

Idaho IGEM Program

Progress Report Form

Proposal No. IGEM13-003

Name: Dr. Jim Alves-Foss

Name of Institution: University of Idaho

Project Title: IGEM Proposal: Multidisciplinary Cyber-Security
Faculty Cluster Hire

Reporting Period: August 2012 – June 2015

Contents

1	Summary of project accomplishments for the period just completed and plans for the coming reporting period:	3
1.1	Summary	3
1.2	Plans for Coming Period	Error! Bookmark not defined.
2	Summary of budget expenditures for the period just completed (include project burn rate): .	5
3	Numbers of faculty and student participation resulting from the funding, including internships:	5
4	List patents, copyrights, plant variety protection certificates received or pending:	5
5	List technology licenses signed and start-up businesses created:.....	6
6	Status of private/industry partnerships (include enough information to judge level of engagement):	6
6.1	Industry Collaborations	6
6.2	Additional Industry Outreach.....	8
7	Any other pertinent information that will indicate to the council that the project is meeting satisfactory progress.	8

Idaho IGEM Program

Progress Report Form

Proposal No. IGEM13-003
Name: Dr. Jim Alves-Foss
Name of Institution: University of Idaho
Project Title: IGEM Proposal: Multidisciplinary Cyber-Security
Faculty Cluster Hire
Reporting Period: August 2012 – June 2015

Information to be reported in your progress report is as follows (attach additional information as needed):

1 Summary of project accomplishments .

1.1 Summary

The focus of this project is on the hiring of several faculty in a multidisciplinary cyber-security cluster, with the intent of expanding current faculty with a cadre of new faculty. This group will then pursue new external funding opportunities for on-campus research and also pursue collaboration with Idaho and regional industry. These activities are based on the 4-phase approach outlined by the successful USTAR program: grow research team, grow extramural funding, develop technology and then commercialization. We are in the active stages of the earlier phases, and have had success in growth of extramural funding. As with USTAR, this growth is expected to occur over many years.

In November 2013 we submitted a project and budget modification proposal to HERC in response to a request to address shortfalls in expenditures. This modification included a reallocation of unspent funds to focus on accelerating industry collaborations in FY 14, and a reduction in total requested funds for combined FY 13-14 budget. We were informed that this re-budget was approved on November 22nd.

In January 2015 we were given 2 day notice to present a status report on the project. We were requested to give a budget estimate for the remainder of that project. At that time a large amount of our remaining budget was reserved for faculty start-up-funds which were partially funded through IGEM and partially through UI resources. In addition, we were still in the middle of the final faculty search. Given the very short notice of the meeting we were not able to provide a “formal budget”. The HERC council was provided a worst-case budget scenario. During that meeting the HERC council suggested using any potential residual funds to support activities that were within the scope of the grant, which we did.

In March of 2015 we were shocked to receive a rescission order from HERC for \$100K from this budget. This unannounced and unexpected budget cut caused a lot of turmoil in the budget. It

was too late to stop all activity we had started, and we were unwilling to stop faculty expenditures of their allotted start-up funds. We did terminate two non-permanent staff members, cancel trips, and cancelled planned summer pay for some faculty and students. In the end we also transferred \$47K in expenditures to other budgets.

Even with the budgets cuts, and delays in hiring. We were able to successfully fill all of the proposed faculty positions. These hires are enhancing research capacity at the University of Idaho. The progress of these searches is as follows:

New Full-Time Faculty Hires

- Computer Science Assistant Professor. Dr. Daniel Conte de Leon
- Sociology Assistant Professor: Dr. Kristin Haltinner.
- Civil Engineering Assistant Professor: Dr. Kevin Chang
- Electrical Engineering Assistant Professor: Dr. Sara Eftekharnjad. This opposition is funded 50% through ECE and 50% through IGEM
- Computer Science Assistant Professor: Dr. Michael Haney. This position starts August 2015 and is covered 50% form INL funds and 50% UofI. IGEM funds will not be used to cover his salary.

Additional Hires:

- Visiting scholar (temporary). Dr. Xia Yang from University of Electronic Science and Technology of China. We had a unique opportunity to bring aboard a visiting professor from China. Most of her pay came from the Chinese government. We provided \$9,500 toward her salary. She acted in a consulting capacity assisting us in reviewing how we work with industry and technology transfer. In addition, her expertise in secure operating systems was a benefit to this project. Although she has now returned to China, we anticipate working on establishing a long-term relationship with her home university. We have already submitted three joint research papers with her and are looking at more before the year is out. We have begun discussion of joint patent and funded research opportunities.
- Rebecca Crellin was hired Spring 2014 as a staff programmer. She started full time work at the end of March 2014. She worked with student developers to enhance existing research products toward the goal of technology transfer and potential commercialization. She assisted with externally funded projects on an as-needed basis. We were able to cover ½ of her salary from June 2014 through January 2015 on grant funds. *Her position was terminated due to the rescission of \$100K in funds in Spring 2015. We did not have sufficient time or resources to cover her salary before a new grant started.*
- Dr. Carlos Rivero was a postdoctoral researcher funded 50% time on IGEM funds and 50% on a federal research grant. Dr. Rivera's research focus was on information interchange, data exchange, semantic web and linked data. He worked with us from January 2013 through June 2013 on expanding expertise in large database systems and security aspects related to those systems.

- Dr. Jia Song was hired as a postdoctoral researcher from October 2014 through May 2015. She worked on developed of automated software analysis tools with Dr. Alves-Foss. *We almost lost her due to the \$100K rescission. We did find sufficient funds to cover her position through June 2015 – which enabled her to partner with Dr. Alves-Foss in the DARPA Cyber Grand Challenge Competition in June 2015, demonstrating the innovation of their automated software tool. They have now advanced to the finals of that competition.*
- Student and staff researchers. From this project, and with funding from related projects we have hired or provided funding for over 20 students.

2 Summary of budget expenditures for the project:

The following expenditures represent the total IGEM funded salary and fringe benefit expenditures the IGEM team, travel related to IGEM, and hiring expenses.

Category	Total Grant Expenditures
Salaries	\$ 941,000
Student Salary	\$ 138,900
Travel	\$ 102,500
OE	\$ 241,300
\$5K > CO	\$ 49,800
\$5K < CO	\$ 84,800
Student Fees & Tuition	\$ 39,200
Total	\$ 1,597,500

3 Numbers of faculty and student participation resulting from the funding, including internships:

- Faculty participation through June 2015: 15 (8 directly funded, 10 others involved in grants activities, travel, and student/new faculty mentoring).
- Student participation through June 2055: 30 (these students are at least partially funded through faculty start-up funds, IGEM software development efforts, and related grant activity tied to IGEM faculty and departmental funds).

4 List patents, copyrights, plant variety protection certificates received or pending:

We submitted an invention disclosure related to the automated software analysis tools developed by Dr. Alves-Foss and Dr. Song. It is likely this will be covered under copyright rules.

Several faculty research publications and monographs were also created through this project.

5 List technology licenses signed and start-up businesses created:

Dr. Alves-Foss and Dr. Song are discussing the creation of a start-up from using the automated software analysis tools they are developing.

6 Status of private/industry partnerships (include enough information to judge level of engagement):

All faculty involved in this project have been involved in discussions with industry and or government partners. These include discussions of joint research work, research/service work utilizing our new laboratory equipment, and partnerships in outreach to the general community. A representative list of these interactions are included below.

6.1 Industry Collaborations

6.1.1 Research Partnerships

The following companies have expressed interest in partnering with IGEM faculty on research projects. Avista corporation has already provided funding for their joint activity.

Avista Corporation: We have been working with Avista with a number of project proposals. They have funded one project for \$80,000 in support of research affecting the stability and reliability of the powergrid.

Frontier Communications: This national company, with a large Idaho impact, is very interested in working with us on improving security for corporate customers who use their communication services. We are working through negotiations of a confidentiality agreement and outlining a work plan.

Iron, Inc., Liberty Lake Washington: Although this global company headquarters its security division in Washington state, at a facility that employs over 1,000 people, many who live across the border in Idaho. We are in negotiations with this company to obtain donations of a smart meter testing lab, and a confidentiality agreement. Discussions have already lead to a preliminary idea for a new software capability that could lead to a start-up firm. In addition we are discussing a lab donation to provide UI faculty and students access to state-of-the art smart meters.

6.1.2 Laboratory Partnerships

The following companies have expressed an interest in partnering with us in research and/or service activities utilizing our new laboratory equipment.

Distributed Database Consulting Inc (DDBC), Boise Idaho: We have a signed a confidentiality agreement with the CEO of this company. DDBC owns eHealthApp, a company that provides

technology which enables insurance brokers to streamline their processes by removing many of the inefficiencies in largely paper-based processes of quoting and enrolling customers for small and medium size businesses. We are working with them to evaluate the security of their applications and websites, and using this real-world application as a training vehicle for our students.

Chief Architect: Coeur d'Alene based Chief Architect Software is a leading developer and publisher of 3D Architectural home design software for builders, designers, architects and home DIY enthusiasts. They are interested in setting up a cloud-based solution for their customers and would like to work with us on helping them evaluate performance and security aspects of such a service.

Murdock Charitable Trust: The trust provided us with a \$240,000 grant to support development of an adaptable computation server that provides us with the ability to provide large-scale modeling of complex scientific problems, including cyber security network analysis, and critical infrastructure modeling.

Schweitzer Engineering Laboratory (SEL): Engineers at SEL are interested in help developing algorithms and processes for examining large amount of power-grid related data for improving the stability of the power grid. They believe that we may be able to use our new laboratory equipment to provide them the solutions they are seeking.

Hewlett Packard (HP): We have had discussions with HP's Boise-based printer division, specifically the computer security group. They are interested in establishing a partnership with us in support of the security analysis of software solutions for their printers, from enterprise level print management down through personal computer solutions.

6.1.3 Education and Outreach:

The following company has expressed an interest in working with us in development education and training material, and providing that material to Idaho businesses..

XO Communications. We have recently started dialog with several individuals at XO communications XO is a provider of telecommunications solutions to a number of Idaho based companies. They are willing to work with UI on developing cyber security training materials for Idaho companies. They are also willing to work with us on presenting the materials as part of a "road show" where we provide regional training seminars.

Cyber Security Symposium Public-Private Partnerships: We hosted two cybersecurity research and practice conferences – spring 2014 and 2015. We had approximately 45-60 attendees at each conference, including some international participation in the 2015 conference. We put the call out to academics, students, industry and government to attend. We had attendance from academics from Idaho and Washington, business from the region and also some government representation. During the conference we had an industry panel discuss ways in which the University of Idaho can partner with industry, beyond our traditional education mission. This discussion has resulted in several follow-up conversations and potential future work.

6.2 *Government (and Government-like) Partnerships*

In addition to our industry partnership activities, we have been exploring the following government partnerships:

Idaho National Laboratory The INL is partnering with UI in several aspects of the IGEM initiative. INL is funding 50% of one of the IGEM faculty positions, to be based in Idaho Falls. INL has also partnered with UI Idaho IGEM faculty on multiple grant proposals for federal funding. We are actively engaged in developing another proposal due end of May.

Pacific Northwest Laboratory: The PNL is partnering with UI Idaho IGEM faculty on multiple grant proposals for federal funding. We are actively engaged in developing another proposal due end of May.

Other Government Agencies: We have had several other meetings and presentations with industry and government partners in the region as well as with NSF, DARPA, NASA and DHS with specific discussions related to multidisciplinary cyber-security research and for critical infrastructure research. These discussions are leading to several proposals being submitted this year to expand our research in these critical areas. The program managers at these agencies are very interested in the UI's approach to the faculty cluster hire and the research directions we are proposing.

6.3 *Additional Industry Outreach*

Cyber Security Seminar: Starting January 2014, we started providing a seminar series on cybersecurity. This series consists of a collection of academic research talks, industry presentations and how-to tutorials. We are videotaping these talks and are making them available on-line so that Idaho industry can view them.

Advisory Board Meetings: During Spring 2014 and 2015 the Computer Science Advisory Board met. One topic of discussion was the follow-on to the symposium discussion, how can University of Idaho partner with industry, beyond our traditional education mission. This discussion led to several future discussion threads, including non-traditional education activities.

7 Any other pertinent information that will indicate to the council that the project met satisfactory progress.

We were optimistic in the hiring timetable by hoping that the funds would be made available by July 1, 2012 and that all searches would move smoothly. We completed the hiring of a good cadre of faculty, with three really good hires already, and with good research staff hires.

Dr. Alves-Foss and Dr. Conte de Leon received a \$444,000 grant from the federal government (funding is for calendar year 2014) for cybersecurity research related to industrial technologies. The proposed research is a direct extension of earlier work performed by Dr. Conte de Leon.

Dr. Alves-Foss and Dr. Oman received a performance-based renewal of the Scholarship for Service program (\$510,000 funded in Summer 2013). Dr. Alves-Foss and Conte de Leon received a \$260,000 supplement to the Scholarship for Service program in March of 2015 and a \$300,000 performance based renewal in June 2015. This project provides full-ride scholarships for students for 2-3 years in return for an equivalent amount of service in federal, state, tribal or local government. IGEM funding was important to the performance review.

Several faculty participated in the submission of proposals for development of an adaptive computation server that provides us with the ability to provide large-scale modeling of complex scientific problems, including cyber security network analysis, and critical infrastructure modeling. This project has been funded at a level of \$540,000.

Dr. Alves-Foss and Dr. Song's participation in the DARPA Cyber Grand Challenge Competition, resulted in the awarding of \$750,000 of "prize money" to the University of Idaho. They have been invited to be one of 7 finalist teams to compete in an August 2016 competition against a field including teams from UC Berkeley, University of Virginia, Raytheon Corporation, and spin-off companies affiliated with Carnegie Mellon University, UC Santa Barbara and Georgia Tech. All of the competing teams have years of experience in either automated cyber defense or cyber-security capture the flag competitions. The grand prize in the final competition is \$2M.

IGEM faculty in CSDS, NIATT and Electrical Engineering have also participated in the submission of proposals for external funding. Proposals requesting over \$2M in research funds are still outstanding. More proposals are being developed and will continue to be developed over the summer.

Summary of total new external funding received by IGEM affiliated faculty since start of the IGEM project, over \$3.3M:

- \$1,070,000 in NSF scholarship for service funds, which includes \$30,000 in laboratory improvement funds
- \$440,000 in a federal cyber security research grant for calendar year 2014
- \$450,000 in a federal cyber security research grant starting Fall 2015
- \$300,000 in NSF funds to support major research laboratory equipment purchase
- \$240,000 Murdock Foundation grant to support major research laboratory equipment purchase
- \$80,000 Avista cooperative research grant
- \$750,000 DARPA Cyber Grand Challenge Competition prize.

USTAR Metrics:

Since the IGEM program is based on the USTAR program, it is instructive to look at the USTAR performance compared to IGEM participant performance. Data for the USTAR program can be found in the Utah Bureau of Economic and Business Research report¹ on the economic impact of

¹ http://www.innovationutah.com/assets/USTAR_Econ_Contributions-BEBR-042712.pdf - economic analysis

USTAR during the first five years of operation as well as the USTAR annual reports, specifically the 2009 report² (after three years of operation) and the most recent calendar year 2012 report³.

USTAR started in 2007 with 8 research teams and has now grown to a total of 21 teams. On average, USTAR has committed approximately \$1.3M per year to each of the research teams, with a current annual investment of \$23Million. Over the first several years of team building the USTAR teams have traditionally carried over a significant portion of these funds. The ability to utilize carry over funds is essential for academic research organizations that do not have access to loans from financial institutions, or funds from investors that can be used for long term hiring and planning. The stability of these funds increases confidence of new recruits.

Over the first five years, the USTAR teams hired 22 senior faculty and now supports 128 FTE researchers, including junior faculty, for an average of 6.5 funded researchers per \$1M in USTAR investment); this includes those hired on external grants. In comparison, the University of Idaho IGEM program is currently supporting 7 FTE in faculty and research staff per \$1M in IGEM investment, and also many student researchers.

The USTAR teams have cumulatively obtained \$69M in external funds over the past 5 years, averaging \$730K per \$1M of investment. In the first two years of team building, the teams averaged under \$170K in external awards per team. In the third through fifth years of the USTAR program, their research teams averaged \$1M in external funds per \$1M in investment. As a comparison, the UIIdaho research team has secured over \$3.3M in external federal and industry funding for the \$1.6M in IGEM investment, during this program. We anticipate continued success with the new

The USTAR research teams' total expenditures (from both state USTAR investment and external funding sources) reached an amount equivalent to 100% of annual state investment in the second year and grew to an average of 200% of annual state investment in the third through fifth years, some of these expenditures were from carry over funds and the rest from external grants. As a comparison, the UIIdaho research team's total expenditures for the first two years are expected to exceed 250% of the state's revised investment. The total expected IGEM team expenditures for FY13 and 14 will exceed \$2.5M; external funds will account for \$1.35M of that total, internal university funds will provide \$150K and IGEM funds account for the remaining \$1M.

This quick summary illustrates that the UIIdaho IGEM team is following the trajectory of the USTAR program, exceeding that program's start in many metrics. The intent of the USTAR and UIIdaho programs has been to build a research program following a four phase approach (see illustration on page 4 of the USTAR 2009 report): Phase I: Research Teams (and for USTAR -- buildings); Phase II: Extramural Funding Growth; Phase III: Technology Development and Phase IV: Commercialization. These phases are not necessarily sequential, but rather take place along a continuum, with initial progress on later phases as earlier phases mature. A trajectory being matched by the UIIdaho IGEM project.

² <http://www.innovationutah.com/assets/USTAR-Annual-Report-2009.pdf> - 2009 annual report

³ <https://secure.utah.gov/ustar-admin/documents/205.pdf> - 2012 annual report

A continued investment in the University of Idaho IGEM project will enable us to continue the growth of the cyber security research team at University of Idaho along this winning trajectory. We anticipate continued growth in external research funds, enhanced research activities, and enhanced growth of partnerships with industry. In the years to come, with continued investment, we will continue on the USTAR-style trajectory with success in all phases.