GMU C^{4}I Center

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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

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 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

- 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 eleven 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 (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 C^4I 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/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 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 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
  - 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 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: 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

Selected Projects

SciCast

- Improve Intelligence Forecasting
  - 500 real forecasting problems per year
  - Have already demonstrated
- 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
  - 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

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

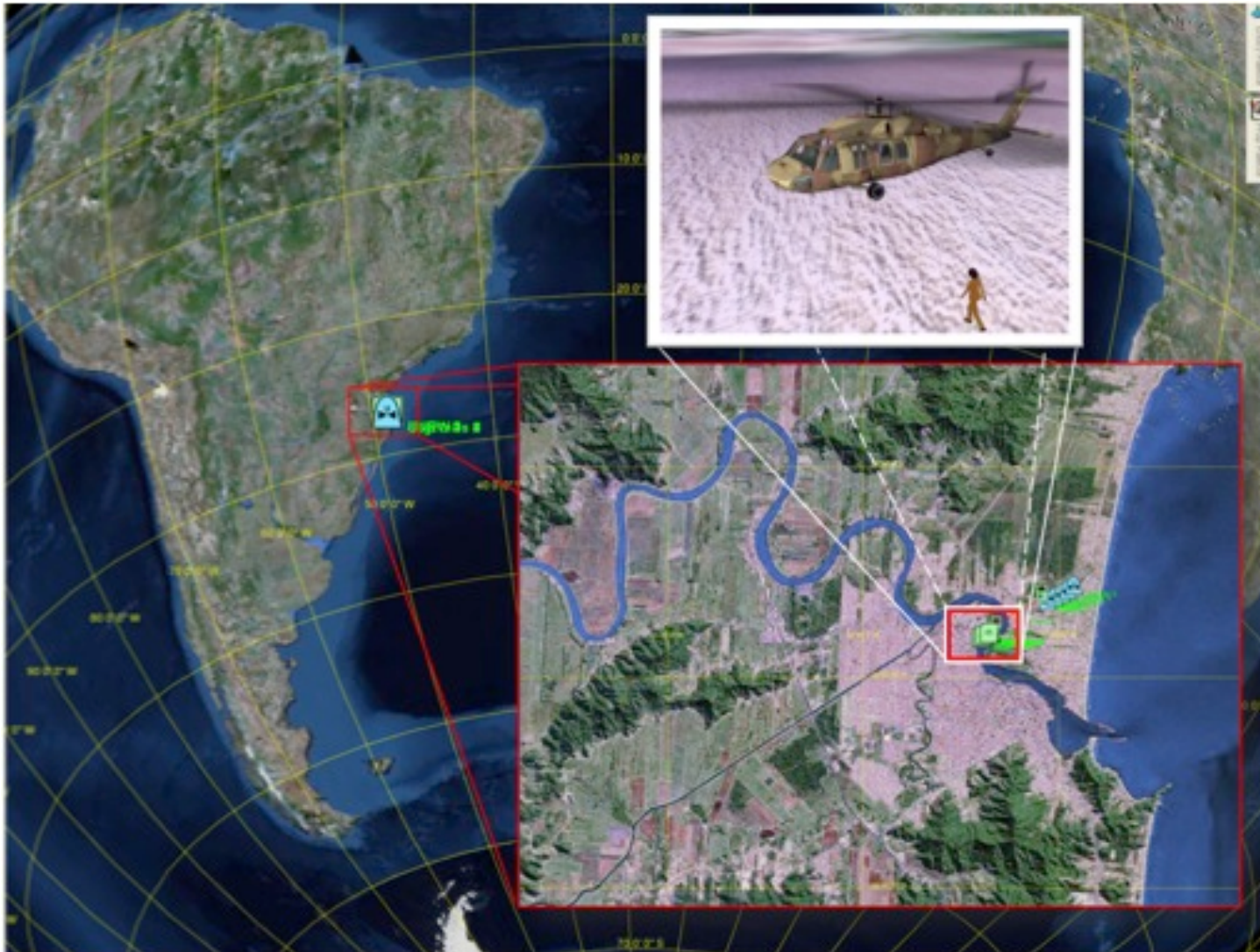Predecessor
won NATO
Science award
2013

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. 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