

The Volgenau School of
Information Technology and Engineering



GMU C⁴I 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.



C⁴I 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

- Air Force Research Lab (AFRL)
- Assistant Secretary of Defense (Networks & Information Integration) (OSD/NII)
- Defense Advanced Research Projects Agency (DARPA)
- Defense Information Systems Agency (DISA)
- Defense Threat Reduction Agency (DTRA)
- 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
- 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

- Battle Management Language (BML)
 - Command & Control – Simulation Interoperation
 - Joint, Coalition (NATO), Geospatial, Multi Agency
- Geospatial Products Experimentation
 - Evaluate effectiveness of AGC geospatial products
 - Help shape next generation battlefield C2
- IARPA ACE : Aggregative Contingent Estimation
 - DAGGRE: improved forecasting in Intelligence activities
- MIST/C Integrated Synchronous Teaching/Conferencing
 - Blend classroom and remote participation from anywhere on the Internet
 - Open source, synchronous and asynchronous
- Persistent ISR for Valued Information at the Right Time
 - Focus on optimizing value of information/life-cycle management



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 nine Industry Partners

- Large and small



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 C⁴I research
 - Volgenau School also offers PhD in Computer Science, Electrical and Computer Engineering, System Engineering and Operations Research



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>



Staff Goals

- ~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



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: 22-23 May 2012 Fairfax Campus
- Advisory group
 - Nationally-recognized senior leaders
 - Organized by Director Emeritus Van Trees
- C4I Center Fellows from government and industry
- Industry partners



Backups



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-048)
- SISO C-BML standards activity
- Multiple sponsors
 - Army Geospatial Center, Army SIMCI, DMSO, JFCOM, NATO RTO



Joint Geospatial Enterprise Service

- Army Geospatial Center testbed for use of geospatial information in C4I systems
- Planned experiments and ad-hoc studies
- We support the experimental process
 - Human interfaces and applications (Adelman/Laskey)
 - Distributed/networks architectures (Pullen/Malek)
- Example: Battlespace Terrain Reasoning and Awareness-Battle Command (BTRA-BC)



MIST/C

- Open-source system for synchronous teaching and conferencing over the Internet
 - Also supports automatic recording/Web posting
- Multimedia tools from other groups plus a lot of our own work to assemble
- Web-based interface used to teach around ten Volgenau School courses per semester
 - Adopted by other groups (available on our webpage)
- Used for C4I Center Seminar series
 - Generally have remote participants
- Also supports technical project conferencing
- Sponsors: multiple (most recently, DTRA)
 - Kept going by dedicated faculty and students



Aggregative Contingent Estimation

- Goal: improve forecasting for Intelligence operations
 - Must beat an *unweighted* average of 1,000 professional MITRE analysts, on a series of 100 forecasting questions.
- Sponsor: IARPA
- Period of Performance: Apr 2011 – Mar 2014
- PI: Kathryn Laskey
 - Executive Co-PI: Charles Twardy
- Team: GMU C4I + LAC, JMU, Mercyhurst College, Australian Center for Excellence in Risk Analysis, nemoSivi Ltd, KaDSCi LLC
 - Plus hundreds of participant “analysts”
- Technologies: Bayesian markets, advanced elicitation, problem decomposition, machine learning



USMC Persistent ISR

- Project started by Naval Postgrad School
 - Sponsored by USMC PM Intel
- Products:
 - Persistent tactical ISR integration for USMC
 - Developed using commercial software development methods
 - Aims to be forerunner of Defense IT acquisition reform