DMT Overview
Nov 2008

Radar for Land, Air and Sea
DMT, LLC Summary

• Opened 1996
  – Privately owned and operated
  – No venture capital

• Located in Sterling & Forest, VA
  – Sterling (Washington DC) – R&D, Software, Training
  – Forest – Factory & production
  – Support Offices Worldwide

• Products
  – “AIMS” Area Intrusion Monitoring Systems - radars for wide area surveillance and high value asset protection
  – Integrated Security Product Suites
  – Optimized Robotic Assembly Stations and Ships Systems

• Services
  – Sensor System Installation
  – Operations and Logistics
Products

AIMS = Area Intrusion Monitoring System

- **Commercial Products:**
  - AIMS Fast-Scan
  - AIMS Fast-Scan-SS
  - AIMS Fixed Beam

- **Military and Custom Products**
  - DMT Airborne Radar
  - Integrated Suites
  - Aerostat Payloads
  - Custom Radar Systems

- **DMT Services**
  - Installation
  - System Integration
  - Operations

DMT Facility in Iraq

Radar for Land, Air and Sea
DMT Cornerstone Product
Area Intrusion Monitoring System

“AIMS FAST-SCAN”
Detection Ranges 1.5 to 15 km Walking Human

- Transmitted Frequency: 9.23 GHz
- Peak Radiated Power: 1 Watt to 80 Watts
- Power Requirements: ~150 watts for 5 km
- Operating Temperature: -40 to +70 degrees C
- Completely sealed (no airflow to the outside)
- Size/weight: 76 x 76 cm / ~ 25 kg
- Requires 2-3 people to transport (depending on range)
- Scan Rate: 0 to 48 deg/sec (programmable)
- Camera Control Server built-in for most Thermal and CCTV cameras (short to long range)
- Connectivity with Commercial GPS, Digital Compass, AIS
- Radar has sea and land clutter rejection algorithms

Antenna
- Continuously 360 degrees or in a scan pattern (e.g. -30 to +30)
- Antenna tilts -30 degrees to +114 deg.

Radar components

Communications/CPU/Electronics

Wireless Ethernet

Wired (RJ-45) Ethernet

Radar for Land, Air and Sea
Scanning Modes

- Elevation (tilt) control while spinning
- Modes:
  - Continuous 360 degrees in azimuth (horizontal)
  - Sector Scan (scanning between 2 angles)
  - Scripted Scan (define pointing as a script)
  - Autoleveling (correction for unlevel surfaces – good for vehicle and tripod mounts)
AIMS Fast-Scan
Standard Configuration

- Elevation Motor
- Antenna
- Azimuth Motor
- Enclosures for RF and Electronic Assemblies
- Breakout Box
- Nomex Radome
- Slip Ring (passes Network, Serial, and Power)
- Kevlar Belts for long wear

Radar for Land, Air and Sea
Unique Features of AIMS Fast-Scan

- All-Weather system – works in fog, rain, snow, sleet, desert storms.
- Widest operating temperature range of any radar on the market.
- Automatically points cameras upon detection – many cameras can be pointed by each radar.
- Many DMT radars can operate within a few meters of each other. 100% coverage overlap is permitted.
- Display software monitors many radars. Map overlay and integrated video.
- Highest Doppler resolution of any radar on the market.
- Built-in network server – may be viewed by many remote clients over a network or Internet. Built-in wireless network.
- Built-in clutter rejection software
- Only radar on market that will work on a vehicle while in motion
- Spins 360 degrees continuously – many radar systems spin +/- 180
- Only radar that has continuous coverage from 0 to Maximum range
- Maintenance Free for years
Upgrade Paths Available

Order:
1.5km, 3km, 5km, 7km, 10km, 12km, 15km human detection range

Beamwidths: $3^\circ \times 3^\circ$, $7^\circ \times 7^\circ$
$11^\circ \times 11^\circ$
$3^\circ \times 7^\circ$
$3^\circ \times 10^\circ$
$2^\circ \times 12^\circ$
$1^\circ \times 20^\circ$

Integration with:
- IR systems
- Camera systems
- LRAD (acoustic)
- Quickset
- Brackets of any kind

Software Enhancements:
- Free Custom Software
- Motion Compensation
- GPS, Digital Compass
- Much more

Power Increase:
- Amps from 1 to 80 Watts
- Waveform Enhancements

Radar for Land, Air and Sea
• AIMS Fast-Scan comes in 1.5, 3, 5, 7, 10, 12 and 15 km versions (human detection ranges)
• Range assumes:
  – Moderate rain attenuation
  – Walking human with 1 square meter mean RCS
  – Full atmospheric attenuation
  – Range can vary with obstruction, uneven terrain, installation height, etc.
• DMT increases antenna size and power amp output to achieve range improvement
• 1 to 80 Watts peak power
Low-Profile, Rugged Configuration

Great for mobile applications, such as vehicles and trailers.

DMT provided this entire package to a country in the ME.

Metal and radome is thicker, components are shock isolated.
Radome Configurations

- DMT provides many configurations of radomes that fit its various antennas
- Radome size relates to range performance
- Weight, size, range are factors for radome size
- Radomes can be provided in:
  - White
  - Desert Tan
  - Green
  - Camouflage
  - Custom (provide color number)

Increasing Range

<table>
<thead>
<tr>
<th>Size</th>
<th>Weight Range</th>
<th>Range</th>
</tr>
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<tbody>
<tr>
<td>29 x 29 inches</td>
<td>50-65 lbs</td>
<td>800m to 1.5 km</td>
</tr>
<tr>
<td>43 x 20 inches</td>
<td>90-150 lbs</td>
<td>3-5 km</td>
</tr>
<tr>
<td>43 x 34 inches</td>
<td>150-220 lbs</td>
<td>3-15 km</td>
</tr>
<tr>
<td>43 x 48 inches</td>
<td>100-200 lbs</td>
<td>3-15 km</td>
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FRU
(Field Replaceable Units)

Power Amp Assembly

RF Transceiver Assembly

CPU Assembly

Antenna

Power Supplies

All these assemblies may be replaced in the field. All installed with 4 bolts. Disconnect power and cables to remove. Power must be disabled prior to replacement.
Typical Fixed Installations

- Tower
- Building
- Pole

Radar for Land, Air and Sea
• DMT simplifies connections as much as possible
• DMT Proprietary cable has video, Ethernet, power, and control lines with a locking bayonet connector
• AIMS Universal Enclosure is customized for each installation type, and typically includes:
  – Power supply for radar
  – Power supply for camera
  – Video server for converting analog video to digital video
  – Ethernet switch for combining radar and video on a single Ethernet port out
  – Ethernet to Fiber adapter (specify mode and connector type)
  – Tamper Alarms
  – Peltier Thermal System

CCTV Camera
AIMS Fast-Scan
AIMS Server (Software)
CAT6, Video, Power, RS-422
AIMS Universal Enclosure
Radar for Land, Air and Sea
Mobile Installations

Trailers

ESI

Northrop

L-3

Harris

Relocatable

Vehicles

DMT

Radar for Land, Air and Sea
Other Installations

Ships
AIMS on a Private Yacht
AIMS Civil Radar in Merchant Marine Trails

Aerostats
Custom AIMS Airborne Radar for US Military in IRAQ
DMT Cornerstone Product
Area Intrusion Monitoring System

“AIMS Fixed-Beam”

Detection Range > 1.5 or 3 km Human*

Radar/ Processors / communication
Antennas

AIMS Fixed-Beam Configurations

Create Invisible Fences

- The “type” indicates the number of transmit antennas on a system
- Other optional configurations are available

Radar for Land, Air and Sea
AIMS Fixed-Beam

- AIMS Fixed-Beam Uses:
  - Perimeter Security
  - Pipeline Security
  - Flight-line Security
  - Invisible Fences
- Points cameras at intruders
- Intrusions plotted on map
- Maintenance Free
- All-Weather performance
- Easy to install
AIMS Fixed-Beam 8-antenna version
- First availability is in 1.5 km version (human detection range)
- Update rate is about 1 second.
- With 45 degree horns, 360 degrees of coverage is available.
DMT Aerostat Payloads

Sensor payload built, flown and operated by DMT in IRAQ

2004

Sensor Payload

2005

Large Ground Planes for 2 VHF Retransmission networks

KB-17 Balloon

Weight = 675 lbs

“Wagon-wheel” Ground Planes for 2 UHF Retransmission networks

2005

2006

New DMT Payloads

Radar for Land, Air and Sea
Example for Base Monitoring

Integrated Ground Station for Long-Range Remote Monitoring

Notebook PC Stations  Handheld Displays
Command Centers

• Available as fixed or mobile centers
• Configurable for the customer

Radar for Land, Air and Sea
Vehicle Mounted System

Traditional system may be mounted on vehicles

New lower profile system reduces air drag and has longer detection ranges

Shock Absorbing Mount
Software
Communication Between Client and Server

Client Software running on PC

Stores:
Detection Data (ASCII)

Detection Data and Spectral Data

Controls/Settings

Network Cable

Server Software running on radar

Stores:
Raw I, Q Data (Binary)

Radar for Land, Air and Sea
Custom User Interfaces

- DMT customizes displays for the users application – typically in 3-4 weeks
- DMT’s software can monitor many radar systems and cameras. This example shows a version for 16 radars and 32 cameras
- DMT’s Global Monitoring system can monitor thousands of radar systems
Custom User Interfaces

Report Window

Detections are plotted on Map

Password Control

Digital Video Recording

Camera Video

Digital Video Recording

Radar for Land, Air and Sea
Zones

Pop-up Editing toolbar

Alarm zone

Types of Zones:
-- coverage
-- alarm
-- warning
-- blanking
-- camera

Radar for Land, Air and Sea
Controlling $P_d/P_{fa}$ in DMT Radar

- For each range bin, DMT calculates the average clutter magnitude (excluding 0 hertz)

- Sensitivity is set relative to the average clutter value calculated

**Diagram:***
- Sets width and depth of clutter notch
- Sets Threshold above Clutter
- Sets Pulsewidth, which controls average power

**Graph:**
- Increasing Range
- 10 dB
- Threshold (Sensitivity)
- Clutter Average
• Radar has built-in test software:
  – Tests motors, communication, networking, critical RF components, some electrical components
  – DC Offset voltages and radar coherency is tested
  – Lobes occurring in the data due to saturation events are also reported and handled.
  – May be monitored on radar server software, or is reported using system status message from client
• Help file is also available to diagnose further problems
• Additional utilities are installed to test A/D board, CPU temperatures, resource use
• The onboard A/D board can double as an oscilloscope. Graphic software provide voltage and frequency readings
• Mouse, keyboard, and display connectors are found inside the electronic enclosure – this is valuable if networking hardware issues arise
• USB ports exist for loading new software or utilities for test
• Internal Ethernet port exists inside electronic enclosure for testing with an external notebook
DMT’s Client incorporates Video Server SDKs (software development kits).
Permits date/time-stamped video recording locally and/or remotely.
DMT uses Moxa and Axis video servers for most installations. Moxa has extended temperature range and is more rugged. Others are available.
Many video storage formats are possible, including MPEG, MPEG4, etc.
Video servers come with relays, which may be used to enable tamper alarms or other hardware.
**Broadcast Mode**

To enable broadcast

**For monitoring radar**

**Software Development Kit**

Permits full control

**Radar Data**

For Playback

**Remote Client**

**Source Code**

**Radar Server**

**Radar for Land, Air and Sea**

**Broadcast toolkit**
Software Tools for Integrators

- **AIMS Data Analysis Package**
  - Good for what-if analyses, parametric and performance evaluation
  - Plays back raw I/Q data saved by DMT’s radar systems
  - Has all the filters and settings of the DMT remote client, but includes more data visualization tools.

- **AIMS Detection Processing**
  - Good for analyzing large amounts of detection data
  - Has 2-D plot of detections on lat/lon grid
  - Permits sorting by multiple parameters

- **AIMS Radar Performance Analysis**
  - Systems engineering tool for designing and ordering DMT radar systems
  - Enter RF parameters to calculate max range, S/N, S/C, max Doppler, Doppler resolution and more
Example Installations
LNG Installations

AIMS Fast-Scan

AIMS Fixed Beam
LP Installations

Radar for Land, Air and Sea
• DMT offers solutions for dams, lakes and reservoirs
• DMT can include interfaces to:
  – Video Cameras
  – Thermal
  – LRAD (Long Range Acoustic Device), which emits directional, high-power sound to warn intruders
  – AIS (Automated Identification System)
• DMT integrates with many other monitoring systems. Examples of past or current work include:
  – Bosch
  – NGC’s, L-3’s, and Harris’ monitoring systems
Swimmer Detection

- DMT radar systems work over land and sea, including:
  - Docks
  - Beaches
  - River banks

- Swimmer detection uses:
  - the AIMS Fast-Scan radar
  - a maritime thermal camera

- DMT recommends:
  - AIMS Fast-Scan radar,
  - Thermal camera,
  - Sonar-based diver detection
  - Warning devices (like LRAD)
Waterside Installations

- DMT has installed on the AIMS Fast-Scan on a number of waterside environments.
- These include at oil refineries, VIP sites, and water treatment facilities.

Installation Site in Middle East

Installation Site in Norway (North Sea)
Large Ship Installation

For Commercial and Private Ships

For Navy and Coast Guard Ships

Radar for Land, Air and Sea
Border Security

- Radar configurations enable systems to work in many types of environment.
- Radars can overlap without interfering with each other, so no gaps in coverage result.
- DMT vehicle systems, tower systems, trailer systems, airborne systems and ship-based systems can all be monitored from the same user interface.
Services

• Radar Installation
  – Radar and other sensors
  – Communication
  – Brackets and special hardware
  – Remote Monitoring

• Provide turn-key solutions for customer, integrated radar, cameras, communications

• Operations (Man-power, systems, logistics)

• Training in available in USA, and at customer locations anywhere in the world
The AIMS radars were designed to be under the EAR and exportable to most countries without a license and were classified as EAR 99. In Sept 2008 the State Department placed AIMS radars on the US munitions list under the ITAR requiring licenses for export. This ruling is being appealed.
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