GMU C^{4}I Center

Dr. J. Mark Pullen, Director

Center of Excellence in Command, Control, Communications, Computing and Intelligence

mpullen@c4i.gmu.edu

http://c4i.gmu.edu

C4I Center Mission

- Perform advanced research in military-related Information Technology
  - Be recognized as premier source of knowledge and innovation
  - Provide advice and assistance to military and civil authorities
- Serve as a bridge between military requirements and faculty who possess relevant expertise

C4I Center Focus Areas

Broad spectrum of research and education across:

- Sensing and Fusion
- Command Support
- Communications and Signal Processing
- Information System Architectures
- Modeling and Simulation
- Distributed Education and Training

Recent Sponsors

- Defense Advanced Research Projects Agency (DARPA)
- Defense Information Systems Agency (DISA)
- Defense Intelligence Information Enterprise (DI2E)
- Defense Threat Reduction Agency (DTRA)
- Intelligence Advanced Projects Agency (IARPA)
- Joint IED Defeat Organization (JIEDDO)
- Lockheed-Martin Corp. (LMCO)
- Office of Naval Research (ONR)
- Raytheon
- Saab Corporation (Sweden)
- US Air Force ISR Innovations Directorate
- US Army Engineer R&D Center (ERDC)
- US Army Night Vision Laboratory
- US Army SIMCI (PM-Battle Command and PM-Simulation)
- US Joint Forces Command J7 and J9 (JFCOM)
- USMC PM Intel (under subcontract to ManTech)

Current Major Projects

- SciCast
  - Science & technology forecasting by crowdsourced combinatorial prediction market
- Battle Management Language (BML)
  - Command & Control – Simulation Interoperation
  - Joint, Coalition (NATO), Geospatial, Multi Agency
- DI2E Framework Academic Plugfesting
  - Rapid integration with heavy user involvement aimed at new paradigm for large intelligence software development
- International C2 Research Simulation Testbed
  - Industry-supported laboratory with international impact

Partnerships

- Many projects performed cooperatively with other organizations, e.g.:
  - Industry/academic teams, either as the lead or as a member
  - Industry, as a subcontractor
  - Other universities, in academic studies
  - Other units of GMU, particularly other Centers
  - Government organizations and FFRDCs, in policy or technology studies
- Currently have eleven Industry Partners
  - Large and small

George Mason University

- Enrollment is 33,000, with students studying in 198 degree programs at the undergraduate, master's, doctoral and professional levels.
- Mason is distributed across three campuses – Fairfax, Arlington and Prince William counties.

- In 2012, U.S. News & World Report named Mason the number one university to watch on its Up and Coming School list.
- The Times of London named Mason among the Top 100 Under 50, which identified the top 100 universities in the world that are under 50 years old.

Volgenau School of Engineering

- Founded in 1985
  (as School of Information Technology and Engineering)
- First PhD in Information Technology in the USA
- Also, only civil institution with a C4I Center

Volgenau School of Engineering

- Departments (with affiliated centers)
  - Applied Information Technology (Center for Secure Info Systems)
  - Bioengineering
  - Computer Science (Learning Agents Center)
  - Electrical & Computer Engineering
  - Engineering Statistics
  - Infrastructural & Civil Engineering
  - Systems Engineering & Operations Research (Air Traffic Systems)
- Center of Excellence in Command, Control, Communications, Computing & Intelligence
- PhD in Information Technology
  - Multidisciplinary; well suited to C4I research
  - Volgenau School also offers PhD in Computer Science, Electrical and Computer Engineering, System Engineering and Operations Research

Volgenau School of Engineering
as of Fall 2013

- Faculty
  - 105 Tenured or Tenure Track
  - 56 Term, Instructional, and Research
- Students
  - 2,986 undergraduate
  - 1,795 graduate
- Degrees
  - 8 undergraduate and 21 graduate
  - Alumni: 15,997 – 85% live in DC Metro Area
- No. 28th in the US in MS degrees awarded and graduate enrollments (rankings from ASEE)
- SEOR Dept ranked 28 in USA; CS Dept ranked 53

Relationships Within Volgenau School and GMU

- The C4I Center's activities cut across all elements of the Volgenau School of Engineering in synergistic relationships
  - benefits from expertise of Departments
  - provides value to them by bringing in external resources to support projects.
- The Center is affiliated with other VSE activities
  - System Architectures Laboratory
  - Evolutionary Computation Laboratory
  - Center for Secure Information Systems
  - Center for Distributed and Intelligent Computation
  - Learning Agents Center
  - Sensor Fusion Laboratory
- And with the GMU Department of Geography and GeoInformation Science (GGS)

Academic Activities

- The Center is associated with the C4I Specialization of the MS in Systems Engineering
  - looking for growth and additional breadth in this program
  - recruiting and building on military graduate students
- Partnership with NPS in C4I and Modeling/Simulation to strengthen the Center
  - Web-based Virtual Simulation
  - Agile Acquisition of C4I Systems
- The Center maintains a technical reports series as an archive for our work and a way of making it available to the larger technical community
  - access through our webpage http://c4i.gmu.edu

Staffing

- ~20 teaching faculty members affiliated
  - from across IT&E, based on expertise/experience
  - about half will be PIs or Co-PIs leading projects
- ~20 research faculty
  - most often work with tenure/tenure-track project leaders
- ~10 administrative & technical support staff (full or part-time)
  - roughly half in general support of the center
  - remainder attached to specific projects
- Most of the faculty and staff hold security clearances
  - several hold SCI clearance
- About 30 graduate students (including research faculty)
  - roughly half doctoral students and half Master's students
  - Computer Science; Computer, Electrical, Software and System Engineering; Operations Research; Engineering Statistics
- One or two visiting researchers

External Activities

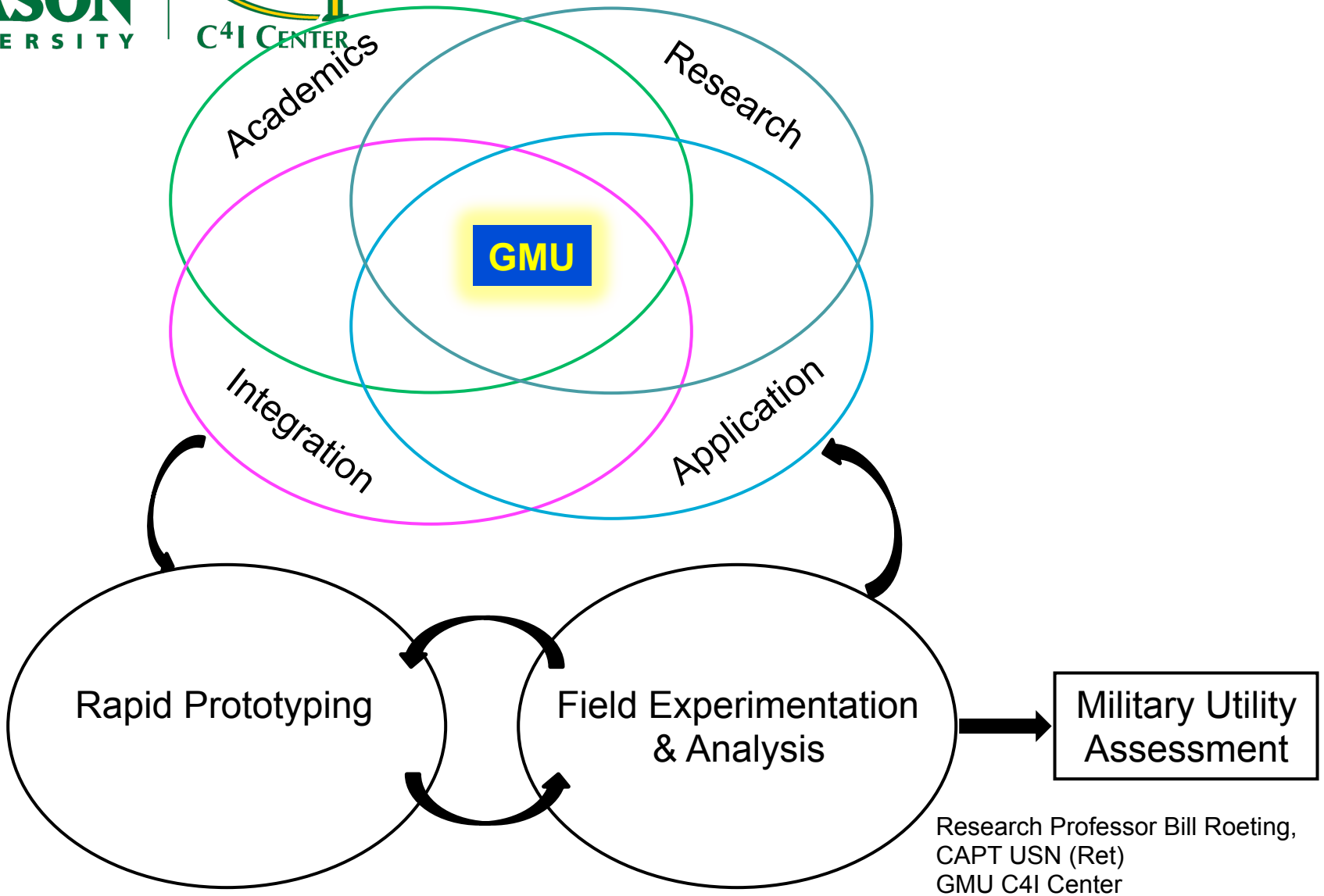
- Web page
  - http://c4i.gmu.edu
- Seminars by C4I Center faculty and visitors
  - All C4I Center faculty and visitors
  - Online and recorded for playback
  - Many co-sponsored by departments
- Annual symposium
  - "Critical Issues in C4I" Symposium with AFCEA
  - Next occurrence: 19-20 May 2015 GMU Johnson Center
- Advisory group
  - Nationally-recognized senior leaders
  - Organized by Director Emeritus Van Trees
- C4I Center Fellows from government and industry
- Industry partners

Technical Interchange

- **STIDS:** Conference on Semantic Technology in Intelligence, Defense and Security (held at GMU; now in its 9th year)
- **URSW:** Workshop on Uncertainty Reasoning in the Semantic Web (held with ISWC; now in its 10th year)
- **BMAW:** Bayesian Modeling Applications Workshop (held with UAI; now in its 11th year)
- **ETURWG:** Evaluation of Techniques for Uncertainty Reasoning (working group of ISIF; yearly special session at Fusion Conference)
- **Fusion 2015:** to be held in Washington DC; chairs Laskey and Costa
- **Critical Issues in C4I**: co-sponsored yearly with AFCEA

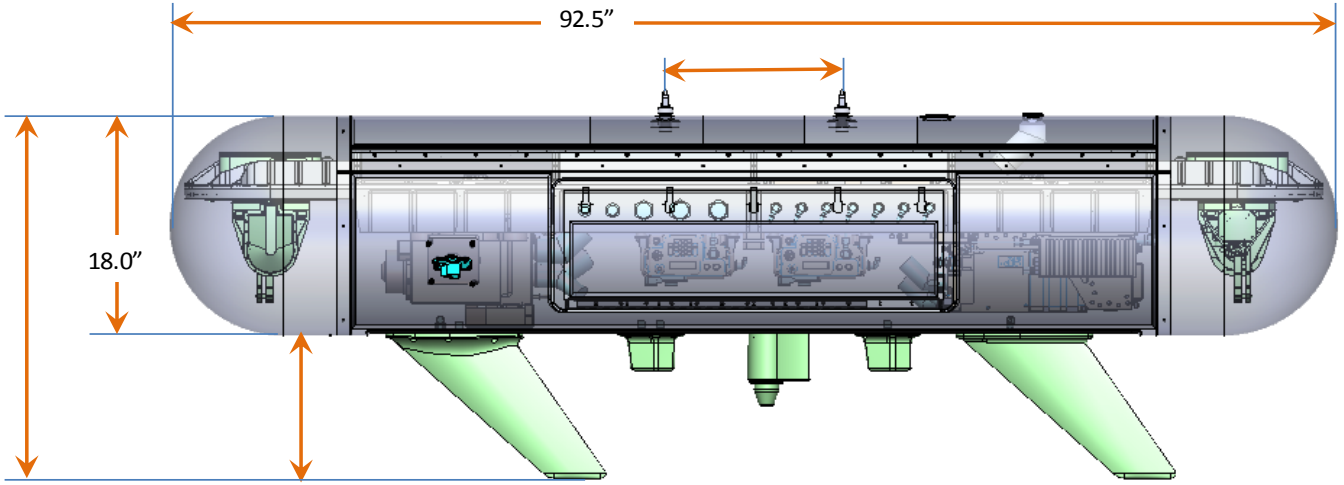
Selected Projects

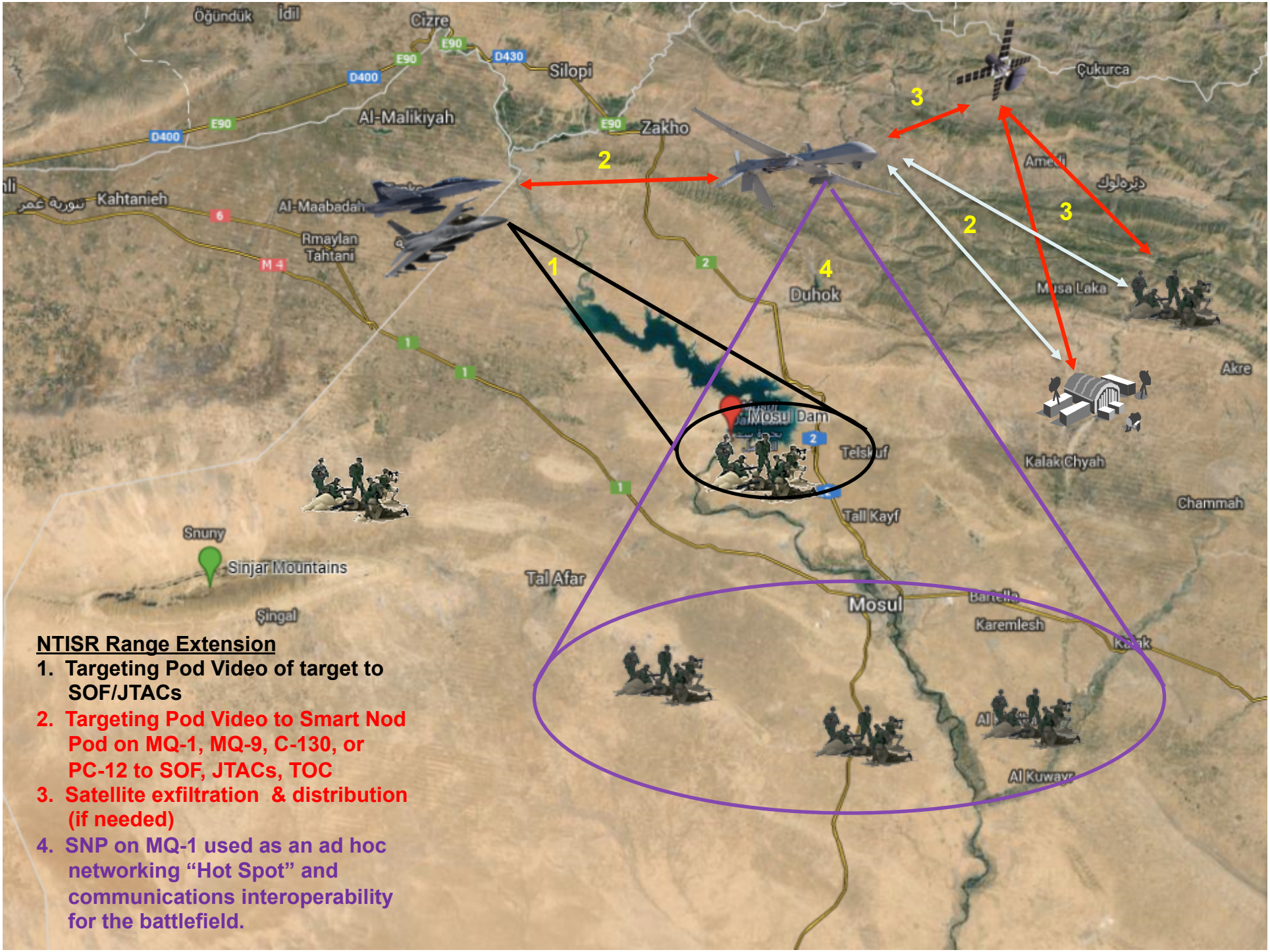
Systems Interoperability Prototyping



Research Professor Bill Roeting,
CAPT USN (Ret)
GMU C4I Center
Area Lead – Rapid Prototyping,
Fielding, & Experimentation

Smart Node Pod Design and Equipment




Öğündük
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Cizre
E90
D400
D430
Silopi
Al-Malikiyah
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Al-Maabadah
Rmaylan Tahtani
M-4
Duhok
Musa Laka
Akre
Mosul Dam
Telskuf
Kalak Chyah
Chammah
Tall Kayf
Snuny
Sinjar Mountains
Şingal
Tal Afar
Mosul
Karemlesh
Kalak
Al Kuwayr
1
2
3
4
NTISR Range Extension
1. Targeting Pod Video of target to SOF/JTACs
2. Targeting Pod Video to Smart Nod Pod on MQ-1, MQ-9, C-130, or PC-12 to SOF, JTACs, TOC
3. Satellite exfiltration & distribution (if needed)
4. SNP on MQ-1 used as an ad hoc networking "Hot Spot" and communications interoperability for the battlefield.

SciCast

- Improve Intelligence Forecasting
  - 500 real forecasting problems per year
  - Have demonstrated accurate forecasts
- Realtime massively concurrent Bayesian combinatorial knowledge representation and inference
- Sponsored by IARPA

- Period of Performance:
  - May 2011 – May 2015
- PI: Charles Twardy
  - Co-PI: Kathryn Laskey
- Team:
  - GMU C4I & Econ
  - Inkling Markets, Inc.
  - Gold Brand Software LLC
  - KaDSCi LLC
  - Tuuyi, Inc.
  - 1000s of participant "analysts"

Academic Plugfesting

- Grew out of work with AFCEA and Esri to demonstrate rapid integration solutions
- Currently sponsored by Defense Intelligence Information Enterprise
  - Building shared infrastructure for Defense Common Ground System as managed by US Army, Navy, MC, AF, and Intel
- Projects in past year:
  - Seed a GMU student plugfest group
    - Student competition Nov 2014
  - Build an open source integration of Common Map API outside of Ozone Widget Framework
    - Successful agile development completed May 2014

Battle Management Language

- Dr. Michael Hieb is the internationally recognized leader in this area
- Automating C2-Simulation interoperation
- geoBML project: complementary geospatial information
- Active NATO partnership (MSG-085)
- SISO C-BML standards activity
- Multiple sponsors
  - Army Geospatial Center, Army SIMCI, DMSO, JFCOM, NATO RTO, AMSO, Saab

NATO BML Group Established In 2006

12 Nations Currently Attending Meetings

Predecessor won NATO Science award 2013

Standardization for C2 Simulation Interoperation

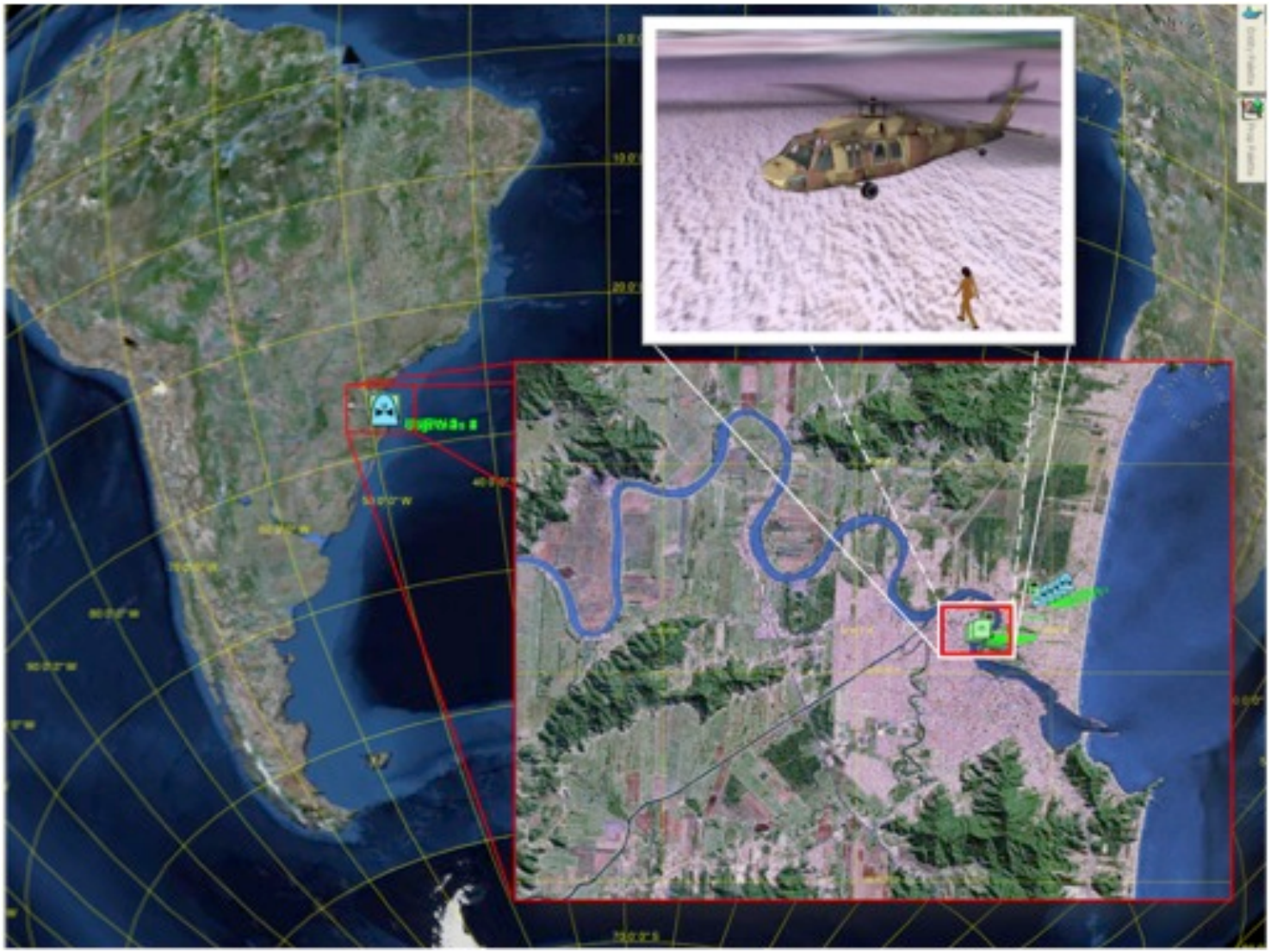
WISE/SBML Project

- GMU is helping Saab expand C-BML/MSDL capabilities in WISE
- GMU builds code; free to publish papers
  - Saab review to ensure no disclosure of proprietary info
- Saab responsible for integration and quality control
- Successfully completed:
  - Incorporate SBMLServer in WISE
  - Demo WISE supporting C2-simulation operation
  - Prototype 10x performance translating server
  - NATO MSG-085 Final Demonstration Ft Leavenworth Dec 2013
  - Supported 6 nation C2 systems and 5 national simulations

International C2/Simulation Testbed

- Joint Use Cases running on Simulations in both Brazil (ITA) and the US (George Mason C4I Center)
  - facilitates collaborative C2 research by University Faculty, PhD/Masters Students and Industry
  - Conference and Journal Publications,
  - Research Demonstrations, and Research Prototypes
- WISE/SBML with Saab (separate, for now)
- Saudi participation proposed

Collaboration with ITA in C2 Research Testbed



Simulation of Plans can be an effective way to convey Command Intent. In this example, being developed in the GMU C4I Center, a rescue operation in Santa Catarina, Brazil is planned.

Manager-Leaders

- Dr. Kathryn Blackmond Laskey, Professor of Systems Engineering & Operations Research
  - Long-term cornerstone of C4I Center; applies information technology to support better inference and decision making
- Dr. Tod Levitt, Research Professor
  - Pattern Recognition & Artificial Intelligence; Designated firefighter
- Dr. Michael Hieb, Research Associate Professor
  - C2 & Simulation expert, in demand by DoD; International Projects
- Dr. Paulo Costa, Associate Professor
  - Semantic Technologies expert; retired Brazilian AF Lt Col
- William Roeting, Research Professor
  - Systems Interoperability Prototyping; retired USN Captain