



Systems Engineering Education Initiative at Georgia Tech

Space Systems Engineering Conference
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**Georgia
Tech**



Research
Institute

Overview

The Georgia Institute of Technology is creating a professional master degree and certificate program in systems engineering. This is a collaborative effort between the College of Engineering, the Georgia Tech Research Institute, and the Office of Distance Learning and Professional Education.

This briefing will provide a description of

- the need
- the degree and the certificate
- their unique features
- the roll out schedule

The Need

- DOD emphasis on Systems Engineering
- Retiring Systems Engineers with inexperienced replacements
- Current state depicts lack of systems thinking and systems engineering
- Systems are getting more complex, mistakes more costly
- Technology is moving faster so upgrades must be planned into the overall life cycle
- Industry wants systems approach – defense, sensors, textiles
- Current systems integrators lack enterprise thinking

Marketing Survey Participants

- Northrop Grumman
- United Technologies
- DuPont
- Boeing
- Hewlett Packard
- Lockheed Martin
- Lockheed Martin, Marietta
- Milliken
- Department of Defense
- U.S. Air Force (AFRL)
- U.S. Army
- Scientific Atlanta
- Scitor
- Raytheon
- Rolls Royce

Market Survey Results

- Strong job growth seen in areas of SE
- Over 40% indicated fair to strong interest in SE programs
- Strong interest in:
 - Supply chain mgt
 - SW
 - Logistics
 - Business mgt
 - Information Sys
 - Integrated Engineering Design
- Curriculum Interest
 - Workplace applications
 - Interdisciplinary approach
 - System of systems oriented
- Domains of Major Interest
 - Radar Systems
 - Modeling & Simulation
 - Homeland Security
 - Military Systems
 - Internet and networking
 - Operations Research
- Core Courses Determined by Survey
 - Systems Engineering Principles
 - Technical Program Management
 - System Modeling, Design, and Optimization
- Secondary Courses recommended by Survey
 - Enterprise Systems
 - Systems Architecture
 - Operations Research
 - Human-System Integration
 - Supply Chain Mgt

Sustainable Professional Masters
in SE: 100 to 300 students / year

What We Want to Do

- Achieve an internationally renowned effective Complex System Engineering education graduate level program
- Promote an innovative interdisciplinary graduate education for engineering approaches melding theory and experience
- Advance SyE thinking and practice further into the technological future
- Contribute to Georgia Tech's goals now and in the future
- Build on and extend core strengths
- Anticipate and address needs of key stakeholders

Systems Engineering Initiative

- Offer Graduate level certification in Sys Engineering to meet Defense customer requirements
- Offer Professional or Executive Masters in Systems Engineering, or Engineering Systems
- Offer short courses in specialization areas based on customer input
- Offer blended learning
- Offer distance learning courses
- Offer on-site courses
- Use Academic and Industrial Advisory Groups to improve programs and courses

Initiative Requirements

- Define Systems Engineering
- Business Case Supported
- Courses taught by professors with industry and government experience
- Provide SyE Education
- Provide Courses in Blended Format – Distance Learning, Weekend, On-Site Format
- Provide as an Executive Type Course
- Include Interest of Stakeholders
- Work as a Team with RI and GTRI
- Communicate Appropriately
- Include Systems of Systems Thinking
- Define Entrance Criteria
- Identify Crucial Core Courses
- Produce Knowledge Map
- Identify Crucial Elective Course depending on Concentration
- Initial Target Areas are Military, Defense, Industrial, Aerospace
- Produce Roadmap
- Formal Market Research
- Workshop to add Experience, Expertise, Confidence

Skills & Knowledge Goals

➤ Skills

- Strategic Thinking
- Leadership
- Organization Building
- Technical Management
- Team Building
- People Management
- Scope Management

➤ Knowledge

- Enterprise and System Architectures
- Decision Analysis
- Engineering Risk Analysis
- Requirements Definition
- Life Cycle Management
- Project Management Finance, Business

Program Descriptions

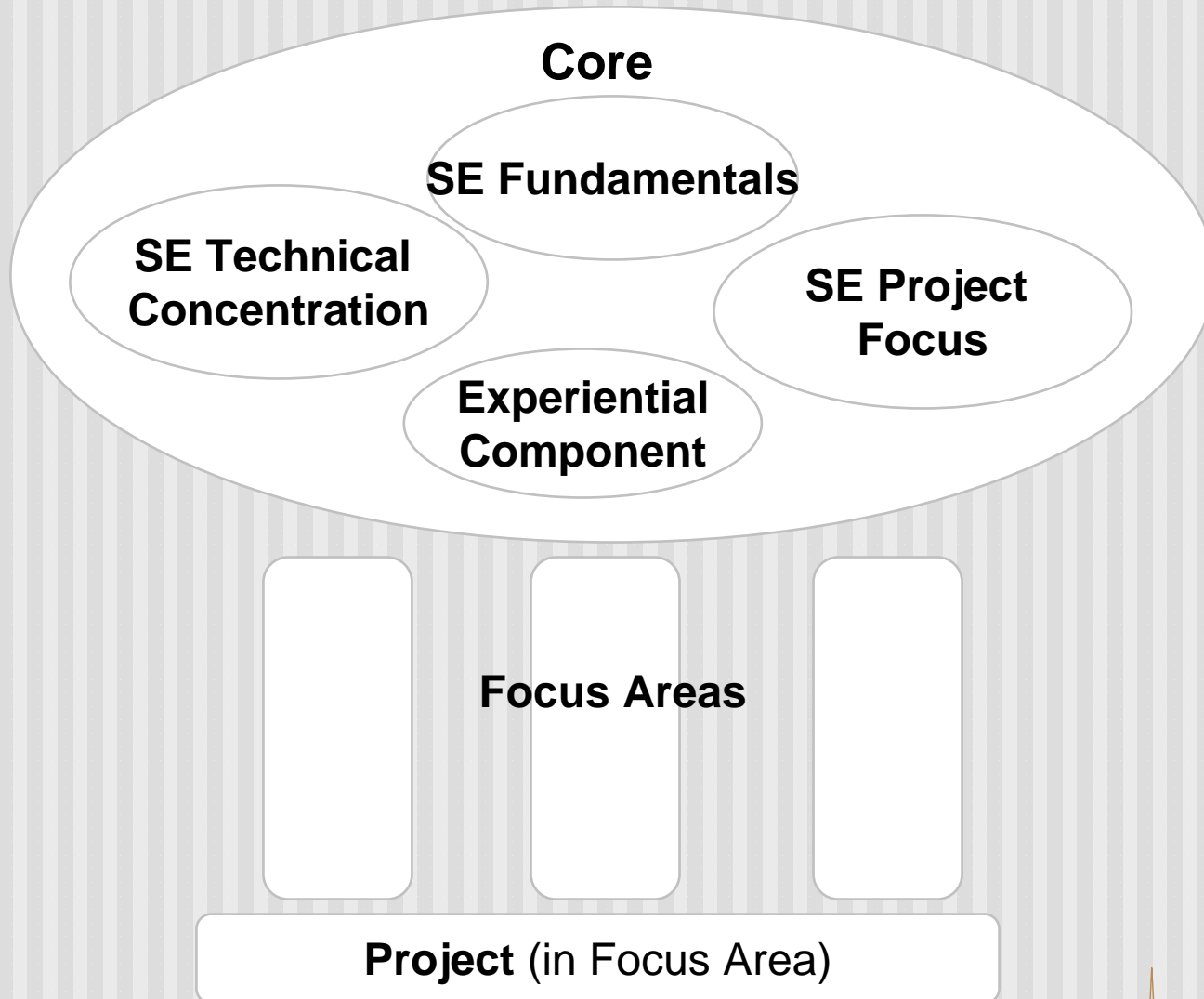
➤ Professional Masters SyE

- 30-36 hours (30 recommended)
- 1 yr FT graduate level
- 2 yr PT graduate level
- 6 core courses plus electives

➤ Certificate

- 12-18 hours
- 4-6 courses
- Additional focus area certificate options

Curriculum Structure



The degree at a glance

Core Courses (6)

1. Introduction to Systems Engineering (SE)* – *technical and project focus*

SE – technical concentration

2. Systems design and analysis
3. Systems modeling and optimization

SE – project focus course

4. Leading engineering teams*

5. Advanced topics in systems engineering
(e.g., enterprise systems, software intensive systems, human centered computing, cost of ownership, modular design, reliability, ...)

Experiential Component (Workshop)

6. Systems engineering laboratory
(based on School of Aerospace Engineering's Collaboration Visualization Environment)

Practice Focus (4)

three courses plus job related individual or group project in focus area

Vehicles

Information Systems

Sensors

*initially includes case studies and facilitated exercises,
goal is to eventually include an engineering project game (simulation based)

Admission Requirements

- Minimum 5 years experience
- No standardized test required
- Basic hard science Bachelor's, i.e. math, chemistry, physics, engineering, biology, computer science, architecture, etc
- 3 letters of recommendations required

The certificate: 3 courses + workshop

SE - Fundamentals

- Introduction to Systems Engineering (SE)* – *technical and project focus*

SE – technical concentration

- Systems design and analysis
- Systems modeling and optimization
 - Software Intensive Systems
 - Human Centered Computing

SE – project concentration

- Leading engineering teams*
- Enterprise Systems
- Cost of Ownership
 - Modular Design
 - Reliability

Experiential Component (Workshop)

- Systems engineering laboratory

(based on School of Aerospace Engineering's Collaboration Visualization Environment)

Additional Certificates Associated with Focus Areas

Vehicles

Information Systems

Sensors

*initially includes case studies and facilitated exercises,
goal is to eventually include an engineering project game (simulation based)

Curriculum – Focus Areas

Focus Areas – (each sequence typically equals 3 courses)

- Radar Systems Sequence
- EO/IR Sensor Technology Sequence
- Test and Evaluation Sequence
- Human System Integration
- Software Intensive Systems
- Modeling and Simulation Sequence
- Software Engineering Sequence
- Avionics Systems Sequence
- Operations Research
- Management Sequence: (Supply Chain, Technical Team, Resources)
- Supply Chain Management
- Resource Management
- Construction Technology Sequence
- Telecommunication Systems Sequence
- Unmanned Air Vehicle Sequence
- Manufacturing Systems Sequence
- Aerospace Systems Sequence
- Military Systems Sequence
- Integrated Engineering Program Management
- Enterprise Systems Management
- Complex Systems Mgt Sequence - (Complex Systems Architecture and Planned Technology updates, Enterprise Systems Management, Integrated Eng Program Mgt)
- Complex Systems Architecture and Planned Enterprise Updates of Complex Systems

Addressing System of Systems Challenge

- New course offering: Introduction to Space Mission Architecture
- System of Systems Engineering focus
 - Use space mission architecture as the backdrop
 - Heavy use of case studies and class projects
 - Thorough investigation of a fully functioning instructional nano-satellite (EyasSAT)
- GTRI cooperative effort with Georgia Tech ASDL
- Funded through GTRI Teaching Fellowship
 - Graduate level design course (Prof Masters elective)
 - Short course (Certificate program option)

Approval Process

- Short course programs/certificate joint effort of committee and sponsors
- Degree program - follow the GT/BoR process for credit approval – will try to accelerate to meet current customer needs
 - School
 - College
 - Faculty senate
 - Provost
 - Board of Regents

Schedule and delivery method

CoVE ported to
GTRI Field Offices

Spring 2008

Certificate and degree
available via distance learning

Fall 2007

Degree offered
at GTRI Field Offices*

Spring 2007

Degree offered
in Atlanta

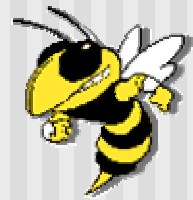
Fall 2006

Certificate offered
in GTRI Field Offices*

Spring 2006

Certificate offered in Atlanta
(4 intensive one week sessions)

*initially Colorado Springs, DC, Dayton, Huntsville, Orlando based on demand (each course via one week workshop or every other weekend for 8 weeks)



Questions