Modeling and Simulation to Support Virtual Chemical Hazard Environments

West Desert Test Center, Dugway Proving Ground

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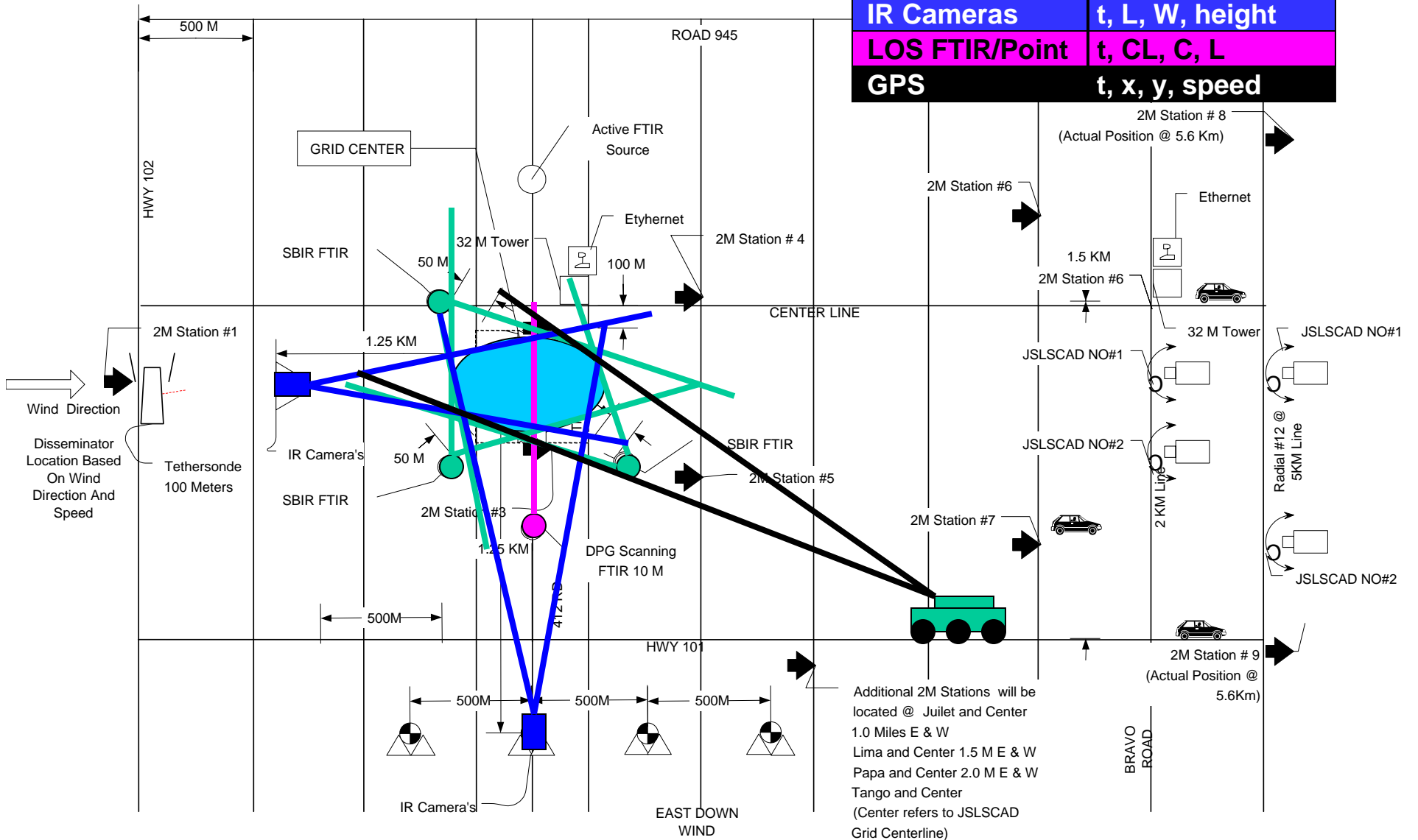
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West Desert Test Center (WDTC) Dugway Proving Ground (DPG)

- DoD focal point for test and evaluation (T&E) of chemical and biological (CB) defense equipment
- Testing is conducted with real chemical and biological agents in surety and biosafety level-3 laboratories
- Agent simulants are used in outdoor field testing
- WDTC is developing and acquiring models and simulations that provide digital representation of important test parameters and systems under test

Sensor Testing

Scanning FTIR	t, length, width, C
IR Cameras	t, L, W, height
LOS FTIR/Point	t, CL, C, L
GPS	t, x, y, speed

ROAD 945

500 M

HWY 102

GRID CENTER

Active FTIR Source

SBIR FTIR

50 M

32 M Tower

Etyhernet

100 M

2M Station # 4

2M Station #6

Ethernet

1.5 KM

2M Station #6

CENTER LINE

32 M Tower

JSLSCAD NO#1

2M Station #1

1.25 KM

Wind Direction

Disseminator Location Based On Wind Direction And Speed

Tethersonde 100 Meters

IR Camera's

50 M

SBIR FTIR

SBIR FTIR

JSLSCAD NO#1

JSLSCAD NO#2

JSLSCAD NO#1

Radial #12 @ 5KM Line

2 KM Line

2M Station #5

JSLSCAD NO#2

2M Station #7

2M Station #3

1.25 KM

DPG Scanning FTIR 10 M

HWY 101

2M Station # 8
(Actual Position @ 5.6 Km)

2M Station # 9
(Actual Position @ 5.6Km)

500M

500M

500M

500M

IR Camera's

EAST DOWN WIND

Additional 2M Stations will be located @ Juilet and Center 1.0 Miles E & W
Lima and Center 1.5 M E & W
Papa and Center 2.0 M E & W
Tango and Center
(Center refers to JSLSCAD Grid Centerline)

BRAVO ROAD

DPG M&S Tools

| Tool	Purpose
MÄK Data Logger	VCR-like application that **records and plays back** all network traffic
MÄK Stealth	**3-D visualization** application with 3-D entity model support
MÄK Plan View Display (PVD)	**2-D visualization** of the battlefield terrain along with icons representing each entity
Role Player Workstation (RPWS)	Displays **situational awareness** data (Force XXI Battle Command Brigade and Below (FBCB2)) and chemical hazard detection alarms
OneSAF Testbed Baseline (OTB)	**2-D battlefield representation** that allows for scenario generation and battlefield situational development
Player	Provides the ability to **playback** entities, static entities, hazard boxes, hazard puffs, **CB detonations**, and **CB tactical messages**
Dial-A-Sensor (CB DAS)	**Simulation tool** used to represent any general class of CB sensors
Nuclear, Chemical, Biological, and Radiological Environment Server (NCBR)	Physics based environment server used for **hazard propagation**
Live Vehicle Interface (LVI)	Reads **vehicle speed and GPS location** and translocates position onto desired terrain
Ocean, Atmospheric, and Space Environment Server (OASES)	Simulation for creating a 3-D, time-varying, digital representation of the natural **atmospheric environment**
4-Dimensional Weather System (4DWX)	Globally relocatable mesoscale **weather model** with high-resolution forecast capability
CB Analyzer	Performs **"what if" analyses** of stationary and mobile CB sensors
Exposure Toxicity Server (ETS)	Tracks the **CB exposures** of each entity

Post-Test Data Analysis

- CB Analyzer is a graphical post-test data analysis tool developed to provide:
  - Concentration
  - Target Location (azimuth, elevation)
  - Ranging (distance to hazard)

Analyzer Data Plots		
Ordinate	*Abscissa*	*Description*
Max CL	Time	Max detected CL values
Azimuth	Time	Azimuth angles for max CL values
Elevation	Time	Elevation angles for max CL values
Azimuth	Time	Max/min azimuth angles that hit the hazard
Elevation	Time	Max/min elevation angles that hit the hazard
Distance	Time	Measured distance through the hazard
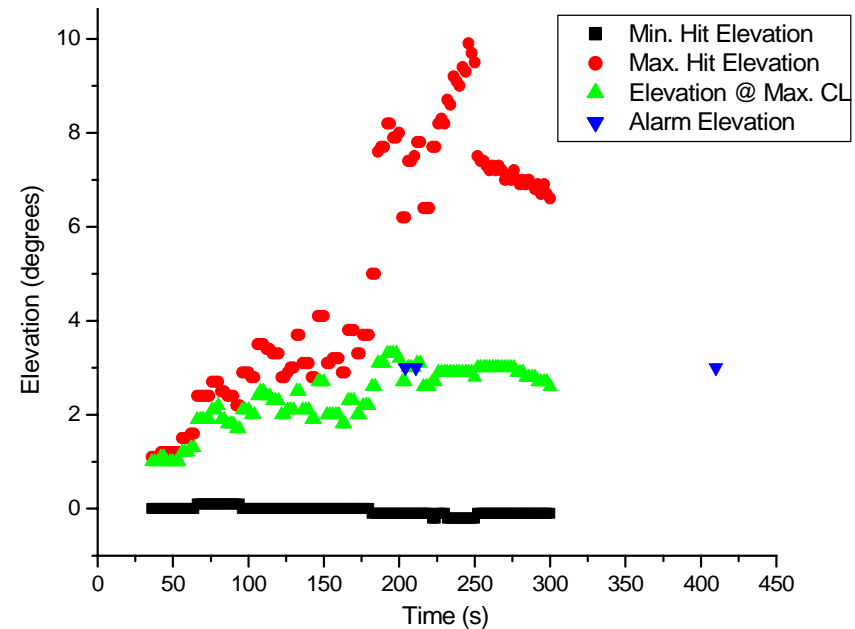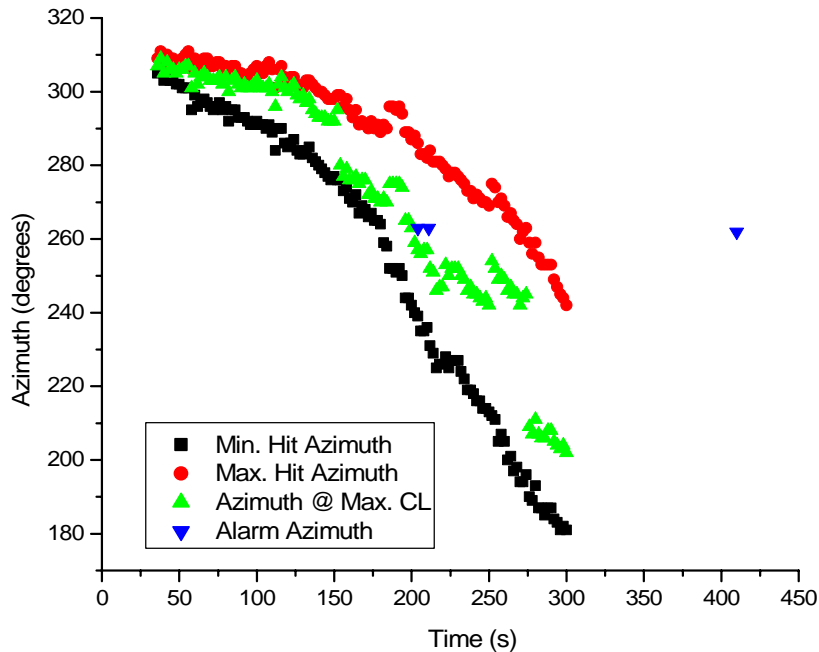
Test Data Visualization
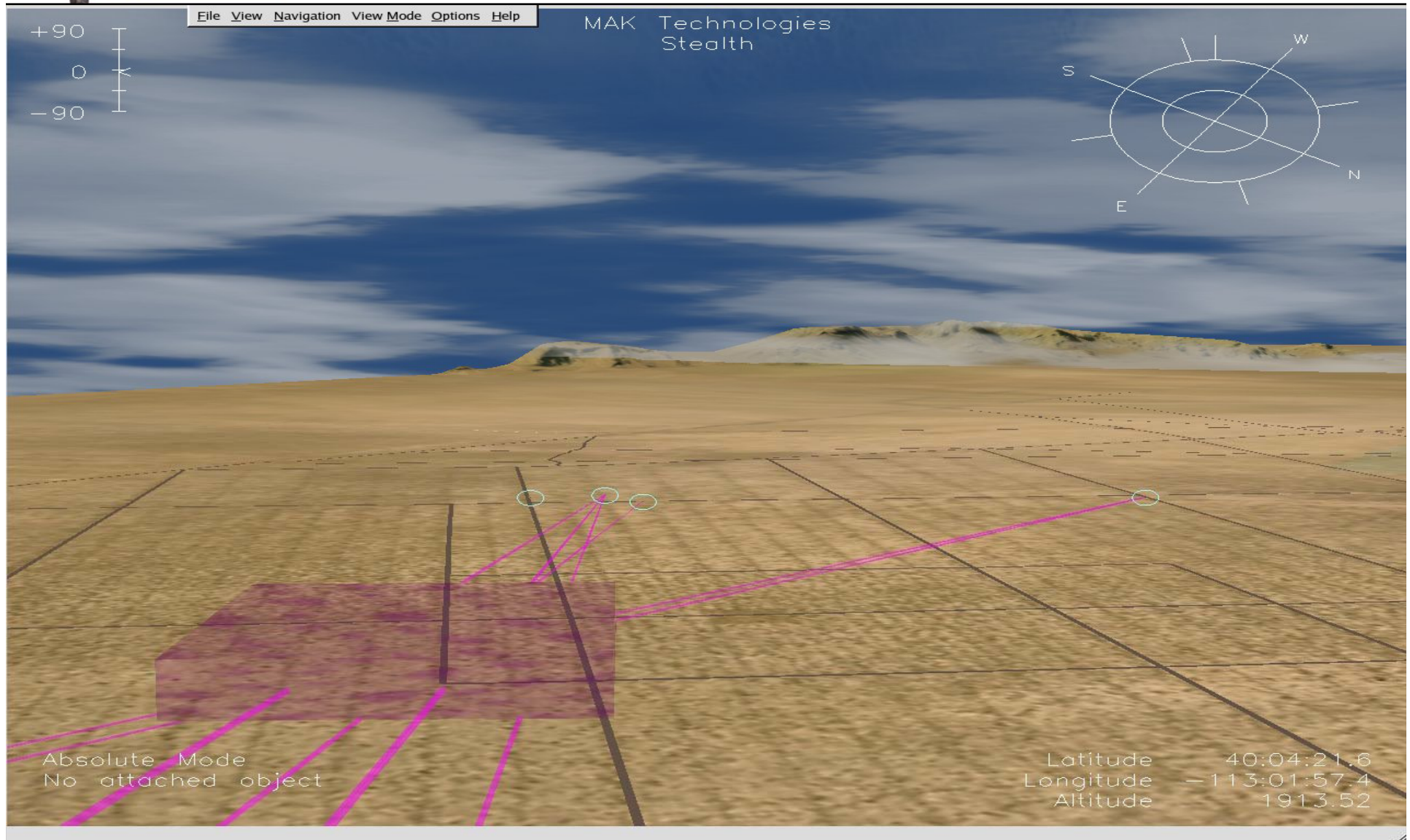
Distributed Test Event 5

- Dugway personnel recently participated in Distributed Test Event 5 (DTE 5)
  - Multi-Service Distributed Environment (MSDE)
    - Army, Navy, Air Force
  - Cross Command Collaborative Effort (3CE)
    - Army Test and Evaluation Command (ATEC)
    - Training and Doctrine Command (TRADOC)
    - Research, Development, and Engineering Command (RDECOM)

- Both DTE 5 events were conducted in a classified (*Secret*) environment
- Use live, virtual, and constructive assets in a mock battle scenario
- Conducted on Southwest Asia terrain
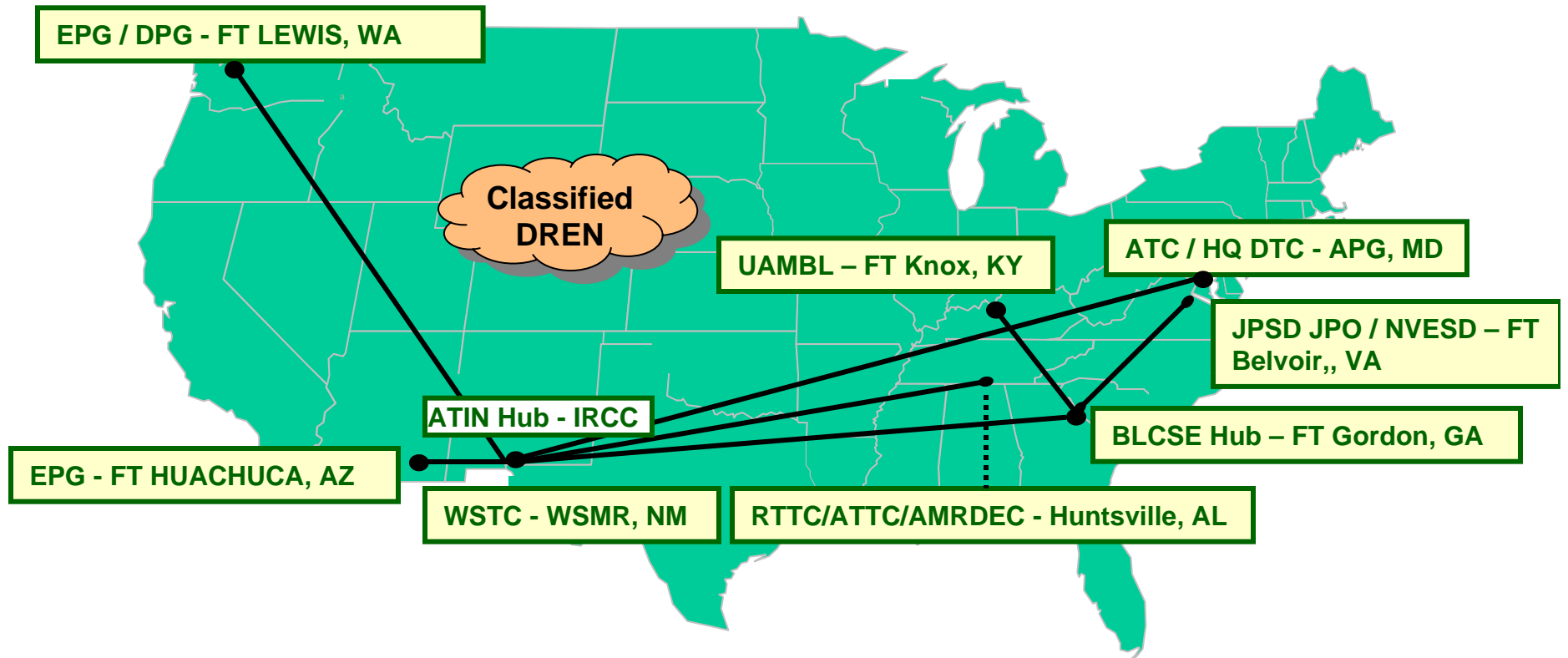- Goal to mirror Future Combat Systems (FCS) Experiment 1.1

DTE 5: MSDE Participants

AIR FORCE - DMOC

DMOC - Kirtland AFB, NM

SIMAF – Wright-Patterson AFB, OH

46thTW – Eglin AFB, FL

19 SOS - Hurlburt Field, FL

CAOC-X – Langley AFB, VA

CEIF – Hanscom AFB, MA

AFAMS-CVC – Pentagon

SWC – Los Angeles AFB, CA

SWC – Schriver AFB, CO

JITC – Joint

DMOC - AF

IRCC - Army

DREN Full Mesh

NSWC Navy

ARMY - IRCC

WSTC - WSMR, NM

ATC / DTC - APG, MD

EPG / DPG - FT LEWIS, WA

EPG - FT HUACHUCA, AZ

RTTC/AMRDEC - Huntsville, AL

JPSD JPO / NVESD – FT Belvoir,, VA

NAVY - NSWC Dahlgren

NSWC – Dahlgren, VA

NAWCAD – Patuxent River, MD

SPAWAR – San Diego, CA

NAWCWD – China Lake, CA

DTE 5: Army 3CE Participants

EPG / DPG - FT LEWIS, WA

Classified DREN

UAMBL – FT Knox, KY

ATC / HQ DTC - APG, MD

JPSD JPO / NVESD – FT Belvoir,, VA

ATIN Hub - IRCC

BLCSE Hub – FT Gordon, GA

EPG - FT HUACHUCA, AZ

WSTC - WSMR, NM

RTTC/ATTC/AMRDEC - Huntsville, AL

DTE 5 by the Numbers

Statistic	3CE	MSDE
1. Duration of scenario:	120 minutes	150 minutes
2. Tactical Missions:	FCS Exp 1.1	JSEAD, JAEA, JFIRES, JCAS, JCSAR
3. Number of sites participating / networked:	13 / 8	USA = 11 / 6, USN = 4, USAF = 8
4. Number of different time zones for sites:	5 times zones	5 time zones
5. Number of entities:	600	650
6. Number of simulations and tools:	49 different simulations, multiple instances	61 different simulations, multiple instances
7. Number of warfighters / threat players:	RTTC = 33, ATC = 16, UAMBL = 6	USA = 49, USAF = 12 , USN = 8
8. Number of integration events (spirals)	10	10
9. Network Bandwidth Utilization:	Never more than 25%	Never more than 25%
10. Command / Service Site Accreditation:	RDECOM = FEB – JUL TRADOC = Already Est. ATEC = FEB – MAY	USN = FEB – JUL USA = FEB – JUL USAF = Already Est.
11. Tasks in Time Ordered Events List:	2416	3473

Dugway Roles in Distributed Testing

- Provide simulated chemical agent release
- Provide weather
- Provide agent propagation model
  - Subject to weather, terrain
- Provide agent exposure monitoring
  - Who was exposed? When? How much? Status?
- Provide virtual chemical agent sensors
  - 3 Joint Services Lightweight Standoff Chemical Agent Sensors (JSLSCAD)
  - 3 ground deposition sensors

Stealth – Visualization Tool
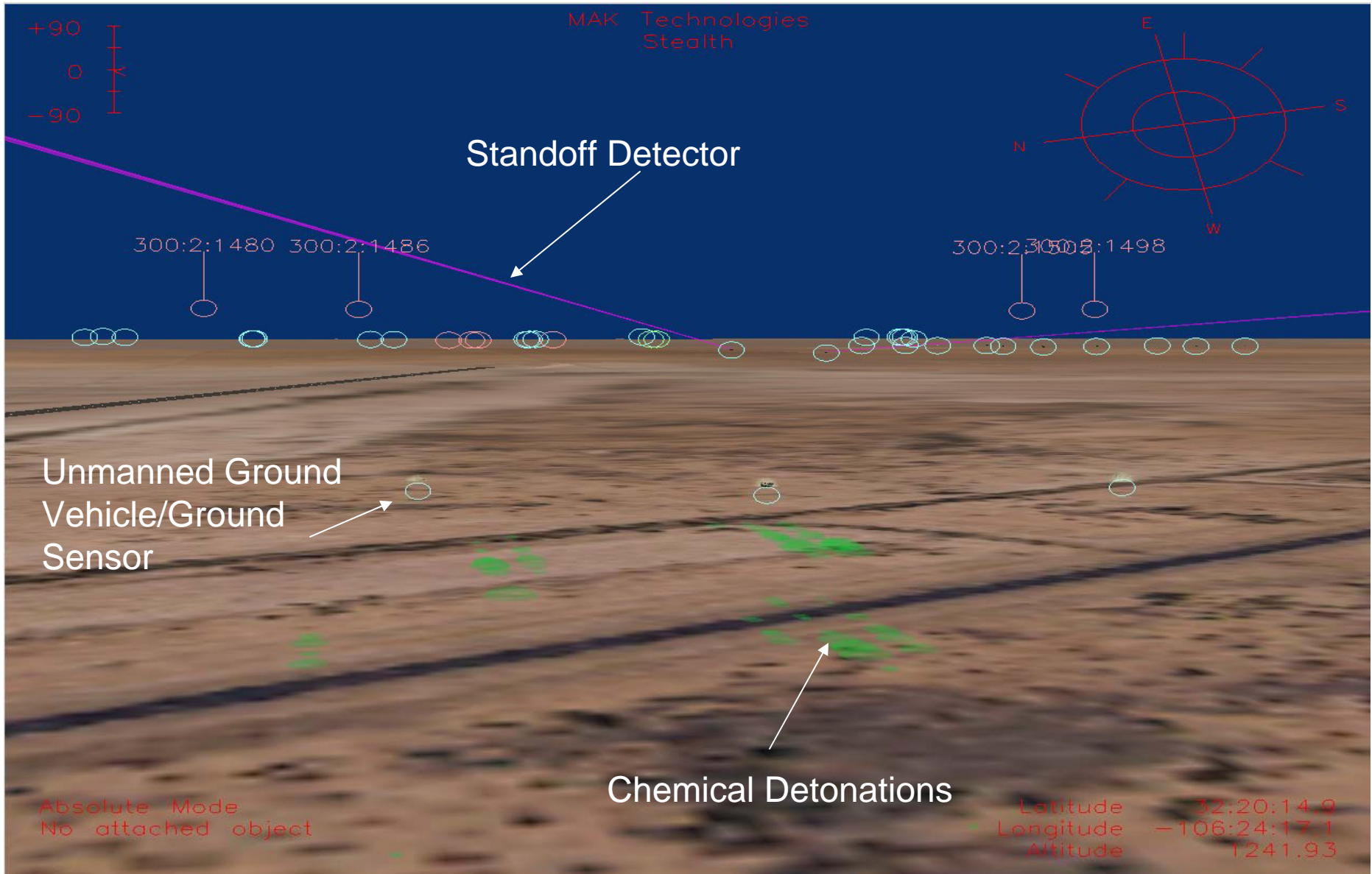
OTB – Visualization and Planning

PVD – Visualization and Information
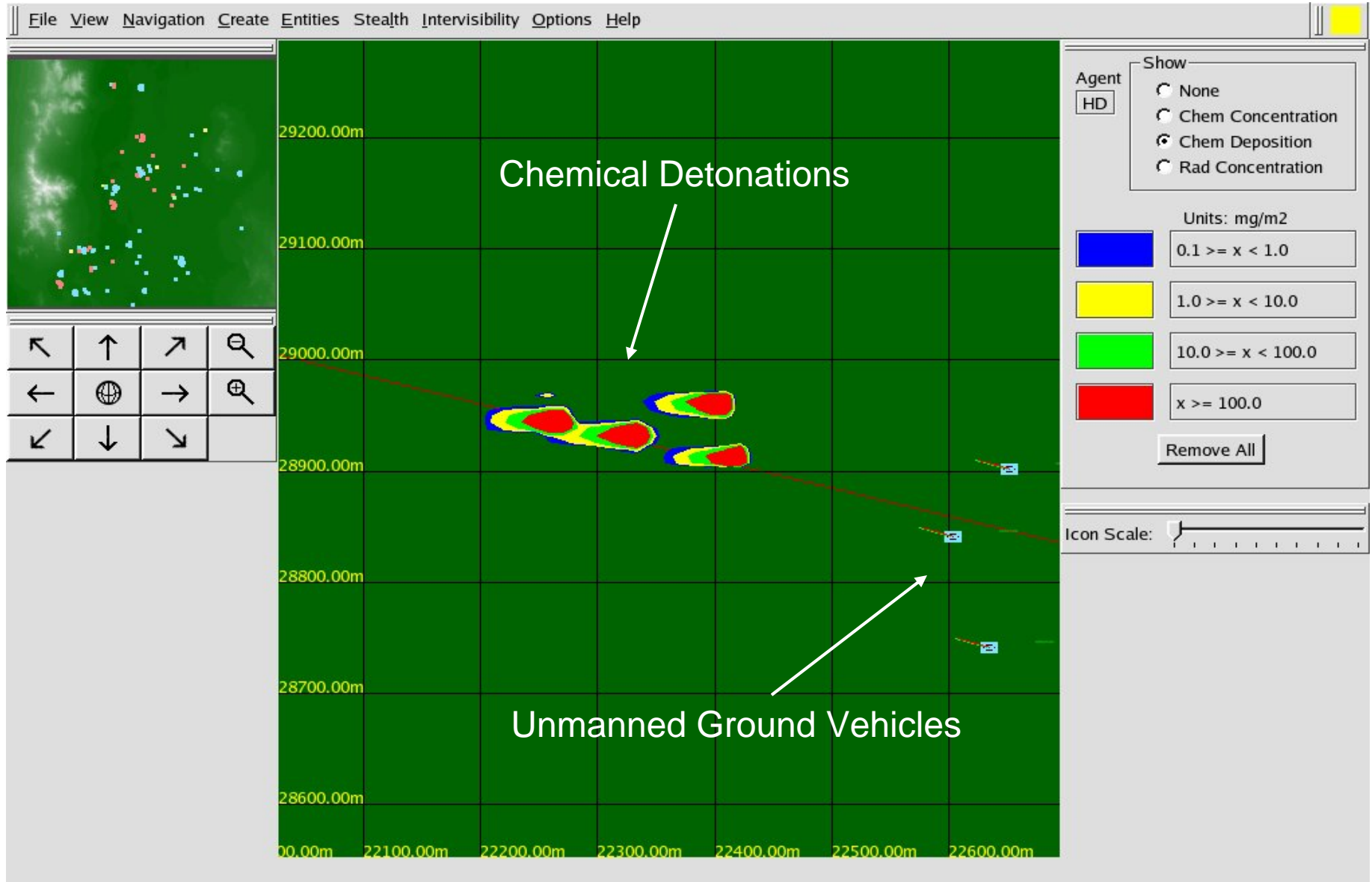
RPWS—Situational Awareness
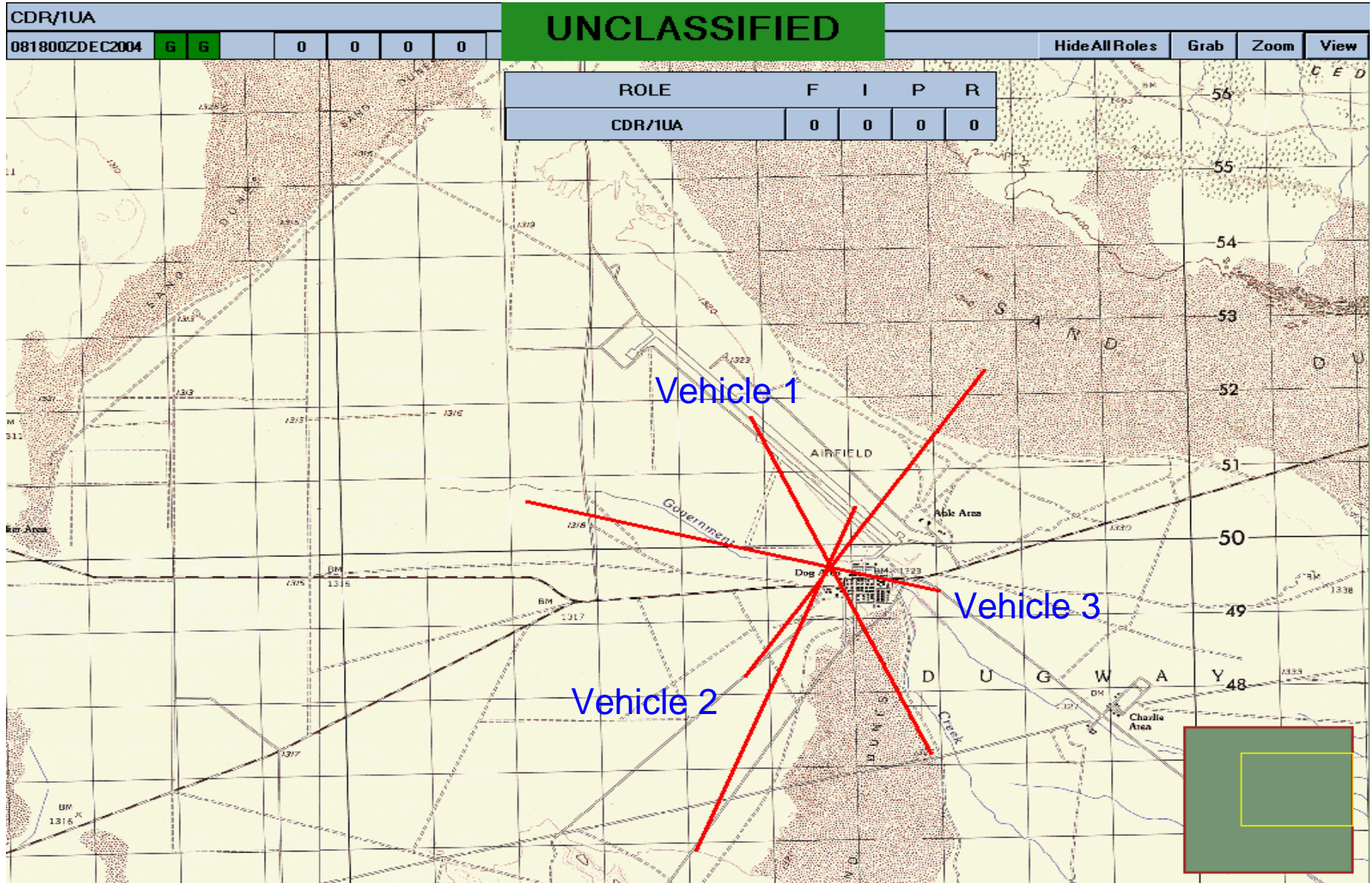
Future M&S Plans at Dugway

- Continue use of tools for post test data analysis
- Support classified testing
- Support future distributed test events
- Distribute live DPG test data to customers/others
- Begin development of live (real-time) test data analysis
  - Stream live field data into Distributed Test Control Center (DTCC)
  - Fusion of sensor data
- Begin development of overarching protection models
  - Individual, Collective
- Provide test support for Joint Warning and Reporting Network (JWARN)