Improved Chemical and Biological Defense Testing Using the Test Grid Operated with the Open Architecture Data Management System (OADMS)

Aaron Twombly[1], Jason Kayser[1], David George[1], Jason Gordon[1], Franz Schulzke[2], Mahdee McNeil[2], Joseph Rybak[2], Nathan Lee[3], Adam Drochner[3], & Matthew McCarty[3]
[1]MRIGlobal; [2]Joint Program Executive Office for Chemical, Biological, Radiological, and Nuclear Defense (JPEO CBRND; funding organization); [3]West Desert Test Center (WDTC)

Introduction to Test Grid & OADMS

The Dugway Proving Ground (DPG) Test Grid provides an unmatched capability for conducting indoor/outdoor testing involving chemical and biological simulants. Testing activities span a wide range of scenarios, including evaluation of chemical or biological sensors, evaluation and modeling of environmental behavior of simulants, evaluation of protective equipment, and training events. The Test Grid is comprised of a set of equipment employed to create a biological and/or simulant challenge and to referee chemical and biological simulanttests using a combina tion of point sensors, standoff sensors, and meteorological sensors. Test Grid also provides the infrastructure required to deploy the system in remote, resource-constrained environments, including in locations external to DPG. The Test Grid is operated by a custom data management system known as the Open Architecture Data Management System (OADMS), which recently successfully completed ATEC Verification and Validation (V&V).

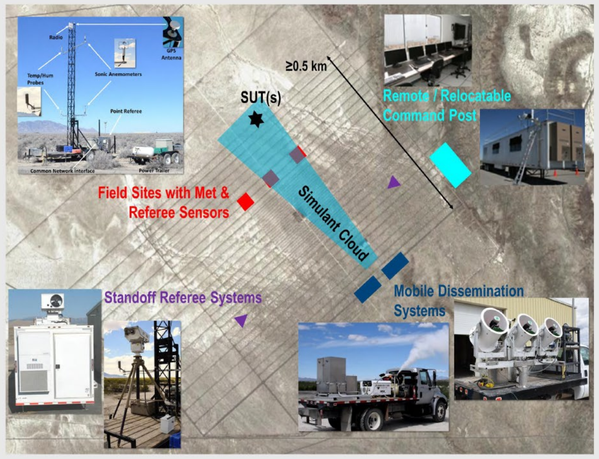

Exhibit 1. Overview of components constituting the Test Grid. OADMS software and hardware (not shown) interconnects these disparate components and enables remote real-time control over all components and full situational awareness

OADMS Architecture & Components

The OADMS "Sidecar" is deployed at each field site to interface with the fielded devices and enable two-way communication with the command post.

- Sidecar contains five "blades", each blade connects to a fielded device and provides communication and power
- Blades housed within ruggedized and fieldable enclosure
- Sidecar and blade provide health and status indications
- Data is encrypted on blade during trial (gold data) and securely transmitted via the TENA protocol through a radio (or wired) connection to the command postfor real- time acquisition and viewing (silver data) in a customizable web interface
- Gold and silver data automatically stored in XML and CSV formats

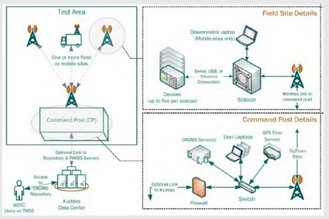

Exhibit 2. OADMS architecture

Exhibit 3. Fielded Sidecar

Exhibit 4. Sidecar blade interface

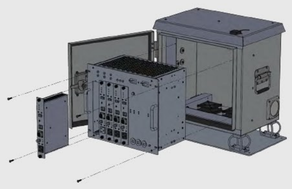

Exhibit 5. Sidecar CAD representation

OADMS Key Features

Streamlines Test Setup / Retrograde:

- Devices connect to Sidecar via Ethernet, USB, or Serial
- Devices can be toggled on/off remotely
- Devices are automatically detected
- Devices are all automatically time synced
- Each site provides GPS location

Flexible Layouts

- Sensors can be at fixed or mobile sites
- Only 120V AC power required in the field
- Radios enable high speed communication at up to 3.5 km distances

Playback

- Trials can be replayed within the same user interface
- Easily can skip to a specific time, change the playback speed, and pause the playback at any time
- Playback of all data is available on the WDTC Data Center OADMS server with TMSS access

Secure & Reliable

- SUT and referee data remain isolated
- RAID arrays on all servers
- Redundant GPS time servers & backup drives
- All test data encrypted
- Field data automatically synchronized with data center server
- User permissions assigned at system and test level
- SUT permissions defined per device type

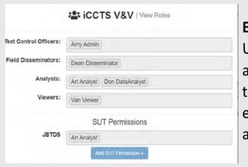

Exhibit 6. OADMS User Roles dialog allows specific roles to be assigned for each test, facilitating access control

Intuiᵡve User Interface

- Web interface with CAC login
- Customizable layout
- Start/stop trials with click of a button
- Detail and summary panels for each device
- Map and device panels alert user to any device errors

Exhibit 7. OADMS GUI provides customizable layouts

Map Layers

- Available in real-time or in playback mode
- Provides layers such as aerial maps, sites, wind vectors, LIDAR scans, and much more
- Customize transparency for each layer
- Measure distances
- Add map markers to the test

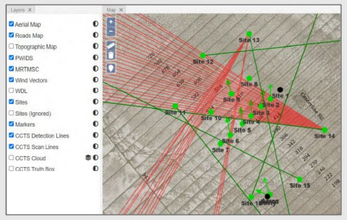

Exhibit 8. OADMS map layers allows user to select different layer components and set transparency levels

Expeditionary Capability

OADMS was architected such thattest data is stored on the Sidecar blade (gold d ata) and field server (silver data) located in the command post. Data is periodically pushed to a repository atthe West Desert Test Center data center for storage. The OADMS compact server system was designed to be one person-portable and fully housed within a ruggedized enclosure. Key components within the enclosure include the server, a firewall, redundant time servers, a switch, and a backup hard drive. Due to this architecture and the design focus on system portability, Test Grid operated with OADMS can be relocated for testing anywhere.

Exhibit 9. Test Grid can be relocated anywhere

Exhibit 10. Compact server system is singe-person portable

OADMS Interface

OADMS GUI

- Web based interface

Header

- Provides status updates of pre-defined tasking, user information, and connectivity status

Tests Page

- Provides access to test setup menu and previous tests

Test Control Center

- Interface control and playback of trials
- Provides adjustable panels to allow user to be able to customize and focus on data of most interest

Layers Panel

- Allows user to select layers to be displayed on the map

Map Panel

- Provides real-time visualization of all Test Grid and SUT (if applicable) device data using map layers.

Device List Panel

- Indicates device status by site location and ability to drill-down into specific devices from this panel

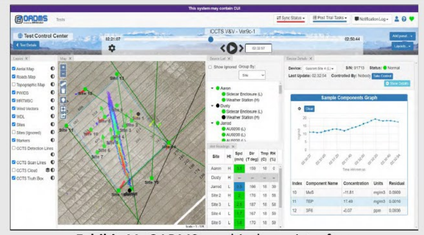

Exhibit 11. OADMS graphical user interface

Met Readings Panel

- Indicates real-time meteorological data from the field to better enable test decisions and understanding of simulant cloud transport dynamics

Device Details Panels

- Each individual device has its own panel that can be opened for examination of real-time data and status
- Provides information about device health and warnings
- Power to device can be toggled on/off from this panel

System Under Test (SUT) Integration

OADMS has integrated the traditional components of Test Grid, including numerous simulant dissemination challenge systems, meteorological instruments, and referee detectors. OADMS provides the capability to integrate SUT devices to allow real-time situational awareness as well as data capture and automatic time synchronization. SUT integration features include:

- SUT Data is isolated from referee data to prevent comingling concerns
- SUT integration can include only data logging or can be expanded to include user interface panels
- Customer-defined data fields can be logged and/or displayed within OADMS
- SUTs communicating via the Integrated Sensor Architecture (ISA) protocol have previously been integrated into OADMS
- OADMS team is available to help with the integration of SUTs

Exhibit 12. Template to assist with SUT integration

Acknowledgements

This work was funded by JPEO CBRND and was a collaborative effort between MRIGlobal, JPEO CBRND, and WDTC. In addition to the named authors, our team would also like to acknowledge Ms. Tam Dang at the JPEO CBRND for contractual and program management support, Bryce Simpson for software development activities, the test officer Eric Nelson at WDTC and the cybersecurity and network administration team at WDTC for their expert guidance and advice, Dr. Daniel Ondercin for invaluable subject matter expertise, Mr. Joseph Olah from the Analysis Center at the U.S. Army Combat Capabilities Development Command for his professionalism in leading the validation of the system, and Angelia Carter-Groft at SURVICE for facilitating knowledge exchange between the OADMS developers and acquisition leaders who will be using the system to test developing capability.

Contact Information

Dugway Proving Ground
Matthew McCarty
Data Sciences Division
T.435-831-5843
E. matthew.g.mccarty3.civ@army.mil
West Desert Test Center
5450 Doolittle Avenue
Dugway, UT 84022

MRIGlobal
Aaron Twombly
Lead System Architect
T.816-326-5539
E. atwombly@mriglobal.org
425 Dr. Martin Luther King Jr., Blvd
Kansas City, MO 64110