U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND – ARMY RESEARCH LABORATORY

Experimentation at ARL-Distributed Virtual Proving Ground (DVPG)

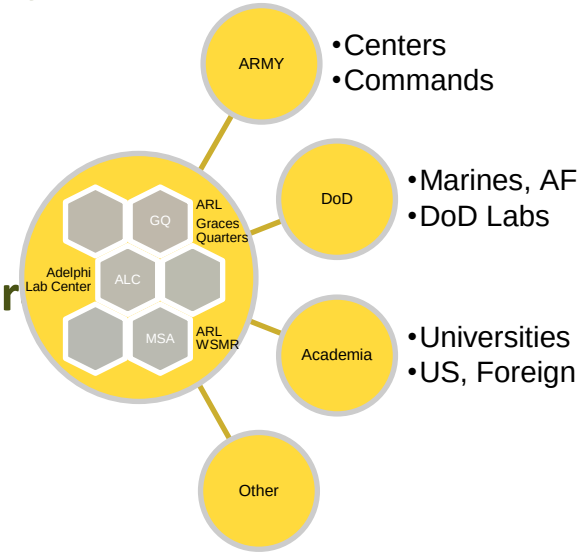
Jade Freeman, Ph.D. Niranjan Suri, Ph.D.

Information Sciences Division

Computational and Information Sciences Directorate

ARL-DISTRIBUTED VIRTUAL PROVING GROUND (DVPG)

- **Decentralized, collaboratively owned, and geographically distributed network**
  - Distributed modeling and simulation
  - Accelerated converged experimental innovation
  - Datasets and an environments where basic research can be explored and evaluated
- **Brings experiments closer within collaborative resear**
- **Component infrastructure to leverage/share/amplify capabilities**
- **External collaborators run experiment on their networks, and provides access to DoD collaborators**
  - Accelerates interactions with innovations
  - Reduces time, costs, and risks associated with network, materials, and labor
- **ARL controlled and addressed security concerns**
  - Core testbeds within the Army control
  - 6.1/6.2 content (outside of PII, ITAR, Financial) is not CUI -- CUI limits foreign national access



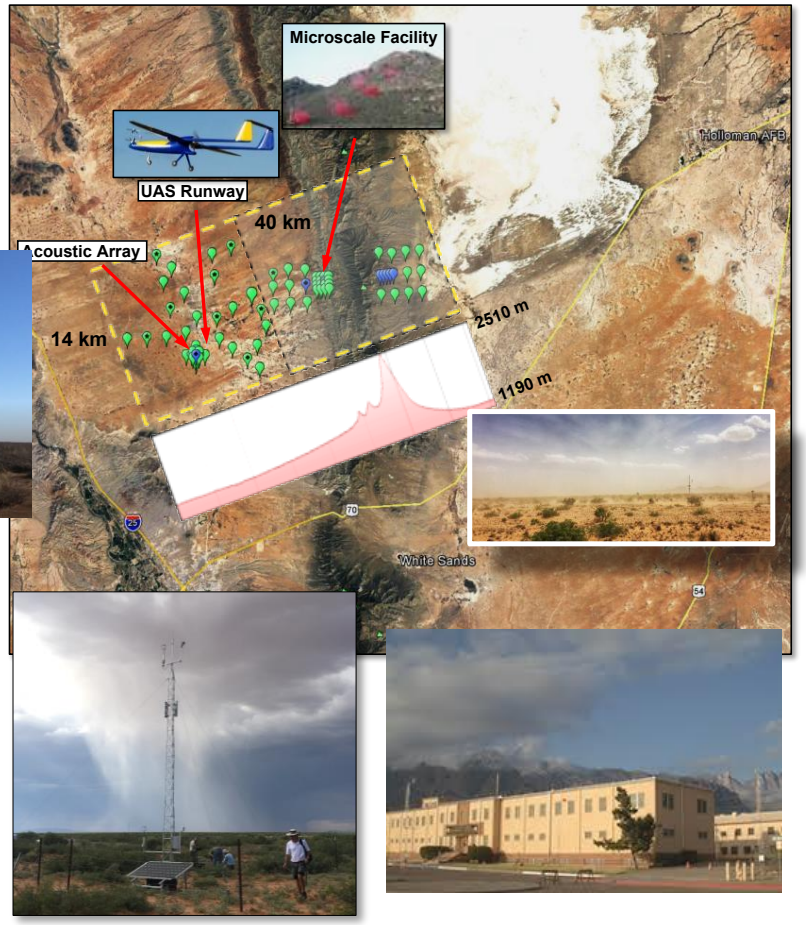
ARL-DVPG FEATURE OVERVIEW

- **Physically Distributed – Leverages Existing Facilities Nationwide**
  - Core ARL Labs at WSMR (NM), ALC (MD), APG (MD)
  - Include collaborator's testbed facilities
- **Complex synthetic environments with sensors and information infrastructure to support live and simulation-based testing of the Army's future systems**
  - Integrated information systems, hardware, Algorithms, Data, Tools, Actors
  - Continuous data collection and Recording
  - Playback and Data Set Creation
  - Ground truth data contained at each test center, access to external data sources
- **Connect heterogeneous sensing and actuation capabilities that achieves scale in spatial diversity and heterogenous capabilities**
- **Represents all conditions in which the Army may operate**
  - Urban/Suburban Warfare
  - Natural environmental effect
    - Desert, Forest, Grassland

MULTI-PURPOSE SENSING AREA (MSA)

Location: WSMR, NM

Fully-instrumented capability to execute collective sensing experimentation and evaluation, with mobility and spectrum effects



ARL's Multi-Purpose Sensing Area (MSA)

- ARL shared-owned facility
- Low security concerns
- Natural characteristics for contested austere environment and MDO Effect Loop evaluation

Fifty-One towers with heterogeneous sensors

Video Cameras, Passive IR, Visual, RF, Atmospheric Sensors (Temp, Humidity, Light) Vibration / Movement Sensors (Accelerometer)

GPS Sensor (for moving entities)

Integration with Joint C2 systems

- Connects to containerized/virtualized C2 systems with firewalled access
- Provides immersive & 2D COP visualizations

ALC CAMPUS SENSOR NETWORK (CSN)

Location: Adelphi, MD

Dynamic heterogenous sensors, network infrastructure on laboratory campus

ARL sensor network infrastructure

- Developed and maintained ARL/ALC
- Originally developed for data exploitation for ARL researchers
- Provide robust and validated research in lab/field test setting
- Real-time sensor data stream acquisition and control

Twenty-Nine sensor assets and more to come

- Ground sensors fully instrumented for movement detection and longitudinal data collection
- Environmental sensing
- Rooftop cameras
- Other sensor capabilities mirroring MSA

Integration with Joint C2 systems

- Connects to containerized/virtualized C2 systems
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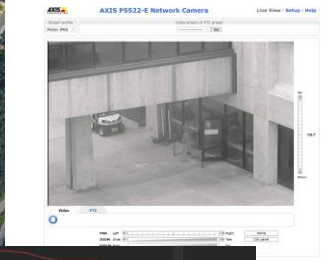
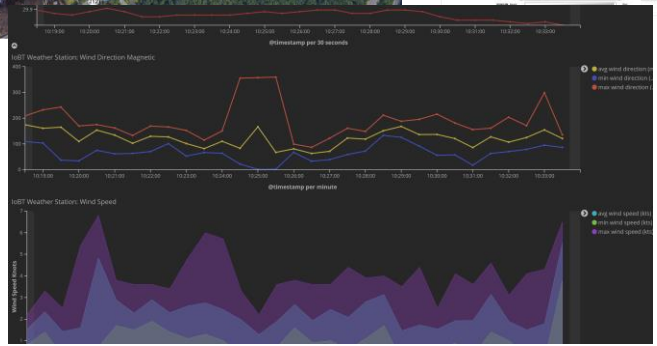




ROBOTIC RESEARCH COLLABORATION CAMPUS

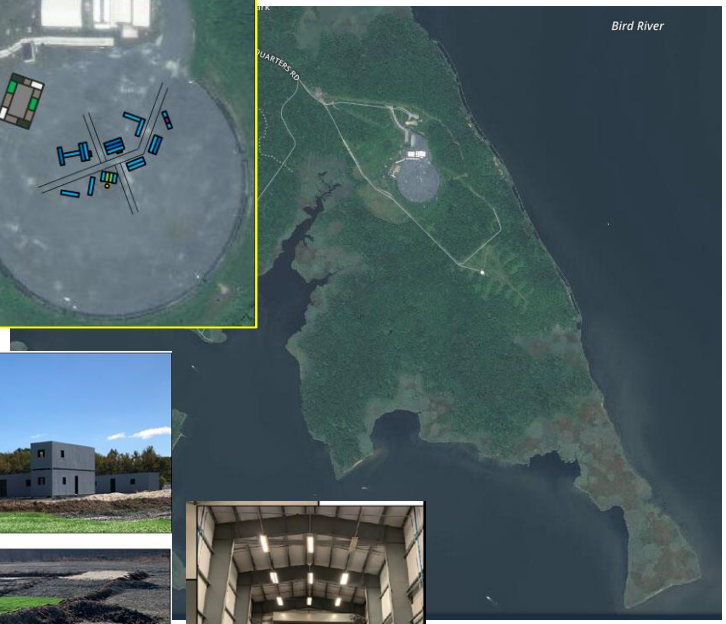
Location: Graces Quarters, MD

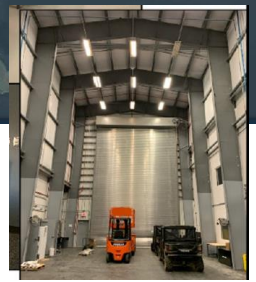
CHALLENGING AND COMPLEX SITUATED EXPERIMENTATION FOR ARL AUTONOMOUS SYSTEMS ENTERPRISE with IoBT Sensing capabilities

Current High Profile DoD Collaboration Projects

- AIMM – Artificial Intelligence for Maneuver and Mobility
- VICTOR - Versatile Tactical Power and Propulsion
- EOT – Emerging Overmatch Technologies
- HAT – Human Autonomy Teaming
- DCIST - Distributed and Collaborative Intelligent Systems and Technology
- SARA – Scalable, Adaptive and Resilient Autonomy
- A2I2 Cooperative Agreements

Integration and engineering support for research-driven development of air and ground platforms





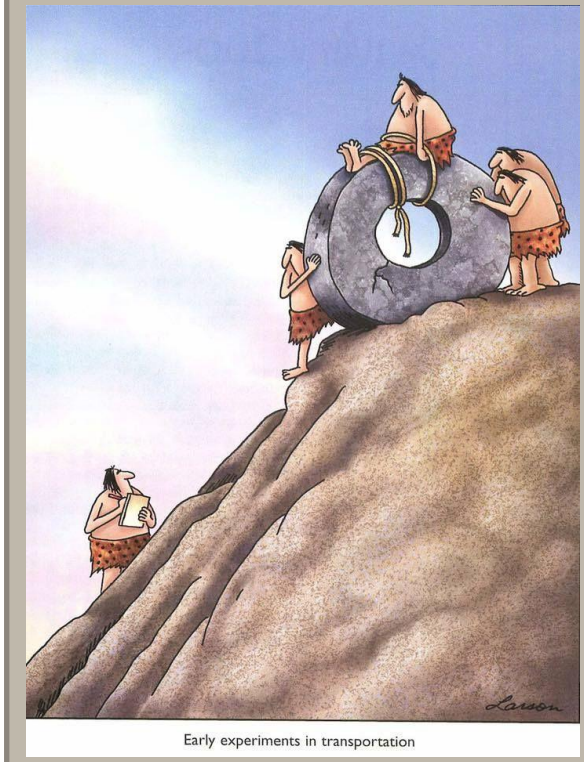
PURPOSE OF ARL-DVPG

- **Large scale basic research experimentations by Virtual integration of new and existing experimentation facilities across collaborating institutions deployed in cooperation with other Army / DoD / US Government Agencies**

- **Allows for validation, rejection, refinement, and abandonment of concepts and hypotheses in the early course of 6.1/6.2 research *safely* within a "would be real-world" environment**

Failing Fast Approach
Failing fast**,** for the right reasons, supports the development of the right concepts.

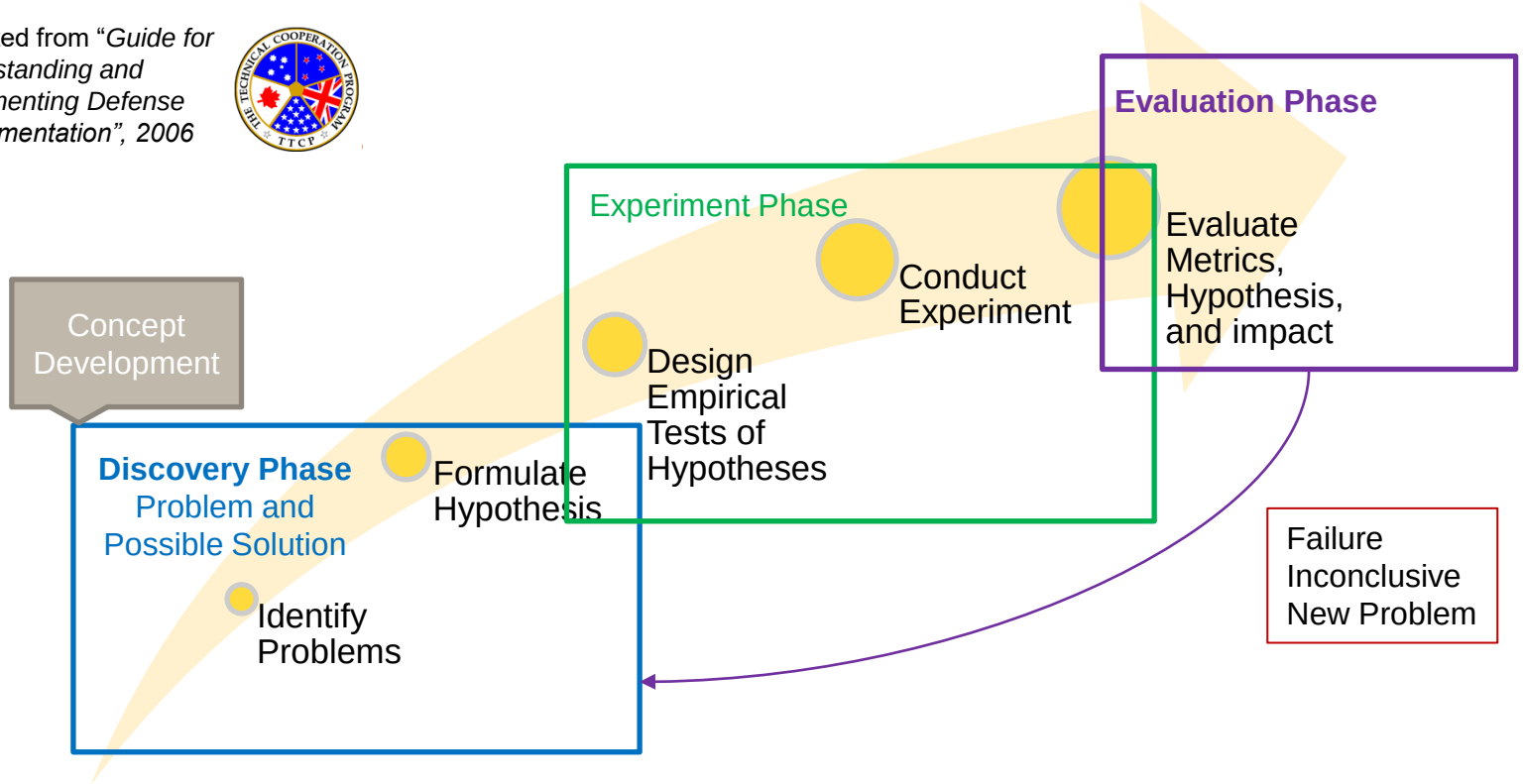
- *NATO CD&E Handbook, 2021*



From *The Far Side, (Gary Larson) 1984*

RESEARCH CONCEPT DEVELOPMENT & EXPERIMENT PROCESS

*Adopted from "*Guide for Understanding and Implementing Defense Experimentation", 2006*



FOUNDATIONAL RESEARCH AND EXPERIMENTATION AT SCALE

Large-scale repeatable experiments accelerates

- Basic and applied research towards incremental scientific advancement
  - – Collaborative discovery and converging capabilities
  - – Robust validations
- Path to transition of future capabilities

Basic Research

Applied Research

Advanced Technology

Transition