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## **AC 2012-3167: INFORMATION ASSURANCE STUDENT GROUP: HOW TO TURN A CLUB INTO A VALUABLE LEARNING EXPERIENCE FOR STUDENTS**

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## **Information Assurance Student Group: How to Turn a Club into a Valuable Learning Experience for Students**

The Information Assurance Student Group (IASG) in the Department of Electrical and Computer Engineering at Iowa State University was started in 2003 as a retention and engagement effort for students who were interested in information assurance and computer/network security. However, it quickly grew into a wholly student run organization that not only focuses on educating its own members, but also runs cyber defense competitions, works with corporate sponsors and recruiters, performs security product testing for vendors and provides K-12 outreach programming for the university. The IASG provides weekly active, inquiry-based learning meetings for its membership which focus on developing students' applied and practical security skills. The IASG has not only supported Computer Engineering (CprE) students who are interested in information assurance and computer/network security, but also opened the door for students in Management and Information Systems (MIS), Computer Science (CS), and other degrees to gain hands-on experience and real-life security skills.

This paper was written to share the authors' experiences, both successes and failures, in the formation, organization and implementation of the IASG so that other institutions can also harness the power and enthusiasm of undergraduate students with an interest in information assurance and computer/network security. The paper is organized into four sections. The first section details why the club was started, while the second gives a brief history of how the club arrived at its current successful state in just eight short years. The third section compiles lessons learned and the fourth section outlines future directions for the IASG on the Iowa State University campus.

### **The Motivation**

Several facets motivated the creation of the IASG. First, and foremost, Iowa State University is one of the original seven National Security Agency (NSA) Centers of Excellence for Information Assurance Education and has a strong and vibrant graduate program in Information Assurance since 2000. With an emphasis on national, collaborative efforts in computer security research, education, and outreach, Iowa State University is addressing the national concern for producing more Information Assurance professionals and is a preeminent academic leader in the field. However, Iowa State University only offers a couple of undergraduate courses in information assurance and it does not offer an undergraduate degree in information assurance. Many of the CprE students who come to study at Iowa State University select the institution because of their interest in information assurance and computer/network security. While upper division undergraduate students may take the graduate courses, the lower division undergraduate students do not have enough hardware, operating systems, or networking background to succeed in the graduate courses. Therefore, their enthusiasm and interest are "put on hold" for two years while they work through their curriculum which would allow them to take formal information assurance and computer/network security courses. For those students who have interest in information assurance and computer/network security, these two years of engineering foundation building can seem like huge obstacles and disincentivize them to continue to be interested in and

want to study in this area. Therefore, the IASG club was started as a retention tool. The IASG was one answer to keeping students who want careers in information assurance and computer/network security engaged during their undergraduate coursework.

Second, one of the authors of this paper is the Director of the Information Assurance Center and his research area focuses on information assurance and computer/network security. In the early years of Iowa State University opening the Information Assurance graduate education program, he had a steady stream of undergraduate students coming through his office looking to work on research projects focused on information assurance and computer/network security. While these undergraduate students were very talented and very interested in learning information assurance and computer/network security, the projects the faculty member could devise and assign were limited in scope. Further, much supervision and direction was needed because the students lacked the curricular background knowledge. Additionally, as the Iowa State University program grew, gained in stature, and attracted even more graduate students, the number of undergraduate students looking for information assurance and computer/network security experiences exploded and the small, intense contact projects could not be scaled to accommodate the large number of requests for the experiences. Because the author is not only interested in information assurance and computer/network security research, but also interested in undergraduate education and student retention, he suggested to some of the upper division undergraduates that they should start a student club focused on helping students learn about information assurance and computer/network security in an informal setting. Thus, the IASG was born.

Third, the faculty member is committed to expanding the pool of students who are attracted to information assurance and computer/network security programs and who graduate with appropriate experience to be valuable to their employers. While the faculty member recruited upper division undergraduate students who had taken courses in computer engineering and had worked on security projects for him to start the IASG, the faculty member was committed to providing access to this club to all levels of undergraduate students. The intention was for IASG to be inclusive in its nature, allowing the lower division undergraduates to actively participate, as well as those upper division undergraduate students. His theory was that by expanding the pool of students who are attracted to information assurance and computer/network security programs, the number of students who graduated with information assurance and computer/network security experience, as well as the number of students entering the graduate program, would grow. Potential employers would be provided a win-win solution with both undergraduate and graduate students able to serve as information assurance professionals or design engineers with a specialization in information assurance.

Fourth, as any ABET accredited engineering program recognizes, students need lab (or hands on experiences) to truly synthesize concepts. The faculty member encouraged the organizing students to present inquiry-based learning topics in each of the weekly IASG meetings. Inquiry-based learning is a multifaceted approach that involves reviewing information about what is known about a problem, gathering additional information, proposing solutions or explanations and communicating or acting on the results. The focus of all activities is on critical and logical thinking<sup>12</sup>. The IASG originally had weekly lectures and hands on activities that focused on foundations and elementary networking during the fall semester and each spring semester would move into more advanced security topics. Initially, faculty members were recruited to come

conduct one hour talks and the ensuing hands-on demonstrations and labs. Also, corporate security folks were asked to be guest lecturers. However, as the IASG grew the students began understanding that the upper division undergraduate students and the more approachable graduate students working on the faculty member's research security projects could be used as a resource for the lectures and hands-on experiments. This phenomenon of students teaching students in an inquiry-based learning environment is covered in detail in the section below.

### **The Evolution of the Club (or How Did We Get Here in Eight Short Years?)**

IASG was started by a core group of undergraduate students in CprE who were interested in security issues and had worked on research projects for one of the authors. While IASG began as a way to support and encourage CprE students, because of its inclusiveness and the large interest among undergraduate students in information assurance and computer/network security, the club quickly grew in membership to include students who are majoring in MIS and CS, as well as CprE. Students from all three majors, (MIS, CS and CprE) work together to run events, provide training and work on vendor products. While there are always ongoing jokes and teasing among the students about which major is better/harder/more important, all students are equal within the IASG. Each of the different majors provides different qualities and skill sets to the IASG and the IASG cabinet, all of which have proven valuable over the years. The last three out of four years the president of the IASG has been a student from MIS.

#### *Membership and Lectures*

While IASG started as small group of CprE students who met once a week each semester, IASG now has a membership of more than 130 students who attend weekly meetings where upperclassmen and graduate students deliver content and provide hands-on activities. The weekly meeting covers advanced topics that involve a level of understanding in information assurance and computer/network security. This year second bi-weekly meeting was added for inexperienced students that focuses on building block concepts in information assurance and computer/network security. All meetings are a combination of lecture, demonstration, discussion and hands-on activities.

Historically, the IASG club would start the fall semester off with basic networking and operating system lectures and labs and build to true security lectures by the second semester. This year the student cabinet of the IASG club decided to hold more frequent meetings. The Tuesday night meeting was on a more advanced security topic. The every other Thursday night meeting was for beginners to help them understand the fundamentals of computers and networking so they could better understand and participate in the IASG. All students, no matter the skill level, were invited to both meetings each week. Additionally, there would be weeks where corporate presenters would be in the Tuesday night meetings. The list of topics for the Fall 2011 IASG meetings is listed below in Table 1. The IASG members record the lectures and post them online on the IASG web site (<http://www.iac.iastate.edu/iasg/frontpage>) for students to have access to later as a reference or if they missed the lecture. There is also a historical archive with all past years' lectures accessible to members on the IASG web site. Average attendance for the Fall 2011 sessions was 50 at the general meetings and 30 at the beginner lectures.

The IASG also has social activities for its members. As can be seen in the topic listing for the Fall 2011, that there was one night where a movie night was held featuring classic hacking movies such as Sneakers, WarGames, and, of course, Hackers. This idea stemmed from the

IASG club members attending DerbyCon where they were able to take breaks between conference sessions by hanging out in a Hacker Movie Marathon conference room. The student leadership wanted to replicate that fun activity for the general club enjoyment. Additionally, the IASG hosts a Halloween Party each year and this year, in addition to food, non-alcoholic drinks, and prizes for best costumes, the IASG provided Karaoke and a technology-themed scavenger hunt as part of the activities. The IASG has also partnered with other student groups (ACM, IEEE, Digi-women) for both technical and social meetings.

**Table 1. IASG Lecture Topics for Fall 2011**

<b>Main-Line Lectures:</b>	<b>Beginner Lectures:</b>
Application Cracking and Anti-Reversing Techniques (Sponsored) Barrier1 Firewall Technologies (Sponsored) McGladery Consulting Password Cracking and Security CDC Debriefing: Shell and Web Server Vulnerabilities Networking 101 (Social Event) Hacker Movie Night (Sponsored) Union Pacific (Sponsored) Boeing SQL Injection Security in the Real World	IPv6 pfSense Firewall How to Set Up a CDC Network in Four Mouse Clicks Linux Primer for Beginners The Basics of Host Security

*Cyber Defense Competitions*

The IASG began hosting Cyber Defense Competitions (CDC) in 2005. The first event was for Iowa State University students only to provide an opportunity for students who were interested in information assurance and computer/network security to work on real systems and protect them from outside attacks. In a CDC students design, configure, and maintain a set of servers and a network in a secure manner prior to the competition. Then during the day long competition they work to prevent security breaches and to remediate any exploits that occur while maintaining a fully functional network for their end users. The program was expanded rapidly and the IASG now hosts four cyber defense competitions each year. The club is responsible for organizing and running events for Iowa high schools, Iowa community colleges (two-year), our own Iowa State University students, and four-year students from universities across the nation.

Organizing and running CDCs requires a large amount of time and technical setup. For each CDC the students for which the event is hosted design, configure and maintain a set of servers and a network in a secure manner remotely approximately one month prior to the competition. The members of the IASG provide the remote setup support for each of the teams for the month leading up to the competition. This is a beneficial exercise for IASG members in

communication, terminology, network design, and implementation. Additionally, the IASG members configure and maintain all the competition equipment and the support systems such as remote access and server imaging machines, as well as writing the rules for the competition and running the actual event.

**Table 2. Cyber Defense Competition Participation Numbers**

Semester	ISU CDC	National CDC	CCCDC	High School CDC/IT-Adventures
Fall 2005	45			
Spring 2006		18		60
Fall 2006	64			
Spring 2007		<sup>a</sup>		107
Fall 2007	74		18 <sup>b</sup>	
Spring 2008		40		139
Fall 2008	71		50	
Spring 2009		88		174
Fall 2009	42		82	
Spring 2010		38		103
Fall 2010	67		82	
Spring 2011		54		103
Fall 2011	50		66	

<sup>a</sup> – The National CDC was not held in the Spring of 2007 due to resource scheduling conflicts.

<sup>b</sup> – The CCCDC was first held in the Fall of 2007.

<sup>c</sup> – The number of students participating in the CDCs fluctuates from year to year. Since the IASG members now completely run the events with only limited faculty involvement, there are fewer club members who participate in the ISU CDC. Also, while the high school CDC peaked at 174 students, we have been fortunate from an equipment provisioning respect that the number students playing each year in the high school CDC has stabilized closer to 100.

The number of students who participated in each of the different types of CDCs is listed in Table 2. The first high school cyber defense competition was held in May 2006<sup>3</sup> and the first community college cyber defense competition was held in December 2007<sup>4</sup>. The national event was first held in 2006. The high school cyber defense competition is now part of a larger initiative to get high school students interested in information technology called IT-Adventures<sup>5</sup>.

The cyber defense competition is one of three venues in which students spend a year studying a venue and then come to the ISU for a two-day competition to showcase the skills they have learned. While our cyber defense competitions range in size from 40 to 175 student defenders in teams of 4 to 8, our largest competitions are for high school students. In April 2009 the largest cyber defense competition ever hosted in any division occurred on campus with 36 teams and nearly 175 students competing. The most recent IT-Adventures competition had more than 300 students participate in the three venues and involved more than 30 high schools.

While the general focus of the CDC is on letting students learn about configuring and securing networks, research projects also come out of the running of them. Most recently, for the Fall 2011 Community College Cyber Defense Competition (CCCDC), a core group of six Iowa State University students decided that the visualization and scoring software that showed how teams were doing during the CDC was not useful to most teams. Because the scores on the old visualization and scoring system were created in several disparate systems and then manually transferred to another, the reporting of the team scores and activities lagged significantly from the real events occurring. These six students developed the specification for new visualization and scoring software by talking to the former IASG club president who has run several of the cyber defense competitions. After talking to him about the litany of desires that the scoring software could do, the team of six students set to work creating a new visualization and scoring system.

The new visualization and scoring system replaced three manual activities that occurred during the CDC. It tests the network services that teams are supposed to be running and scores if they are up or down. It immediately displays the end user usability scores, as well as the scores for detecting, reporting and fixing vulnerabilities and intrusions on their networks during the event. The new visualization and scoring software centralizes all the data that used to be stored on several systems and computes the team scores in real-time as they are earned during the competition. While the new software was not specified to provide traffic visualization which was a function of the old software, the group of six students has that upgrade as one of their revisions for the software. Total development time for the new visualization and scoring system was three months from inception of the project to use in a cyber defense competition; something the six students were very proud of.

The IASG uses the Internet-Scale Event and Attack Generation Environment (ISEAGE – pronounced ice age) as the test bed in which to run the CDCs. ISEAGE simulates the Internet through which the students connect their competition networks. While ISEAGE provides the competing teams with proxy web and ftp access to the real Internet, it provides a self-contained “sand box” for the student competition networks. By using ISEAGE, the penetration testing, vulnerability exploiting, and ensuing attacks on the student competition network ensures that no attack traffic is released into the real world. All projects associated with the ISEAGE research program develop ice-associated names such as Avalanche, Glaciers, Freezer, ISEMaker, ISECube, etc. The six students who worked on the new visualization and scoring software were in tune to the ISEAGE research project naming scheme, although none of them are formally associated with the research project. The six students named their new product IScorE (or ISE for short). The six students were very proud of their ability to contribute to the ISEAGE project in the CDC area and to develop such a clever name that kept with the research team’s naming convention.

A final note about the IScorE software - its development was a complete and wonderful surprise to the faculty member in charge of the ISEAGE research project. This further demonstrates how the IASG and student members who are empowered can develop research questions and projects, as well as resourceful solutions, on their own given a problem and a desire to solve it.

### *Hack-a-Thons*

While CDCs give students experience in how to identify and secure vulnerabilities in their computer networks and systems, as well as defend against attacks from exploits, the IASG decided they wanted to give Iowa State University students an opportunity to learn about penetration testing and playing offense on computer systems and networks. Thus, the first IASG Hack-a-Thon was born. More than 30 students participated in the all-day event held on a Saturday early in the Spring semester. The Hack-a-Thon gave students the opportunity to gain hands-on experience with system testing and provided them insights into how hackers actually use exploits to gain access to systems.

### *Outreach Activities*

Although three of the CDCs could be considered outreach activities since they are run to benefit students who are not Iowa State University students, but rather high school students, community college students, and university students from across the nation, this section of the paper focuses on additional outreach activities beyond the CDCs that are undertaken by the IASG members.

One of the outreach activities which requires the most preparation for IASG members is teaching a week long summer workshop on security for high school students for the Office of Precolliagate Programs for Talented and Gifted (OPPTAG). The OPPTAG workshop focuses on providing basic networking and basic security issues for different operating systems and services to the high school students in short, one-hour sessions and then gives the high school students several hours to build their own network and servers using what they just learned in the discussions about security. At the end of the week long activities, the high school students use the systems and network they constructed to play in a mini CDC and have their security skills they learned put to the test. The high school students work with current technology like firewalls, wireless routers, and intrusion detection systems in the ISEAGE test bed. The IASG members provide all lessons, materials, labs, and equipment setup for the week's activities. There is no faculty member involvement in the high school outreach program.

Additionally, the Department of Electrical and Computer Engineering advisors call upon the IASG members to help with high school career days and other displays and booths where students are being encouraged to study at the institution and in the department.

Further, some IASG members have coached high school teams competing in the CDCs. Many times the basic lecture materials and hands on activities provided to the IASG members is also provided to the high school teams that the IASG members are coaching to help them prepare themselves for their CDC competition. Most of this activity has been with local high schools within driving distance of Iowa State University so the IASG members and the high school



students could meet face-to-face. However, there has been some experimentation with coaching teams at a distance to help students in rural Iowa be able to participate in the CDCs.

### *Vendor Testing*

During this past year several companies have come to the Director of the Information Assurance Center asking about having students test their security products. In response the IASG now works with companies to implement product testing. A company wanting the IASG to test their product has a representative come to an initial kick-off meeting to discuss their product and outline the ground rules for the testing with the club members. After the testing cycle is complete, the company representative returns and talks about the results. This is one of the few times where the faculty member manages the interaction to make sure the expectations are set correctly.

In the most recent test a company provided a network security product and the students were challenged to try to attack systems protected by the device. The students were provided the network addresses of the machines to be attacked and were told that if they “broke” into one of the systems they would win a cash prize. The company was told that since this is a group of students testing their product that they would not get any formal report. The company was also asked to donate the prize money to the student group if no student was able to break into the systems. During the two month long testing period the company reported thousands of attack attempts launched against the target computers. While the students were unsuccessful in their attacks they had fun being part of a product test and also now have another experience to cite on their resumes. The faculty member and the IASG are currently formalizing this testing methodology to offer it to other companies. The companies involved see this as a way to get their name in front of potential employees, as well as a way to have their products examined by young and resourceful individuals.

### *Funding for IASG*

Any new club needs a resource stream and IASG was no exception. The initial startup money to fund IASG’s weekly meetings, social activities, and CDCs came from an incentive account controlled by one of the faculty members who authored this paper. The IASG members also paid a nominal yearly club fee. The costs in the early years were relatively small. Funding for the CDCs primarily involved paying for food to feed the students during the events. Research equipment for the competitions was readily available for use and the IASG members were given access to special equipment purposed for such events.

Once the companies started seeing the types of students coming out of IASG club membership, especially the CDC competitors, companies started to heavily recruit those undergraduates. While the students did not have a certificate or degree in Information Assurance, they had gained practical knowledge and hands-on experience from their membership in IASG and experience in the CDC events. The IASG was able to leverage this interest in hiring graduating members and now these corporations are providing sponsorships and other funding for the IASG. One of the larger sponsors provided enough money to run all the CDCs in the 2011-2012 academic year. In return, they received major sponsor naming of the events.

Corporations are more than happy to provide money to encourage undergraduate students to participate in the IASG so that they learn about information assurance and computer/network security. The corporation sees the value of having undergraduate students who are knowledgeable about security and are willing to put money into the IASG to help ensure they will be getting the information security and design engineers they are looking for upon graduation.

### *Empowering Students is Critical*

Although providing information assurance and computer/network security inquiry-based learning activities, creating the correct inclusive environment, financially supporting the hosted events, providing opportunities to work with new equipment in vendor testing, and connecting the students into the Iowa State University outreach activities have all been important in the IASG's success over the last eight years, the most critical component has been the empowering of the undergraduate students. While a faculty member helped initiate and facilitate the early years of the IASG, the true success of the program stems from the ability to provide undergraduates unfettered control of their own activities. The IASG members are provided with keyed access to their own physical space within to work. This empowers them to be in control of the space and of the activities that occur in that space. The IASG members were also given almost unlimited access to the ISEAGE test bed and other research equipment with which to experiment and develop their own ideas and activities. They also were allowed to help develop testing protocols for the vendor product testing and to work in product testing on the latest products the vendor supplies to the research group.

Although there have been three physical moves of the ISEAGE research facility in the past eight years, the IASG and its members were always given a space where they can come and go at will and work on projects at any hour of the day or night. They have access to research equipment and are not only allowed, but encouraged, to setup servers and services, as well as try new approaches to teaching and solving problems. There is no real structure to the space they are provided and no one monitors their productivity in return for the use of the space. It is truly a creative environment for the IASG members.

### **Lessons Learned**

Although the authors would like to claim that the success of the IASG club was part of a grand design, more honestly it has been lessons learned through trial and error about what works for undergraduate students to keep them interested in information assurance and computer/network security, as well as what motivates them to take on their own projects. In this section the authors highlight some of those key lessons learned over the past eight years and encourage others to provide the same access to undergraduate students at their institutions.

### *Let the Students Run the Club*

In starting an information assurance and computer/network security club, it was critical to find the key undergraduate students to lead the club. Then turn them loose and let them run. Don't weigh them down in the first years with trying to find resources or do the corporate fundraising. That will come with time and with the growth of the club. Let the students focus on the learning materials, the labs, the social activities, and the events they are going to host and run. The members of the IASG are encouraged to research a topic of interest and create a session for the group. There are no "core" set of lectures and labs that are visited every academic year by the IASG. The club clearly focused on the security interests of the members each year. The most well-received programs each year are presented by the undergraduate students. Their peers find them accessible to their technical abilities and intellectually engaging to their interest in information assurance and computer/network security. Further adding the beginner lectures has enabled less experienced members to not feel overwhelmed, leading to higher membership and involvement overall.

And, when we say let the students run the club, the authors really mean it. You must truly let the students run the show. The Department of Electrical and Computer Engineering at Iowa State University was so impressed with success of the IASG, that four or five additional special interest groups in things like solar power, software systems, and communications systems were setup a few years ago. And they failed miserably because the faculty members in charge tried to treat the club activities like a course where the students were getting a pass/fail grade. There were lectures which consisted of the faculty talking heads – think "sage on the stage" – approach to a club. The students weren't engaged and the club memberships dwindled and some completely dried up. Also, these clubs were exclusive and targeted only the high-end students. Students don't want another course. They want an opportunity to put into practice some real world experience and to learn through inquiry.

Further, letting the undergraduate students run the club scales more easily from faculty directed clubs where the faculty basically has another lecture to prepare to faculty empowered student inquiry-based learning where students lead the charge. The faculty members continue to be a resource for learning and an advocate for the group, however, the students need to take ownership of the club.

A word to the wise, when you empower students to run with their own agenda and have very little adult supervision, be prepared for a few misqueues along the way. Be ready to help them back out of their small problems and be ready to pick up the pieces when they run 100 miles per hour into a brick wall and totally mess up whatever project they were working on. Most of us have all been there with research; selecting one path only to find a more parsimonious solution in a different branch of thinking. Unfortunately, because undergraduate students have less real world experience they tend to make more mistakes than those of us who have been around for awhile. This means they sometimes find really cool solutions to problems. But, it also means they can completely underestimate the amount of time or planning needed for hosting an event. Our IASG members always pull through in a tight situation, but many times they pull "all nighters" or event all "weekenders" to get their projects completed. They also learn from this experience, though it sometimes is hard not to interfere when you see them heading down a poorly chosen path.

Also, since students who study information assurance and computer/network security have to understand how attacks, exploits, and hacking work to be able to prevent or minimize their effect, there is always a need to discuss ethics at the beginning of the academic year. The first or second meeting of each year the IASG devotes a session to the ethical use of the knowledge the students will be learning throughout the year. As an additional reminder, during each session where vulnerabilities and their associated exploits are demonstrated and experimented with in the lab environment, the presenter reiterates the importance of ethics when studying information assurance and network/computer security. With this reminder also comes the standard “DO NOT ATTEMPT THIS AT HOME!” warning stated and restated throughout the night’s session to ensure the students realize that experimenting outside the lab environment is not to occur.

### *Inclusive, Not Exclusive*

The club needs to be inclusive, not exclusive. In higher education, especially in computer science or engineering, academicians tend to target the Talented and Gifted (TAG) students. This begins in middle school, continues into high school, and is found in extracurricular programming, as well as in academic classes. When high school graduates get to campus as undergraduates, the courses, or at least the faculty members in the courses, tend to teach to the TAG students. Or, in the case of computer science or computer engineering, teach to those students who have had a programming class or to whom math and logic comes easily. The goal of IASG is to allow all levels of students to feel at home and to be able to learn. The students who are upper level undergraduates and graduate students in the club can provide valuable leadership, teaching and knowledge for lower level undergraduates (and lower knowledge students). It is fun to watch how much the students really enjoy teaching each other, as well as others, about security.

Another note to the wise, even when the goal of the club is inclusion, there can be setbacks in membership. In one year where the president of IASG was not as inclusive and wanted the club to be more exclusive and working on upper level topics only, the lower level undergraduate students’ participation drop significantly. This is a time where the faculty member needs to intervene by reminding the IASG cabinet that the club was meant to be inclusive and helping them find their way back to inclusive topics and territory.

### *Have FUN!*

The IASG isn’t all security, all the time. The IASG’s main purpose is to provide an outlet for undergraduate students to participate in information assurance and computer/network security activities. However, one of the key team building activities that happens with the IASG membership is their bonding during social activities, as well as during the setup, management and running of the CDCs. The students spend hours and hours together working side-by-side on these club activities and they forge friendships that are stronger than any that can be built during the classroom time. The social events that IASG sponsors allow the students to be themselves with other students who are like them and to share funny stories and activities. Additionally, since IASG is not monitored by any adult (faculty member), the students also have fun during the times they organize and staff an event. Yes, it does mean that sometimes the projects run into the wee hours of the night because the students don’t get down to business until midnight.

But then, you just have to remember that these are students and their work schedule doesn't always match the rest of the working world. And, there is a lot of fun when hosting events and performing outreach activities. When the students are allowed this freedom they work even harder and perform even stronger under pressure. And, many times, they are more creative than when they are "told" what to do and required to "act professional." The addition of "just for fun" events and hands-on security labs have been motivation for students to volunteer with the IASG club activities and events such as the CDCs. They started off just wanting to have fun, but end up enjoying it so much that they don't mind the work.

*If You Build It, Funding Will Come (and It's Not Really Much Money that is Needed)*

Funding will come, but it may be slowly. Once the companies find out the type of students being produced through the IASG and the students' understanding of security, the funding for the club and its events will come. While the IASG has been active and very beneficial for the students for the past eight years, it has just been over the course of the last two years where significant corporate sponsorships have started to materialize. While companies have always been happy to feed the IASG members when they give technical talks at the weekly meetings, providing enough pizza and soda to feed a small army, it is only recently that they have started to pay for events where they are not the keynote speakers and to fund scholarships focusing on security. As part of an initiative for the upcoming academic year, Iowa State University and the IASG has received corporate money to provide scholarships to students who are working on information assurance and computer/network security by participating in the club. This is the first time scholarship money has been given for IASG participation and it is anticipated other companies soon following suit.

Also, creating and maintaining ties with the professional community has aided students in finding internship, part-time, and full-time employment opportunities. Companies which employ alumni of the IASG are often vocal that they prioritize and prefer the group's members during the hiring process. And, those IASG alumni are strong allies in corporate America and help provide inroads for new graduates to jobs in information assurance and computer/network security. They also are valuable resources in funding the IASG activities and recommend sponsorship of the club to their employers. Additionally, many IASG alumni return to campus to teach one of the weekly club meetings and they also return several times a year to participate as the attack team for the CDCs. The IASG has been instrumental in building strong alumni ties for, not only the research project and the club, but also for the Department of Electrical and Computer Engineering.

In an effort at full disclosure, it should be noted that the estimated yearly cost to support the IASG and the three CDCs is about \$10,000. The high school CDC is not part of this estimate since it is funded as part of the IT-Adventures program. In addition to the \$10,000, the IASG has access to the ISEAGE research lab and to department labs. Even if an institution does not have access to research lab equipment, the total dollar value needed to establish a security lab to allow students to work on projects is minimal. Often older, cast off computers serve well as Unix machines which the students can use.

There is one cautionary note in working with corporate presentations. These presentations can be a gamble as to how they will be received by the club members. In the early years, the IASG

leadership did not review presentation content beforehand from corporate presenters, which often led to dry, infomercial-style presentations with little technical background into the products or services the company provided. Today, the IASG's leadership will first make suggestions and review slides prior to the presentation to ensure that the content presented will be engaging and relevant to members. Members have commented on this change and our corporate presenters have also noted it helped them be more prepared and comfortable when speaking to the organization.

### **Future Directions**

A totally student run club that focuses on information assurance and computer security has enhanced undergraduate education at Iowa State University. The students are gaining valuable security skills, as well as leadership and teaching skills through participating in weekly meetings. Additionally, the interest in information assurance and computer/network security is nurtured and supported during all undergraduate years of education, not just the upper level years where students can take formalized classes. This paper was written to share the authors' experiences, both successes and failures, in working with the IASG so that other institutions can learn from our work to engage and activate the enthusiasm of undergraduate students with an interest in information assurance and computer/network security.

Although many of the activities of the IASG that have been described in this paper have been mature, on-going events, the club is always looking for new ideas and twists on old ideas to keep students engaged and interested in information assurance and computer/network security.

One of the grandest activities that is being considered is hosting a break-in lab that would allow anyone with a valid Iowa State University login to participate in the event. This would be similar to the annual Hack-a-thon where IASG learn about penetration testing. However, the activities would be designed to be accessible to students who are not formally studying a computer-related field, but who have an interest in security. Like all of the CDCs and the Hack-a-Thon, all activities would be carried out in the ISEAGE testbed environment and would be isolated so no attacks could take place on real network equipment or servers. The IASG leadership is conceiving of this activity as a game with "levels" and that the different levels would build in complexity just as any game does. While this activity is intriguing currently there are two road blocks to implementing it. First, and foremost, is the time commitment from the IASG membership to build and support a long-running activity such as this and to continue all their CDCs, meetings and outreach activities. Second, there would university permission to obtain before any security activity which would allow campuswide access could be released onto campus. This permission would also require additional ethics education for those students participating in the event and more vetting of the students to ensure everyone understand the significance and responsibility of what they are learning.

With the advent of new monies for the IASG, especially the scholarships, thought needs to be given to the start of formal education in security education for undergraduate students. If our corporate employers are willing to pay to sponsor extracurricular activities and provide

scholarships for them, as well as preferring to hire our students who participated in IASG and/or the CDCs, we see that as a clear signal that the corporations desire students with this knowledge. To this end Iowa State University is working on the development of an undergraduate certificate in Information Assurance. We will use some of the ideas for lab and lessons developed by the IASG to help create the undergraduate courses for the certificate. Even after the new degree is created we see there will still be place for IASG and their education mission. Students interested in security often cannot get enough and if anything we see the new degree will increase the interest in IASG.

## References

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