The Georgia Tech CSEMS Project At Age Six

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Atlanta

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Background

- **CSEMS**: “Computer Science, Engineering and Mathematics Scholarship”. Mandated by US Congress in 1990s to increase numbers of US graduates in these fields. Funded by fees from H-1B visa applications.
- 2004: Funding dried up as H1B applications declined after Internet crash.
- Revived as “**S-STEM: Scholarships for Science, Technology, Engineering and Mathematics**”.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CSEMS</th>
<th>S-STEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligibility: US citizen/permanent resident</td>
<td>Generally undergrad, fulltime</td>
<td>Generally undergrad</td>
</tr>
<tr>
<td>Selection criteria</td>
<td>Merit + need, subject to FAFSA need limit</td>
<td>Any “cohort”</td>
</tr>
<tr>
<td>Funding limit per year</td>
<td>$3125 subject to FAFSA need limit</td>
<td>$10,000 per year subject to FAFSA need limit</td>
</tr>
<tr>
<td>Institutional limits in national competition</td>
<td>One per institution</td>
<td>One per degree-granting school OR one per College</td>
</tr>
<tr>
<td>Qualifying BS degree programs at GIT</td>
<td>Only CoE, CoC and School of Math</td>
<td>COE, COC, and all of COS</td>
</tr>
</tbody>
</table>
Program History at GIT:
“FAST: Financial Aid for Success in Technology”

- 1st proposal in 2001 per approval of Dr. Robert McMath, VP Academic. Funded $400K through 2005. NSF encouraged use of
  Up for renewal now (S-STEM proposal deadline Aug. 12, 2008, Letter of Intent July 10)

- Zero overhead (per NSF). Zero administrative $/faculty time $ per PIs.
- Thirty volunteer Mentor faculty from CoE, CoC and Math participate in one-on-one mentoring of every student.
  Scholars must find, attend and summarize 2 research seminars per semester, in ANY technical field. Cross-disciplinary exploration encouraged.
  Superlative record of guidance into Co-Ops, campus PURAs, sponsored RAs, Internships, International Internships, careers.
  Made the difference to keep enthusiastic students in school through difficult economic times.
Program Objectives & Elements

Objectives:
To enable access to a top-quality education to the most deserving students and
To ensure the best guidance for their success.
It was anticipated that many such students would be from under-served backgrounds that include rural and inner-city environments.

Basic elements:
• introduce the most deserving and talented students to the excitement of CSEM careers,
• provide access to a top-quality education, and
• furnish the best guidance for their success and development.

Major components of data and findings used in this paper:
• Distribution of students by academic discipline and other criteria
• Their responses through summaries of what they learned there.
• Graduating seniors’ suggestions to the program and to those following them in the program.
• Mentor observations.
## FAST demographics vs. overall GIT CSEMS undergrads

<table>
<thead>
<tr>
<th></th>
<th>African-American</th>
<th>Asian-American</th>
<th>Caucasian</th>
<th>Hispanic-American</th>
<th>Native-American</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAST</td>
<td>13.8</td>
<td>17</td>
<td>51</td>
<td>14.9</td>
<td>0</td>
<td>25.5</td>
</tr>
<tr>
<td>GIT CSEMS colleges, 2008</td>
<td>6.5</td>
<td>22.2</td>
<td>64.6</td>
<td>5.5</td>
<td>&lt;1%</td>
<td>25%</td>
</tr>
</tbody>
</table>
Number of Mentors
Distribution of students By Discipline

- ECE: 28%
- ISyE: 11%
- Math: 2%
- MSE: 4%
- UnDec.: 7%
- AE: 24%
- BioMed: 6%
- CEE: 7%
- ChBE: 2%
- CS: 7%
- Comp Med: 2%
Figure 2: Grade Point Average Distribution

- 3.0-3.49: 32%
- 3.5-3.99: 19%
- 2.0-2.49: 14%
- 2.5-2.99: 21%
- 1.5-1.99: 7%
- 4.00: 7%
The Seminar Requirement Experience

Aimed at undergraduates who are least likely to be cognizant of the opportunities available in technology.

Students explore and discover their own interests.

Seminar options meet diverse needs:

• Freshmen and sophomores are encouraged to go to the Division of Professional Practice and Student Success Center, who arrange Co-Op and Internship opportunities, and take seminars and one-to-one help with interviewing and resume writing.
• Juniors and seniors are encouraged to attend at least one PhD or Masters Thesis defense to learn what kinds of research and student expectation levels occur in graduate school.
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<th>Recommended Activities Outside Classes</th>
<th>Mentoring Requirements: Minima</th>
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<tr>
<td>Freshman</td>
<td>2.0</td>
<td>Seminar series; One “project team”, limit of 1 extra-curricular</td>
<td>Twice a semester</td>
</tr>
<tr>
<td>Hrs. 0-30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sophomore</td>
<td>2.3</td>
<td>Seminar series; Two project teams; 2 extra-curricular; peer-leader of freshmen</td>
<td>Twice a semester. Resume writing; interviewing.</td>
</tr>
<tr>
<td>Hrs. 30-60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior</td>
<td>2.4</td>
<td>Two project teams including one research/ design competition; 3 extra-curricular; Peer leader</td>
<td>Once per semester. Interviewing skills; grad school/ career surveys</td>
</tr>
<tr>
<td>Hrs. 60-90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior</td>
<td>2.6</td>
<td>Two project teams incl. one research; 4 extra-curricular. Peer leader</td>
<td>Once per semester. Grad school applications; letters; scholarships</td>
</tr>
<tr>
<td>Hrs 90-136</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Graduating Senior Survey Results, 2007

1. What did the scholarship funds enable you to do?

• Reduce loans (ALL 27 Responses)
• Reduce/eliminate part-time job (13 responses)
• Didn’t have to get a part-time job (1 response)
• Responses under “Other”:
  • 1. Have more study time because I was able to reduce my job hours.
  • 2. Made Daycare for my daughter affordable so I could stay in school.

2. How did the seminar attendance requirement affect you?

• Able to narrow down technical area of interest (13 responses)
• Made contacts with future employers (2 responses)
• Nuisance, didn’t help at all: (1 response)
• 14 other responses:
  • Insight into what engineers do in the real world
  • Helped learn more about my field
  • Gathered information on succeeding in the professional world
  • Applying to graduate school (2) - current research
  • Professional presentations & how research is done.
  • Perspective of how my skills could be applied.
3. How did mentoring help you?

• Able to narrow down technical area: 10 responses
• Helped schedule more productive classes
• Helped get me co-op or internship
• Suggested seminars that helped in weak aspects
• Gave me great advice
4. Suggestions to Improve the FAST program
5. Advice for younger students in the FAST program now
6. Where are the graduates going?

<table>
<thead>
<tr>
<th>Destination</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate School in technology disciplines</td>
<td>14</td>
</tr>
<tr>
<td>National Labs (NASA)</td>
<td>2</td>
</tr>
<tr>
<td>Private Industry</td>
<td>7</td>
</tr>
<tr>
<td>Industry, unrelated to degree</td>
<td>1</td>
</tr>
<tr>
<td>Undecided, going to industry</td>
<td>3</td>
</tr>
</tbody>
</table>
## Success Breeds Competition

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<tr>
<td>Selection criteria</td>
<td>Merit + need, subject to FAFSA limit</td>
<td>Any “cohort”</td>
</tr>
<tr>
<td>Funding limit per year</td>
<td>$400K over 4 years.</td>
<td>$600K over 3 years, max of $225K per year.</td>
</tr>
<tr>
<td>Institutional limits in national competition</td>
<td>One per institution</td>
<td>One per degree-granting school OR one per College</td>
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<tr>
<td>Overhead/Administrative</td>
<td>Zero Overhead. Upto 9K per year in “administrative costs”</td>
<td>Zero overhead. Upto $78K in administrative costs.</td>
</tr>
<tr>
<td>Result:</td>
<td>No interest in COE office</td>
<td>COE “selected” another proposal to represent COE, not schools</td>
</tr>
</tbody>
</table>

*Experimental Aerodynamics and Concepts Lab, School of Aerospace Engineering, Georgia Tech*
RFP conditions and implications:

1. Every proposal must BUILD ON and REFER To results from any prior CSEMS or S-STEM project at the Institution. (“FAST” Phases 1 & 2 are the ONLY CSEMS/S-STEM projects ever funded at GIT)

2. PI must be a “faculty member teaching in one of the disciplines represented”.

3. Proposal must be signed off and endorsed by a College other than COE.

4. We want to retain the winning features and lessons from “FAST”.
Our S-STEM Proposal

1. Retain “FAST - Phase 3” as name. Why:
   - Brand recognition
   - Seamless continuation of current program recruitment and funds distribution

2. Program endorsement through VP Academic as a campuswide program, but identify with College of Sciences / School of Physics to avoid conflict with CoE interests.

3. Expanded project team brings in CoS faculty member(s), Space Grant Consortium (Armanios), Women in Engg/ Science (Philobos+CoS faculty member), CoS faculty Mentors from EAS, Physics Chemistry, Biology as student interests dictate.

   **Program Theme: Cross-Disciplinary Teams Pursuing Grand Challenges**

   - Grand challenges modeled on NASA Institute of Advanced Concepts programs.
   - Students must pick one team. For-credit Special Problems courses OK.
     - No work-for pay from scholarship funds. PURA etc. are fair game.
   - University Honors Program as the facilitator of CoS-CoE-CoS-CoA-CoM interactions.
     - Individual mentorship and seminar attendance requirements stay.
   - Scholarship amounts generally $1000/semester, but more possible for emergency needs.
Description

- Funded by the National Science Foundation through a national competition.
- US citizen/ permanent resident, full-time undergrads in Engg., Computer Science or Math.
- Scholarships upto $3125/yr.
- Scholars participate in mentor program; help in assessment.
- Criteria – need, grades, initiative & enthusiasm.
Program Objectives & Elements

Objectives

To enable access to a top-quality education to the most deserving students and to ensure the best guidance for their success.

Many such students are from under-served backgrounds that include rural and inner-city environments.

Basic elements of the program:

- introduce the most deserving and talented students to the excitement of CSEM careers,
- provide access to a top-quality education, and
- furnish the best guidance for their success and development.
Project Team

• Ten faculty from the Colleges of Engineering and Computer Science.
• Two financial aid experts from the Student Success Center.

No overhead – all CSEMS funds are directly used as scholarships for students.

100% of the NSF funds go directly to the students
– no administrative or other costs are charged,
- none of the faculty involved get any release time or such other benefits from this program.
Recruitment Strategy and Experience

• Large pool of well-qualified students at GIT
• Recruitment efforts are conducted through various means for identifying and contacting prospective students.
• Space Grant Consortium at GIT visits numerous middle schools and high schools throughout Georgia every year, and includes the FAST brochure in their communications. Georgia Tech’s annual Engineering and Computing Career Conference (ECC), sponsored by the Women in Engineering program.
• The FAST opportunity is also part of the package of initial communications from Georgia Tech’s Office of Admissions to newly accepted freshman and transfer students.
• The program is advertised on the Financial Aid website, and a special site.
• As the program matures, referrals from faculty advisors and the Financial Aid Office identify students in dire need.
• Recently, applicants transferring from another school with a CSEMS project, and contact comes as a result of the NSF’s conference of CSEMS Principal Investigators.
Application Process

The application process consisted of 4 steps:

1. Submit FAFSA form to qualify for Federal aid and identify the maximum permitted amount of aid receivable under this program. This is required by CSEMS.

2. Download 1-page form from the Financial Aid website, fill it with details such as class standing, GPA, and other aspects required to evaluate qualifications of the overall CSEMS program and the specific Georgia Tech requirements. [http://www.ae.gatech.edu/~msmith/FAST/Apply.html](http://www.ae.gatech.edu/~msmith/FAST/Apply.html)

3. Write and attach 1-page to 2-page free-form “essay” delineating the candidate’s interests in a career in technology – begin the process of getting candidates to think about “where” they plan to be in 5, 10 and 20 years’ time.

4. Mail the package to the Financial Aid Office (or to the project director), along with unofficial transcripts for evaluation.
Selection Process

• Financial Aid office passed FAFSA-qualified applications to the PI.

• For the first round, each application was seen and evaluated by at least two faculty. As far as possible, one evaluator was from the applicant’s field of interest.

• Candidates were rank-ordered within each evaluator’s set, across evaluators, and eventually checked against Financial Aid’s intimate knowledge of each student’s financial circumstances.

• For later semesters, sub-team including the Financial Aid Office and two faculty members did evaluations. Recommendations from other faculty were also considered carefully.
Distribution Level and Designing for Steady State

Most awards are $1000/semester. More in case of special need.

Figure 1: Number of active students by semester
Mentoring Experience and Requirements from Participants

Each student must:

• Meet assigned mentors at least once a semester and discuss their progress, evolving strategic plans, and to identify suitable opportunities for development.

• Find and attend two seminars given by visiting faculty (research seminars) or industry visitors to obtain a perspective of the industrial environment and problems of interest.

• Submit 1-page to 2-page summaries of what they learned by attending each seminar.
Seminar Requirement Experience

• Mandatory attendance at “FAST-specific” seminars is a hurdle, given the diverse class schedules.

• Given diversity of our students, invited speakers to such mandatory seminars would have to be constrained to speak on topics of rather general interest across disciplines.

• It became obvious that there was already such a wealth of seminars scheduled every week at our campus, catering to a wide range of interests. We decided to let students explore and discover their own interests.

• *Essential and successful.* Students who took the initiative early to explore for seminars have sent in abstracts that reflect genuine excitement and interest. Discipline of having to plan, explore, find and actually attend two seminars was a tough challenge to several students.

• Most responded to reminders. Those who did not were put on “probation” in the scholarship program for one semester, and failing that, were asked to reapply in competition with new applicants.

• In most such cases, this appears to have motivated them to find other avenues of support, involving research internships, Co-op positions, or other jobs.
Examples of Seminars Chosen by FAST Students.

<table>
<thead>
<tr>
<th>Area</th>
<th>Title</th>
<th>School, date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>Nobel Prizes Related to Superconductivity and Superfluidity</td>
<td>Ph 10/2003</td>
</tr>
<tr>
<td>System Design</td>
<td>Lifecycle Simulation</td>
<td>AE 9/2003</td>
</tr>
<tr>
<td>Neurology</td>
<td>Modeling a Neuronal Network at Three Different Levels: Lessons from the Leech Heartbeat Central Pattern Generator.</td>
<td>BME 3/2002</td>
</tr>
<tr>
<td>Number Theory</td>
<td>“As natural as 1-2-3”</td>
<td>CoC 9/2003</td>
</tr>
<tr>
<td>Genetics</td>
<td>“Environmental Applications of DNA Microarrays”</td>
<td>BME 11/2003</td>
</tr>
</tbody>
</table>
Other Experiences

• Freshmen and sophomores are encouraged to go to the Division of Professional Practice and Student Success Center, who arrange Co-Op and Internship opportunities, and take seminars and one-to-one help with interviewing and resume writing.

• Juniors and seniors are encouraged to attend at least one PhD or Masters Thesis defense to learn what kinds of research and student expectation levels occur in graduate school.
Progressive GPA Scale, and Effects on Retaining Students

Figure 2: Current GPA distribution
# Summary of FAST Scholarship Requirements

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<th><strong>Recommended Activities Outside Classes</strong></th>
<th><strong>Mentoring Requirements: Minima</strong></th>
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<td>2.0</td>
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<td></td>
<td></td>
<td><strong>Sophomore</strong></td>
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<tr>
<td><strong>Hrs.0-30</strong></td>
<td>2.3</td>
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<td><strong>Junior</strong></td>
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</tr>
<tr>
<td><strong>Hrs 90-136</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Evolution and Impact

Distribution by Major Field
**Metrics & Assessment**

*Increased retention of students to degree achievement*

CSEMS retention data comparison

<table>
<thead>
<tr>
<th></th>
<th>Freshman Ret.</th>
<th>Overall ret.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAST</td>
<td>94%</td>
<td>94.4%</td>
</tr>
<tr>
<td>GITCoE, CoC, CoS</td>
<td>87%</td>
<td>84.1%</td>
</tr>
</tbody>
</table>
“Increased numbers of well educated and skilled employees in technical areas”

• Strengthened partnerships with high technology industry.

• Improved student support programs at institutions of higher education.

• Improved educational opportunities for students in the named disciplines
Summary of Lessons Learned

1. Finding good Academic Faculty Mentors – for zero “pay” – by simply asking them to volunteer.

2. Sliding GPA scale. Students more than justify our faith in their ability and determination to work hard. FAST program has reduced or eliminated their need to work at part-time jobs while studying full-time.

3. Zero-overhead administration. Simple program management structure enabled every participant to focus on what s(he) wants and is skilled to do.

4. Let the students find seminars - a strong component of efforts to broaden perspective of the scholars while still undergraduates.

5. Locating students who have need. Mentors and student referrals are increasing each semester - synergism with the Financial Aid Office.
The Tougher Lessons

1. Lack of student attention to obligations. Reasons need deeper examination, and motivating strategies / responses must be fine-tuned.

2. Apparent correlation between school’s undergrad advising policies, and attitude. Solution: seek student input on the right mentors to recruit. Saying: “Your students told us that you are the most caring advisor in your school” is a far better persuasive technique for faculty mentors than: “your Dean told us.”

3. Application process and the “requirements” seem simple and non-intrusive to us, these still appear to pose large obstacles to many students. New FAST web site for students is a positive step in this direction.

4. It is not easy to get post-graduation data.
The authors gratefully acknowledge the support by NSF of the Georgia Tech FAST program under the CSEMS initiative under Grant 0123030.