



UNITED STATES DEPARTMENT OF DEFENSE

# HUMANITARIAN DEMINING R&D PROGRAM

An advanced robotic system to detect anti-tank and bounding fragmentation landmines using GPR and EMI sensors

## NEMESIS

The Nemesis is a robotic vehicle equipped with dual sensor detection, navigation and positioning, and marking subsystems. A Modular Robotic Control System (MRCS) provides independent command and control of the detection system and the platform. The dual sensor detection system integrates electromagnetic induction (EMI) and ground penetrating synthetic aperture radar (GPSAR) sensor arrays with real-time landmine recognition algorithms. The navigation/positioning system combines Real Time Kinematic (RTK) GPS and local positioning sensors to co-register EMI and GPSAR detections with centimeter accuracy.



### STATUS

Tested in Cambodia May 2008, and at various US test sites from 2009-2010.

System development and final technical testing completed in May 2011.

The robotic platform has the versatility to carry out detection missions at slow speeds using closed-loop speed control and can follow the terrain using feedback from six ultrasonic standoff sensors mounted in front of each detection sensor.

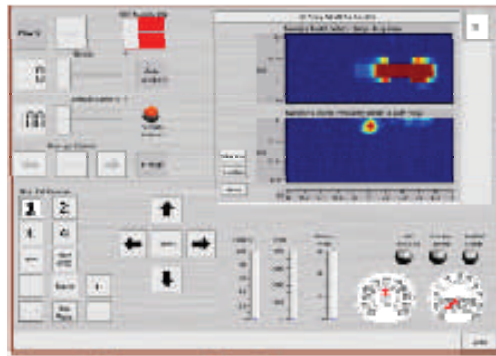
Cutting-Edge Solutions  
DEMINING TECH

MINE DETECTION



## FEATURES

- Remote operation with manual operator controls retained.
- Real-time electronic and physical marking of suspect landmine locations with cm-level accuracy
- Coverage mapping
- Multiple video and audio feedback from platform to the operator control station
- Real-time display of EMI and GPR data and alarm marking



**Touch Screen Display**



**Nemesis Operator Control Station**

## APPLICATIONS

- For detection of AT mines in flat / open areas
- The Nemesis platform can operate in relatively flat terrain. Roadways or open fields are ideal environments
- Detection of hard-to-find landmines such as low-metal mines
- Operation of Nemesis requires prior computer knowledge and well-trained, skilled operators

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## SPECIFICATIONS

### Nemesis Robotic Platform

Weight, Platform Only	2,630 kg / 5,800 lb
Weight with Detection System	3,260 kg / 7,200 lb
Length x Width x Height, Platform Only	2.54 m x 1.55 m x 2.26 m
Length with Detection System	5.71 m
Ground Clearance	0.305 m
Ground Pressure	21.4 kPa / 3.1 psi
Track Width	0.381m (15 in)
Ground Contact Area	1.14 m <sup>2</sup> / 1,770 in <sup>2</sup>
Engine Type	Perkins 404C-22T diesel, turbocharged
Gross Power @ 2800 rpm	44.7 kW / 60 hp
Torque, peak	190 Nm / 140 ft-lb
Auxiliary Hydraulic Pump Flow, Pressure	65.9 Lpm/ 17.4 gpm; 20,684 kPa /3,000 psi
Travel Speed	0.2–13 kph (<1kph for detection)

### Nemesis Detection System

#### GPSAR Array

Frequencies (Selectable Frequency Steps)	Stepped from 400 MHz to 3 GHz
Average Radiated Power	63 mW
Receiver Antennas (Tx-Rx pairings)	46 spiral antenna pairings
Effective Detection Footprint Width per Scan	185 cm
Real Aperture Along x Across Track Resolution	3 cm x 4 cm

#### EMI Array

Receiver Channels (Single Tx Multiple Rx)	10 monoloop & 10 Figure-8 coils
Effective Detection Footprint width per Scan	185 cm
Along x Across Track Resolution	3 cm x 10 cm