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

The Center will perform advanced research in military information technology, where it will be recognized as a premier source of knowledge and innovation and will be relied upon by military and civil authorities for advice and assistance. It will serve to provide a bridge between military requirements in IT&E areas of expertise and the faculty who possess and practice that expertise.

C^{4}I Center Goals

- Provide an intellectual base for C4I area
- Integrate theories and results across multiple disciplines to increase understanding at C4I systems level
- Impact the synthesis and analysis of C4I systems
- Bridge cultural gaps among government, industry and academia in C4I

C^{4}I 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

- Air Force Research Lab (AFRL)
- 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 Army Engineer R&D Center (ERDC)
- US Army G3/G6 (under subcontract to BAH)
- 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

- IARPA ACE : Aggregative Contingent Estimation
  - DAGGRE: improved forecasting in Intelligence activities
- Battle Management Language (BML)
  - Command & Control – Simulation Interoperation
  - Joint, Coalition (NATO), Geospatial, Multi Agency
- DARPA Innovation House
  - Pilot for teams that make "sprints" in imagery/geospatial data
  - "Eight weeks, six teams, one rule: try something different!"
- MIST/C Integrated Synchronous Teaching/Conferencing
  - Blend classroom and remote participation from anywhere on the Internet
  - Open source, synchronous and asynchronous
- 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 ten Industry Partners

- Large and small

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
  - Computer Science
  - Electrical & Computer Engineering
  - Engineering Statistics
  - Infrastructural & Civil Engineering
  - Systems Engineering & Operations Research

- Center of Excellence in Command, Control, Communications, Computing & Intelligence

- PhD in Information Technology
  - Multidisciplinary; well suited to C^{4}I research
  - Volgenau School also offers PhD in Computer Science, Electrical and Computer Engineering, System Engineering and Operations Research

Volgenau School of Engineering

- Faculty: 105 Tenured/Tenure Track, 56 Term and Research

- 7 Departments, 4 Research Centers

- Students: 2,986 undergraduate, 1,795 graduate

- Degrees: 8 undergraduate and 21 graduate

- Alumni: 15,997 – 85% live in DC Metro Area

- No. 28 in the country in MS degrees awarded

- Also No. 28 nationwide in graduate enrollments

  - Rankings from ASEE

- Mason ranks 153 in research expenditures on the NSF Annual Research and Development Survey.

- SEOR Dept ranked 30 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 IT&E 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 IT&E 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
  - will recruit and build 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 tenured/tenure-track 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: 21-22 May 2013 Johnson Center

- Advisory group
  - Nationally-recognized senior leaders
  - Organized by Director Emeritus Van Trees

- C4I Center Fellows from government and industry

- Industry partners

Backups

- Improve Intelligence Forecasting
  - 100 real forecasting problems per year
  - Must beat government baseline (unweighted average) by 50%
- Bayesian markets, advanced elicitation, problem decomposition, machine learning
- Sponsored by IARPA's "ACE" program
  - Aggregative Contingent Estimation

- Period of Performance:
  - May 2011 – May 2014
- PI: Charles Twardy
  - Co-PI: Kathryn Laskey
- Team:
  - GMU C4I & Econ
  - Mercyhust Univ.
  - Australian Center for Excellence in Risk Analysis
  - Gold Brand Software LLC,
  - KaDSCi LLC
  - JMU
  - DRDC Toronto
  - 1000s of participant "analysts"

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, Saab

NATO BML
Group
Established
In 2006

12 Nations
Currently
Attending
Meetings

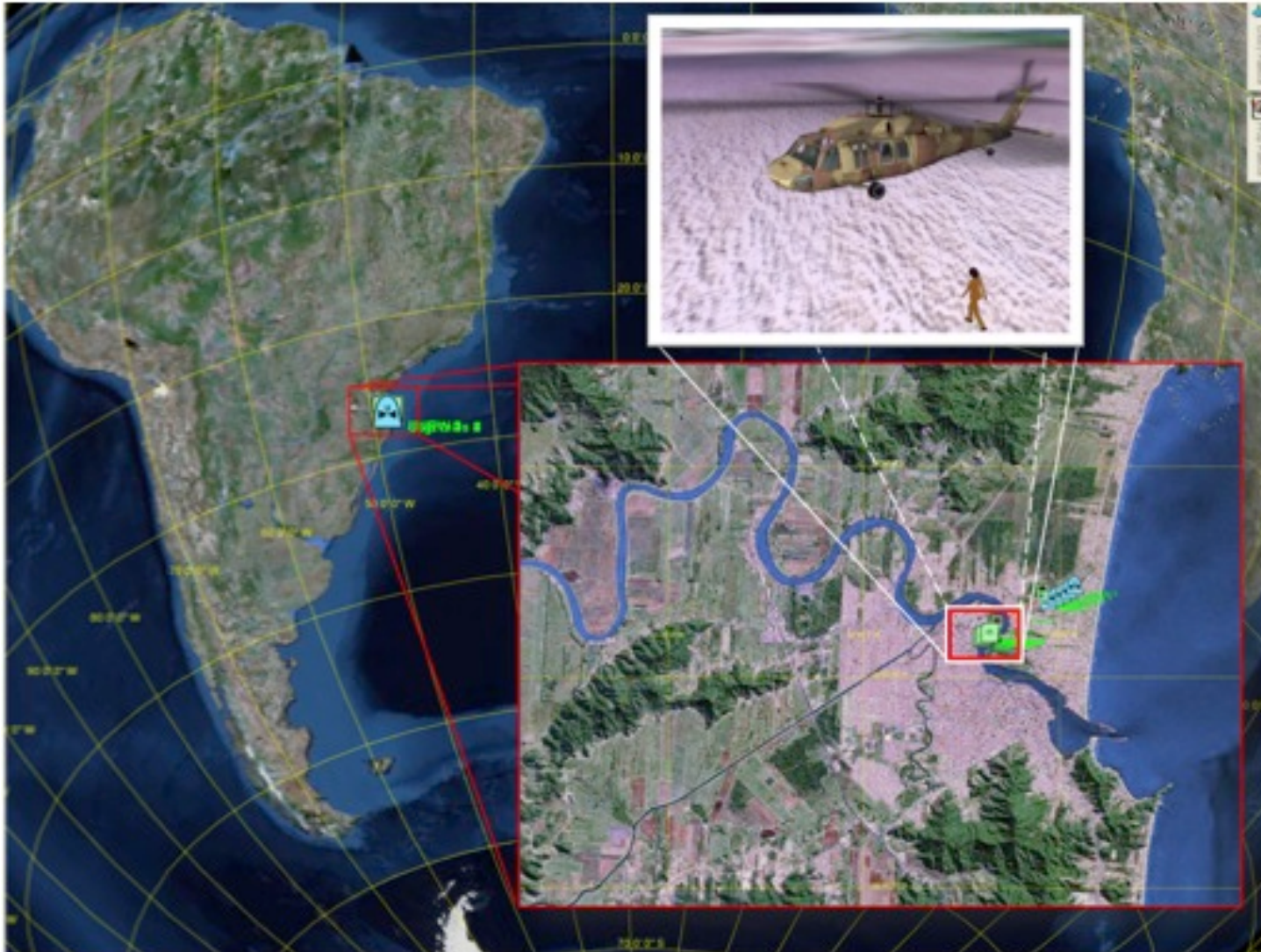Predecessor
won NATO
Science award
2013

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.

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

- Planned phases:

  –Incorporate SBMLServer in WISE (done)

  –Demo WISE supporting C2 Operation (Nov 2012)

  –Demo WISE supporting C2-simulation operation (Feb 2013)

    - 9LandBMS, BattleTek, OneSAF

  –Prototype 10x performance server (in Windows context)

Manager-Leaders

- ## Dr. Dennis McBride, Research Professor
  - Recently managed C2 at DARPA; retired Navy; specializes in visionary projects; co-funded by VP for Research

- ## 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 LTC