armored vehicles, at a time when support from other ground or air assets may be more difficult to achieve. While Javelin missiles can provide some organic protection, the missile's weight limits how many Javelins a dismounted unit can carry.

Javelin missiles have also proved useful against hardened targets, such as bunkers and walled compounds.

The HDT Protector robot can carry five Javelin missiles and its Command Launch Unit, or three TOW missiles and its launcher. The robot can also carry a seven-pack of 70mm rockets with laser-guided precision seeker heads and a laser designator/range-finder. All of these missiles still must be manually launched.

Anti-Armor. The Protector can give small, dismounted units much heavier organic firepower.

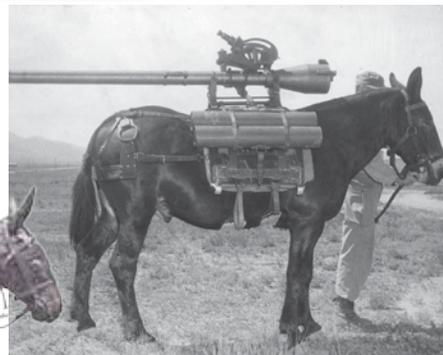
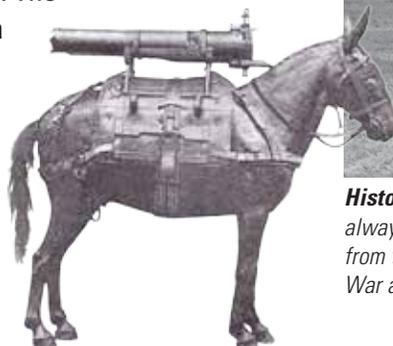


Carries five Javelin missiles and Command Launch Unit



TOW launcher and three TOW missiles

When the HDT Protector robot is carrying a CROWS that is equipped with its optional Javelin launcher, the robot can function as a miniature, remotely operated tank destroyer. This capability is a significant departure from previous doctrine. The Protector robot gives a dismounted infantry unit an organic, although limited, combined arms capability.

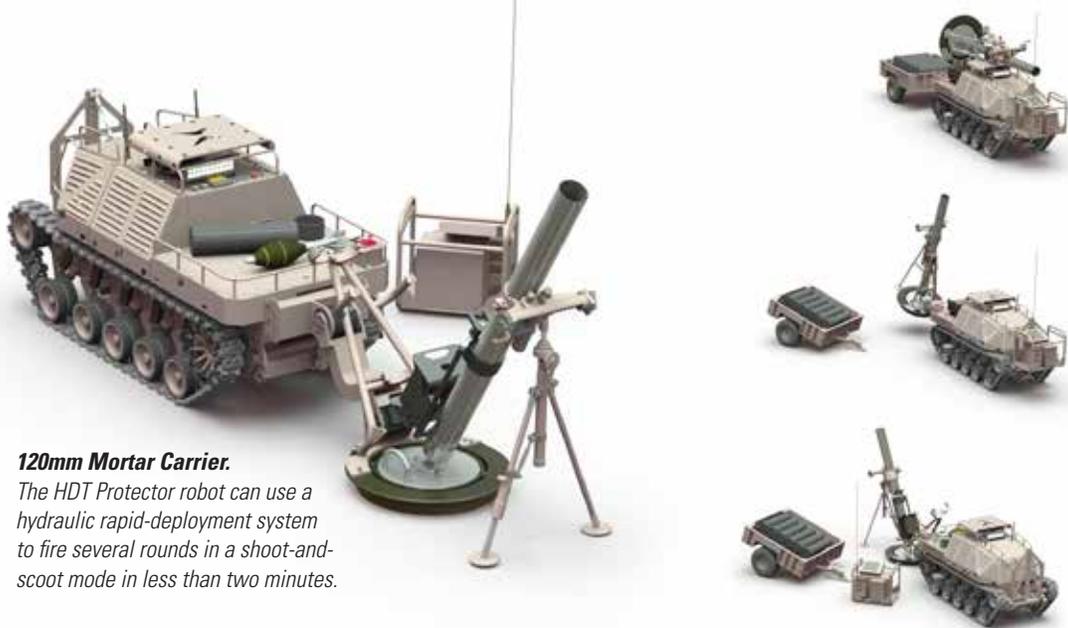


Historical Examples. Dismounted infantry has always sought ways to carry heavier weapons, from the 19th Century on the left to the early Cold War above.

Mortar carrier

Organic indirect fire can be as important to a dismounted infantry unit as direct fire, sometimes more so. At most, however, small infantry units carry a 60mm mortar and each member of the unit carries one round. A single HDT Protector robot can carry a 60mm mortar, bipod, the full M7 baseplate, and 100 rounds.

A Protector robot with its logistics trailer can carry an 81mm mortar, bipod, baseplate, and 100 rounds. Two MUV robots with trailers can carry a 120mm mortar, bipod, baseplate, precision aiming electronics, and 100 rounds.



120mm Mortar Carrier.
The HDT Protector robot can use a hydraulic rapid-deployment system to fire several rounds in a shoot-and-scoot mode in less than two minutes.

The design shown above has a rotary hydraulic actuation system that can deploy a 120mm mortar in seconds, using hydraulic force and the weight of the robot to set the baseplate firmly into the ground. The crew can fire several rounds, retrieve the mortar, and be on the move in less than two minutes.

Communications Relay and Intelligence, Surveillance, & Reconnaissance (ISR)

Dismounted infantry units have come to greatly value having an Unmanned Aerial Vehicle (UAV) overhead, but small UAV's have limited endurance. Larger UAV's have limited availability.

A new class of tethered UAV's are available that can stay 1,000 feet (305 m) above the ground for weeks, with power and video going through their tether. The HDT Protector robot can deploy a tethered UAV with EO/IR sensors for ISR or a radio relay to provide wide area coverage.



CASEVAC

When a small, dismounted infantry unit takes casualties and has to exfiltrate under fire to a safe landing zone, each unit member who has to help carry a litter reduces the unit's ability to provide defensive fire. One or two non-ambulatory casualties per squad can immobilize the unit.

Hard points are built into each side of the Protector robot for stretcher bars. Talon folding stretchers and the stretcher bars can be compactly carried while the robot is performing a variety of other missions. If needed, the robot can be set-up for CASEVAC in less than a minute, allowing for rapid exfiltration to a safe landing zone.

MEDEVAC helicopters can carry an HDT Protector robot internally.



Litter Carrier. The HDT Protector robot can carry two stretchers. With its on-board folding ramps, the robot can self load into a UH-60.

Amphibious

HDT Global has designed an amphibious kit for the Protector robot. The pontoon attaches to the same hard points used for the stretcher bars. The propulsion module attaches to the rear bumper payload attachment fittings.

The propulsion module has a pod-mounted propeller. The pod can rotate 360° in the yaw axis, to provide both propulsion and steering. The pod assembly can also rotate back and up in the pitch axis, to retract the propeller once the robot reaches land. The propeller is powered by a small hydraulic rotary motor in the pod, which is driven by hydraulic flow from the power take-off.

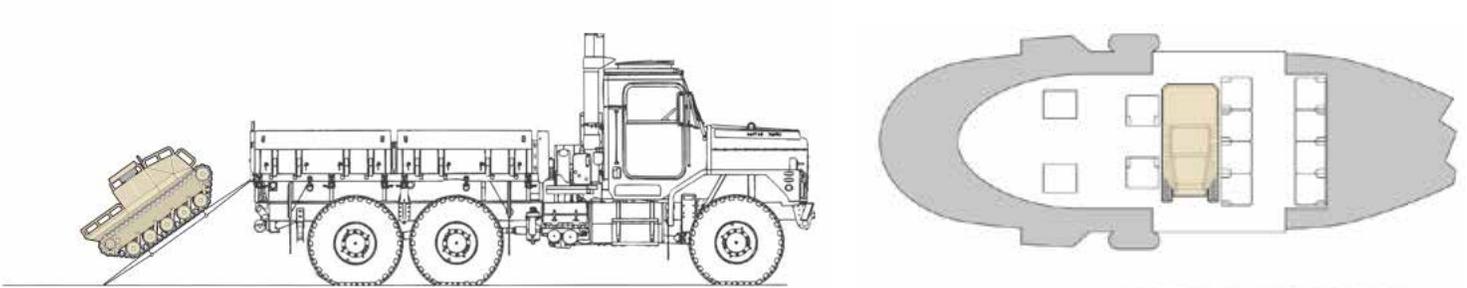
Using our optional satellite communications kit, the robot is capable of being launched from over the horizon and swimming to shore. Until the amphibious kit is built and tested, it is not possible to know its actual performance in terms of speed and sea state.



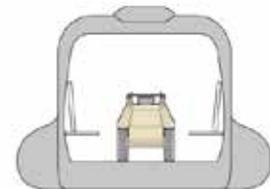
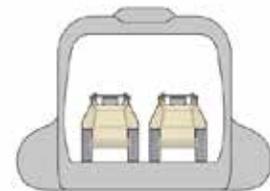
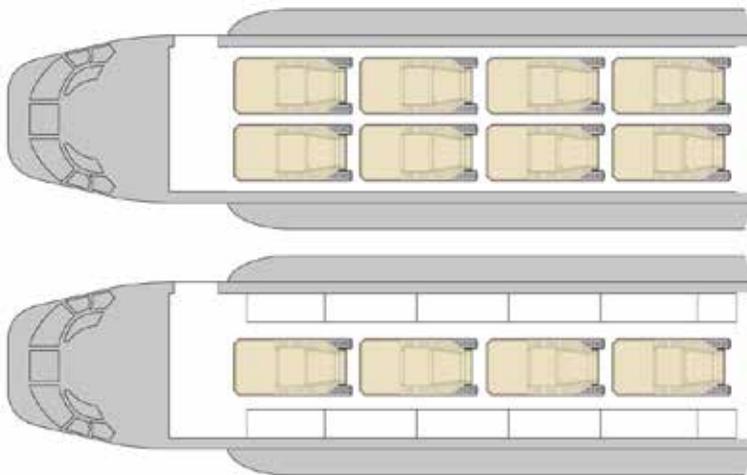
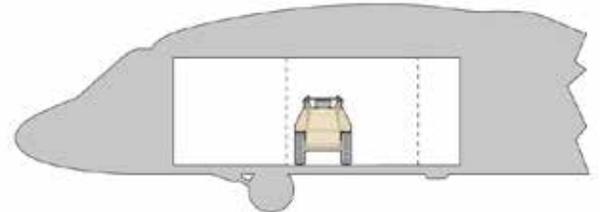
Amphibious kit. The Protector robot can power a steerable propeller pod using its hydraulic power take-off. The propeller pod rotates up and out of the way when the robot reaches land.

Transportable

The small size and light weight of the HDT Protector robot makes it easy to transport. The Protector robot has compact folding ramps that allow the robot to self-load onto a truck or into a UH-60. Up to eight robots can be carried internally in a CH-47 and three robots can be carried internally in a V-22 Osprey.



Transport. With ramps carried on the robot, it can self-load onto a truck with bed heights up to 1.5 m, and into a UH-60. Eight robots can be carried in a CH-47 in cargo configuration, or four robots and two infantry squads in a mixed load. Three robots will fit in a V-22 Osprey.



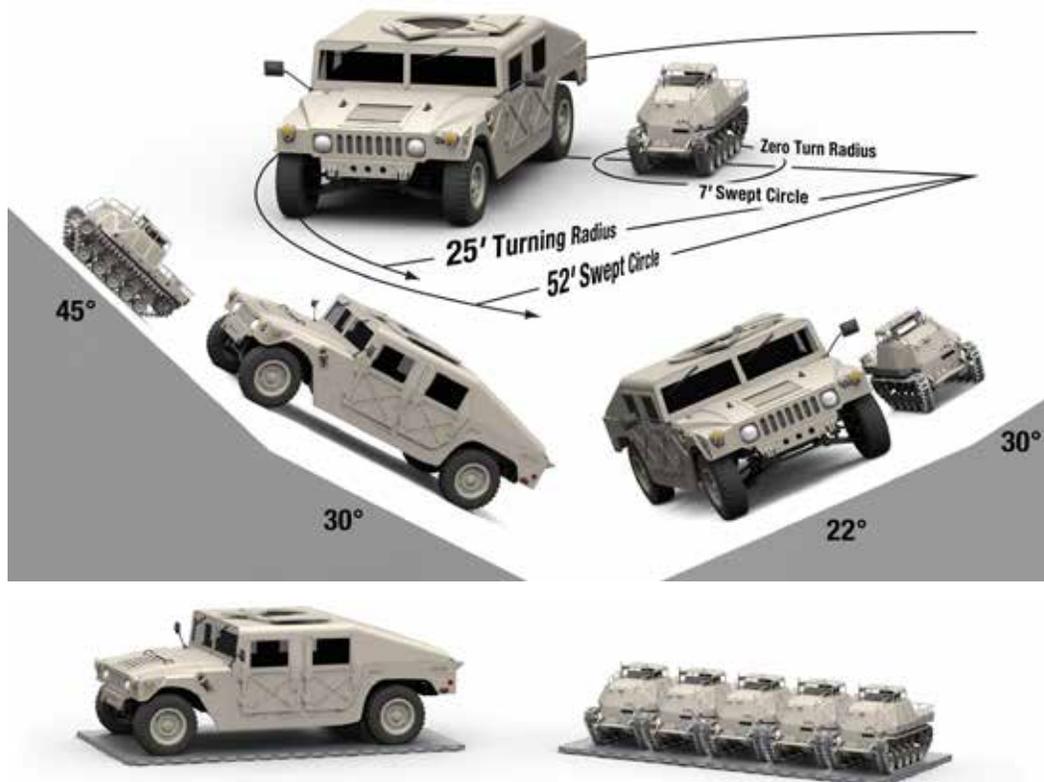
The robot can also be carried as a sling-load. With a full load of fuel, the robot weighs about a half ton.

The robot has a fully compliant suspension with a significant amount of vertical travel, so it can be safely air-dropped with very little preparation time.

Comparison with HMMWV and ATV

The HDT Protector robot is built to support dismounted infantry, which means it is small enough to travel on walking trails and its top speed is a steady jog (about 5 mph or 8 kph). While it can be equipped with four web seats for infantry, using the hard points on both sides of the robot, it is not intended to convert leg infantry into mounted infantry.

The Laws of Physics limit how fast a vehicle this small can safely move across uneven terrain. Most All Terrain Vehicles (ATV's) are actually larger and heavier than the Protector robot. In addition, ATV's rely on having a single rider who can actively shift the vehicle's center of gravity. Even with skilled riders, however, ATV accident rates are high. The HDT Protector robot's very compliant tracked suspension provides much better rough terrain traversability than an ATV.



	One HMMWV		Five Micro-Utility Vehicles	
Weight (kg)	7,000 lbs	3,200 kg	6,500 lbs	2,950 kg
Payload (kg)	2,000 lbs	900 kg	5,500 lbs	2,500 kg
Width (m), each	7.5 ft	2.3 m	3 ft	0.9 m
Length (m), each	16 ft	5 m	7 ft	2 m
dB at 15m	60		58	

Even compared to an unarmored HMMWV, the Protector robot is more maneuverable and can handle steeper slopes. Five Micro-Utility Vehicles fit within the footprint of a single HMMWV, but the total of those five Protector robots weigh less than a single HMMWV, and those five Protector robots can carry more than twice the cargo.

Operator Control Unit

The HDT Protector robot's Operator Control Unit (OCU) was specifically designed for dismounted operations. The OCU is composed of a wireless hand controller and a radio repeater. The hand controller weighs less than a half pound (0.23 kg) and can snap into a Picatinny rail adapter to act as a weapon fore grip. The radio repeater weighs three pounds (1.36 kg) and fits into a MOLLE pouch. The entire OCU, including batteries for eight hours of operations, weighs about four pounds (1.8 kg).

Control range is 0.62 miles (1 km), line of sight. An E-Stop is built into the radio repeater, with its own dedicated radio link. In addition, the Protector robot has demonstrated an autonomous "follow-me" capability.

HDT Global's standard OCU does not include a video link. An operator *cannot* walk and simultaneously use a video link to remotely control a non-line-of-sight robot. In order to use video, the operator must halt. Video radios also add substantial cost and their batteries increase the weight of the OCU.

For those times, however, when non-line-of-sight remote operations with video is desired, HDT Global offers a video link and robot control through the Tactical Robot Controller. We also have a satellite communications kit.

Specifications

Performance	Robot Only		Robot and Trailer	
Payload	500+ lbs	250 kg	1,000+ lbs	500 kg
Width	<36"	91 cm	<36"	91 cm
Max slope climb	100% (45°)		60% (27°)	
Side slope	67% (30°)		67% (30°)	
Step height, unassisted	16"	38 cm	6"	15 cm
Step height, using on-board ramp	60"	150 cm	60"	150 cm
Operating temperature	-20° to 49°C		-20° to 49°C	
Top speed	5 mph	8 kph	5 mph	8 kph
Speed up 60% grade, sea level	3.5 mph	5.6 kph	2.5 mph	4 kph
Speed up 60% grade, 4,000 m	2.3 mph	3.7 kph	1.5 mph	2.4 kph
Fording, no snorkel	20"	75 cm	20"	75 cm
Power available to payloads	2 kW @24VDC		2 kW @24VDC	

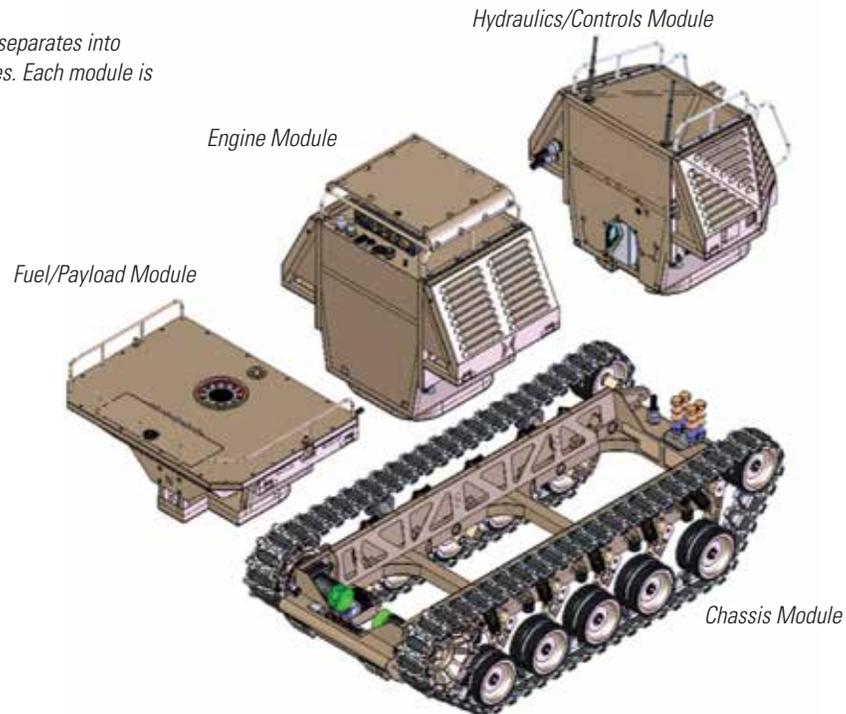


OCU. Operator, holding hand controller in right hand and wearing radio repeater on front of load-bearing vest.

Modularity

The HDT Protector robot separates into four modules in a few minutes. Reassembly is equally rapid. Each module is a four-man lift. This modularity simplifies field maintenance. Also, when an infantry unit is faced with an obstacle that the robot simply cannot cross, even using its folding ramps, the robot can be quickly separated into individual modules, carried across the obstacle, and reassembled.

Modular. The robot separates into man-portable modules. Each module is a four-man carry.



Removing the hydraulics/controls module. The robot separates into man-portable modules in a matter of minutes.

ATEC Safety Release

The Army Test and Evaluation Command (ATEC) has granted the HDT Protector robot a Safety Release.