Unmanned Ground Vehicles/Systems Joint Project Office

Robotic Acquisition through Virtual Environments and Networked Simulations

RAVENS

Joint Robotics Program SMART Implementation

RAVENS

RAVENS: Geographically distributed Soldier/Marine in-the-loop, Hardware in-the-loop, Software in-the-loop virtual & live analysis, test, & experiment architecture

- **Assist Users in Requirements Development Efforts**
- **Assist the S&T community in Developing & Evaluating Technologies**
- **Assist in Risk Reduction Efforts**
- **Assist in Developmental and Operational Tests**

Vision - Applying SBA/SMART principles to minimize cost, speed development, reduce risk, & ensure that Soldiers and Marines remain at the center of all system development efforts

Background

RAVENS

- JRP Asset to Assist in Developing & Fielding Ground Robotic Systems -

VPG

- Distributed Tests
- Leverages Test Center Capabilities

RDECS / FED LABS

- Assist in Technology Development & Evaluation
- Supports Technology Transfer Process

USER SITES

- Concept Evaluation
- Requirements Development
- Continuous Involvement in UGV Development Efforts

RAVENS provides full life cycle support for the acquisition of Robotics Systems

Purpose

Purpose: Support tests, analyses, and experiments to assist in UGV:

- **Requirements Development**
- **Risk Reduction**
- **Technology Development & Evaluation**

Soldiers & Marines

RAVENS Applications	• Concept Development • Requirements Analyses	• Technology Assessment • Risk Reduction • Limited Developmental Tests	• Developmental Tests • Risk Reduction • Limited Operational Test
UGV Representation	90% Virtual 10% Live	50% Virtual 50% Live	10% Virtual 90% Live

Fielded System

Time

Vision - Applying SBA/SMART principles to minimize cost, speed development, reduce risk, & ensure that Soldiers and Marines remain at the center of all system development efforts

Applications

- **Assist Users in Requirements Development Activities**
  - **Concept Exploration**
  - **"How to Fight" Experiments/Analyses**
  - **Examine technologies in operationally valid scenarios**
  - **Requirements Analyses**

- **Assist S&T Community in Technology Assessments & Development Efforts**
  - **Examine subsystems/components (HW/SW in-the-loop)**
  - **Work with Users to establish scenarios/concepts of employment**

- **Support Developmental Tests & Joint Developmental & Operational Testing**
  - **Hardware/Software in-the-loop**
  - **Develop OT scenarios & system concepts of employment**

- **Introduce Hardware/Software Early in the Development Process & Examine in User Environments**

Participants

Maneuver Support Center
- Chemical
- MP
- Engineer

Armor Center
- MMBL

Infantry Center
- DBBL
UGV Driving Stations

USMC
- MCCDC
- Warfighting Lab

Additional UGV Proponents

AMCOM RDEC
APEX Facility
UGV Virtual Driving Station

Dugway Proving Ground
- Chem/Bio Sensors -

Electronic Proving Ground
- Datalink -

RTTC, RSA
- HWIL RSTA FLIR -

TACOM
- Mobility -

Aberdeen Proving Ground
- Data Monitoring -

Sandia National Lab
- Manipulator Arm -

CECOM
- Sensors -

AFRL
- Manipulator Arm -

Additional test & analysis centers

- CY 00 Build
- CY 01 Build
- CY 02+ Build

Follow an Open Systems & User Centered Approach to Best Accommodate Future Proponents & RAVENS Technical Capabilities

RAVENS Proof-of-Principle
- FY 00 Architecture -

• Nuclear/ Chemical/ Biological/Radiation Simulation
• Chemical Stand-off Detection System Simulation

Dugway, UT
DPG

Ft. Knox, KY
MWTB

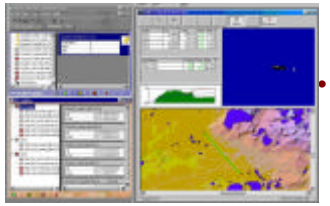
Ft. Leonard Wood, MO
MANSCEN

• Propagation Path Loss Simulation
(Radio Link from OCU to XUV)

Ft. Huachuca, AZ
EPG

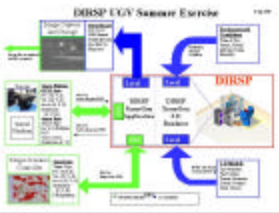
Distributed Connectivity

Operational Scenarios
MOUT – MPRS (RSTA)
Defense – XUV (Chem/Bio Detection)
Defense – XUV (antiarmor – Javelin)



• Event and Data Monitor

Aberdeen, MD
ATC / ARL



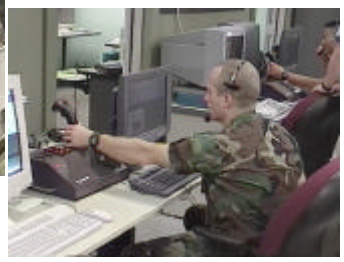
•SARGE FLIR Stimulated by Dynamic Infrared Scene Projector (DIRSP)

Huntsville, AL
RTTC

Redstone Arsenal, AL
APEX / RDEC

• Exercise Architecture Development & Control

• OCU Simulation



RAVENS
- FY01 Path Forward -

User Participation

Establish User nodes to support stand-alone and distributed analyses

- **USAIC (DCD/DBBL)**
- **MANSCEN**

S&T/RDEC Participation

Expand, via the RDEC Federation, to better capture individual RDEC capabilities and reduce potential redundancy

- **CECOM**
- **TACOM**
- **Sandia National Lab**

RAVENS Users Group Meeting (24 & 25 Jan)

- **Participants**
- **Objectives**
- **Schedule**
- **Technical Path Forward**

Experiment 2

Purpose:

- Assist in COUGAR architecture development
- Provide force-on-force data to show operational effectiveness
- Assist in defining FY02 architecture

DBBL

TUV VP

EPG

TUV OCU (Teleoperated) AMRDEC VP

AMRDEC VP

MMBL

XUV VP

EPG

XUV OCU

T72

M1A2

AMRDEC Simulation Elements

Combat ID

Chemical Agent Dispersion & Detection DPG

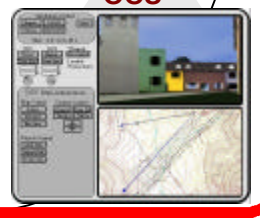
AMRDEC (Generic UAV) Target Spotter

COUGAR Employment

EPG

AMRDEC VP
AMRDEC MSL Model
CECOM Sensor

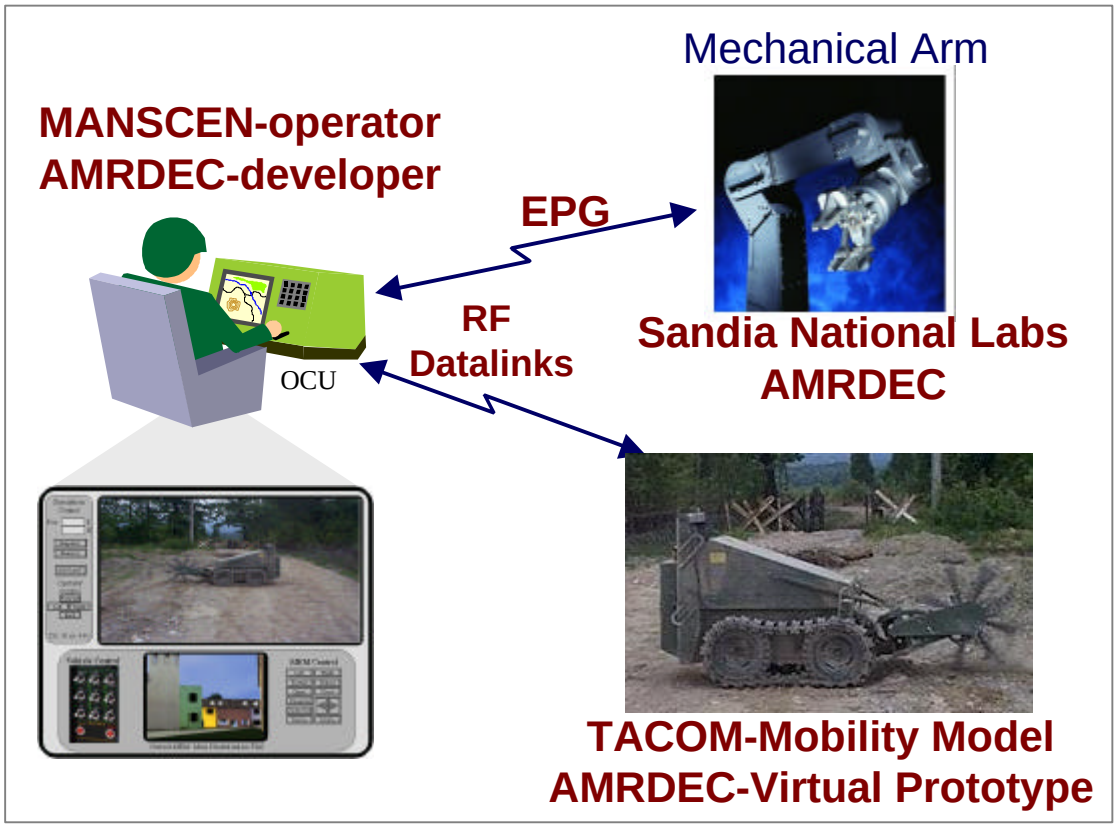
Reconfigurable OCU



Experiment 2:
COUGAR, TUV, and XUV

- RSTA Sensor functions
- Lethal UGV
- Chemical Detection UGV

Experiment 1



RCSS Program Support & Manipulator Arm Development

Objective: Establish and apply a combined simulated and live test and analysis environment to assist the RCSS Program & Manipulator Arm Development.

- Requirements Analyses
- Developmental and Operational Tests
- System, subsystem, and component risk reduction

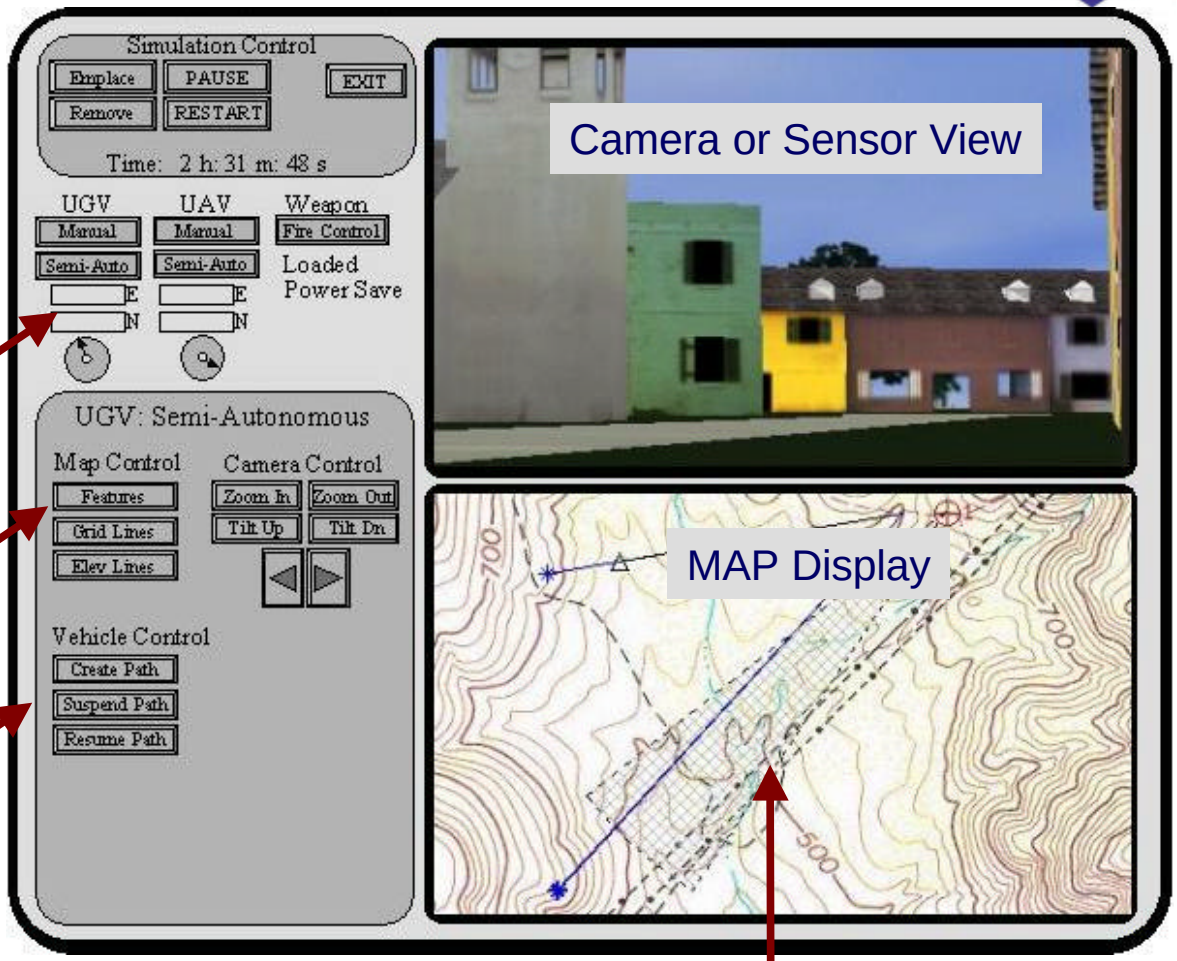
Reconfigurable OCU

Features:
- UGV Control
- UAV Control
- Weapon/Payload Control
- Rapid Reconfigurable

Control Menu allows user to choose UGV, UAV, or Weapon Control

Supports Teleoperation, Semi & Fully Autonomous Simulation

Options change depending on the platform chosen in the Control Menu above



Map Functions:
- Waypoint Navigation Planning
- Vehicle Position
- Target Tracking
- Line of Sight

Generic Simulation Interface to enable Rapid Prototyping

Products & Benefits

- Establish User sites to support requirements/COE development efforts
- Refine datalink models to support HWIL testing & realistic User experiment
- Extend COUGAR experiment by providing robust force-on-force analysis results
- Support SNL manipulator arm development efforts by providing near-continuous user involvement/experimentation
- Develop RCSS framework to support DT and concept of employment development

Summary

RAVENS tools and architecture, when coupled with traditional analyses and experiments, can assist:

- Users to develop requirements & concepts of employment

- Users to experiment with hardware and software components without developing costly surrogate systems

- S&T community to better develop components and subsystems by including warfighters and their operational environment

- Test community can remain involved with both the UGV/S JPO and users throughout each program's life cycle