



Computer Science Industry Advisory Board Meeting Minutes  
September 12, 2012

Industry Members Present:

- Terry Brandt, IAB member representing Zoot Enterprises, Inc
- Tyler Dusek, IAB member representing Schweitzer Engineering Laboratories
- Bill Ivanich, IAB member representing EchoStar
- Justin Malsam, IAB member representing Micron
- Craig Spanning, IAB member representing TeeJet Technologies
- Greg Waring, IAB member representing Energy Laboratories, Inc.

Montana Tech Representatives Present:

- Jeff Braun, C.S. Dept. Chair
- Frank Ackerman, C.S. Faculty
- Celia Schahczenski, C.S. Faculty
- Michele Van Dyne, C.S. Faculty
- Keith Vertanen, C.S. Faculty
- Tami Windham, C.S. Administrative Associate
- Brent Donovan, C.S. Student
- P.J. Neary, C.S. Student
- Steve Wilson, C.S. Student
- Justin Emge, S.E. Student

**Welcome and Introductions**

Doug Coe, Dean of the College of Letters, Sciences and Professional Studies welcomed the board members to Montana Tech and thanked the members for their time and efforts put into the Computer Science program.

Chancellor Don Blacketter welcomed the board members to Montana Tech and emphasized the importance of their advice to the department. Dr. Blacketter expressed his appreciation to the board members for their time support and feedback to the Computer Science program.

Introduction of all attending the meeting were made. Jeff Braun, Department Head welcomed the board members to Montana Tech and thanked the members for their input to the department.

**Computer Science Department Updates (Jeff Braun)**

- **2<sup>nd</sup> Highest Enrollment with 2815 students – Fall 2012**
- **Buildings:**
  - Health Sciences Building renovated
  - HPER expanded
  - Alumni Center nearly completed
  - New dormitory being considered
- **New High Performance Computing cluster** – located in MG building
  - 20 node cluster, dual 8 core Xeon processors (E5-2660)
  - 25 TB storage
  - 40 Gbps InfiniBand Interconnect
  - 4.6 TFLOPS
- **3D Visualization Wall**

**New Developments in CS Since Last Year**

- **Faculty:**
  - No major changes
  - Michele Van Dyne received tenure
  - Gary Mannix retired
  - Melissa Holmes – Adjunct Instructor teaching 3 CSCI courses
- **Equipment:**
  - NAO Robot used for Senior Design Project
  - iRobot purchased for SE projects
- **ABET Accreditation:**
  - Interim Reports submitted for both CS and SE
  - Accreditation should be extended beyond 2013
    - Both SE concerns and weaknesses resolved
    - CS weakness now a concern, one CS concern resolved
- **Curriculum**
  - Students are no longer required to select an option in Computer Science
  - Fundamentals of CS I/II using Java - Keith Vertanen (Video)
  - First Graphics course taught last spring
  - Computational Thinking – now satisfies a social sciences elective for all Tech students

**2011 Goals Update**

- **Increase Enrollment**
- **Decrease Administrative Overload**
- **Enhance (External) Image**
- **Address ABET Accreditation weaknesses**
- **Increase research and scholarly activity**
- **Developed a strategic plan to address these goals**

**Progress**

- **R.E.A.L. Scholarship Program – Year 4**
  - Earn up to \$600 by completing 4 online modules
  - Competitive Programming Challenges
    - Earn \$300 for each program completed
  - 6 completed all 4 modules (1 did 2 modules)
    - One student completed a program for an additional \$300
  - All 7 enrolled in 2012 (3 in FESP)
  - Currently helps support 18 students (\$3500/year)
  - First corporate sponsor - Zoot
- **Increase Enrollment**
  - Dine with the Chancellor – Missoula/Flathead
  - Developed Recruiting Plan in Strategic Plan
  - New Recruiting Brochure
  - Improve Year 1 to Year 2 retention
  - CS/SE Enrollment up 20%
  - CSCI/ESOF course enrollment up 35%

Enrollment			
Total students	SE	CS	CS+SE
2000	13	113	126
2001	16	100	116
2002	18	86	104
2003	28	69	97
2004	26	45	71
2005	20	45	65
2006	21	36	57
2007	25	26	51
2008	21	26	47
2009	26	27	53
2010	20	28	48
2011	22	26	48
2012	25	32	57

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Enrollment			
CS+SE	total fr	total grads	%graduate
2000	51		
2001	41		
2002	34		
2003	40	13	
2004	22	7	14
2005	21	7	17
2006	17	10	29
2007	24	11	28
2008	23	5	23
2009	24	4	19
2010	19 (FESP)	4	24
2011	18	2	8
2012	~17	4	17

- **Decrease Administrative Overload**
  - AbOut – ABET Outcome Assessment database
    - First version completed this past summer
    - Tested on Spring 2012 courses
    - Will use for 2012-13 assessment
  - CS Faculty Handbook draft completed
  - Created schedule for FESP-CS students
    - Possible to graduate 4 years if start in Intermediate or College Algebra
- **Enhance (External) Image**
  - Website – current events – updated about once a month with latest department news
  - Programming Team Wins Montana Competition at MSU and at Salt Lake City site
  - TechXpo – SE student projects, AI Connect Four tournament, Graphics projects, NAO Robot
    - Good department exposure and non departmental interest
  - Computational Thinking course – now a Social Science elective. 14 students enrolled in fall 2012
  - High Performance Computing – working with several other departments
- **ABET Accreditation**
  - CS and SE accredited through October 2013
  - Submitted Interim Report to extend
  - Reworked Continuous Improvement Plan
- **Increase Research and Scholarly Activity**
  - Michele Van Dyne presented two papers
  - Keith Vertanen presented one paper
    - Received Honorable Mention for Best Paper
    - Coauthored four other papers
  - Keith Vertanen cosponsored SIG-CHI Workshop
  - Frank Ackerman presented a paper at ASEE
  - Keith Vertanen submitted three grant proposals
  - Celia Schahczenski submitted one grant proposal
  - Michele Van Dyne accepted into the Montana NASA EPSCoR Faculty Connections Program
  - Jeff Braun headed up Tech’s HPC initiative

#### 2012 Goals

- **Increase Enrollment**
- **Decrease Administrative Overload**
- **Enhance (External) Image**
- **Increase research and scholarly activity**
- **Any and all suggestions welcome!**

#### Plan

- **Increase Enrollment**
  - R.E.A.L. Scholarship Program – Year 5
  - Montana Minds Scholarship returns - \$6500/yr. Expect ~5 CS/SE students to receive one in 2013
  - High School Presentations – Keith Vertanen
  - Dine with the Chancellor
  - Follow-up on campus visits
  - Improve retention
- **Decrease Administrative Overload**
  - Improve AbOut and provide additional reports
  - Reduce assessment for some outcomes
  - Complete Faculty Handbook
    - Improve advising for different situations
- **Enhance (External) Image**
  - Website – keep current
  - Improve Tech –wide and Montana Visibility

- First Robotics Competition – November 10<sup>th</sup>, changed to December 15<sup>th</sup>
- Computational Science & Data Visualization course development
- Programming competition
- Research and Scholarly activity

**Computer Science and Software Engineering Program Assessment (Michele Van Dyne)**

Michele began her presentation with a general overview of the Program Outcomes Assessment process. She informed IAB members that this is the first full year the department assessed courses with ABET Outcomes. Michele informed members that in the past the program outcome goal was 70% of the students score 70% or better; noting none of the department outcomes fell below the 70% threshold. The faculty is discussing changing the 70% threshold to 80% must meet a “C” level or better (70%).

The highlighted areas on the table fell below the 80% threshold. Michele emphasized that the department has some discussing to do concerning the thresholds and addressing any concerns within our continuous improvement plan.

CAC – Computer Science Program		Spring 2012
a	(a) An ability to apply knowledge of computing and mathematics appropriate to the discipline	83.1%
b	(b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solutions	83.8%
c	(c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs	84.9%
d	(d) An ability to function effectively on teams to accomplish a common goal	82.0%
e	(e) An understanding of professional, ethical, legal, security and social issues and responsibilities	91.0%
f	(f) An ability to communicate effectively with a range of audiences	88.6%
g	(g) An ability to analyze the local and global impact of computing on individuals, organizations and society	92.6%
h	(h) Recognition of the need for and an ability to engage in continuing professional development	93.6%
i	(i) An ability to use current techniques, skills and tools necessary for computing practices	84.3%
j	(j) An ability to apply mathematical foundations, algorithmic principles and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices	92.2%
k	(k) An ability to apply design and development principles in the construction of software systems of varying complexity	78.8%

EAC - Software Engineering Program		
a	(a) An ability to apply knowledge of mathematics, science and engineering	77.9%
b	(b) An ability to design and conduct experiments, as well as to analyze and interpret data	91.5%
c	(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustain ability	87.5%
d	(d) An ability to function on multidisciplinary teams	80.0%
e	(e) An ability to identify, formulate and solve engineering problems	82.4%
f	(f) An understanding of professional and ethical responsibility	85.2%
g	(g) An ability to communicate effectively	88.3%
h	(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context	81.5%
i	(i) A recognition of the need for and an ability to engage in life-long learning	95.6%

j	(j) A knowledge of contemporary issues	90.8%
k	(k) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice	83.8%
SEC-1	(EAC-1) the ability to analyze, design, verify, validate, implement, apply and maintain software systems;	89.0%
SEC-2	(EAC-2) the ability to appropriately apply discrete mathematics, probability and statistics, and relevant topics in computer science and supporting disciplines to complex software systems; .	89.6%
SEC-3	(EAC-3) the ability to work in one or more significant application domains;	90.0%
SEC-4	(EAC-4) the ability to manage the development of software systems	73.3%

Courses		Number Outcomes Assessed	Number Students	
CSCI/ESOF 194	<b>Freshman Seminar</b>	4	19	80.5
CSCI 135	<b>Fundamentals of Computer Science I</b>	7	21	70.0
CSCI 136	<b>Fundamentals of Computer Science II</b>	8	13	87.5
CSCI 232	<b>Data Structures and Algorithms</b>	15	9	77.7
CSCI 246	<b>Discrete Structures</b>	4	7	85.0
CSCI 255	<b>Introduction to Embedded Systems</b>	10	15	71.4
CSCI 305	<b>Concepts of Programming Languages</b>	13	5	96.2
CSCI 332	<b>Design and Analysis of Algorithms</b>	10	6	52.5
CSCI 340	<b>Database Design</b>	26	8	83.8
CSCI 361	<b>Computer Architecture</b>	14	6	75.0
CSCI 438	<b>Theory of Computation</b>	4	7	93.0
CSCI 446	<b>Artificial Intelligence</b>	7	7	93.9
CSCI 460	<b>Operating Systems</b>	11	7	90.7
CSCI 466	<b>Networks</b>	11	7	91.0
CSCI 470	<b>Web Science</b>	11	4	100.0
CSCI 486	<b>Senior Project</b>	7	2	0.0
CSCI 494	<b>Senior Seminar</b>	7	7	100.0
CSCI 498	<b>Internship</b>	6	7	86.0
ESOF 322	<b>Software Engineering</b>	13	6	96.2
ESOF 326	<b>Software Maintenance</b>	23	7	71.3
ESOF 328	<b>Requirements and Specifications</b>	6	4	87.5
ESOF 427	<b>Software Design and Architecture</b>	9	5	69.4
ESOF 486/7	<b>Senior Design Project</b>	11	7	87.8

Michele continued her presentation informing IAB members of the Senior Assessment Exams – ETS Major Field Test which is administered to senior students. A major advantage of the ETS Major Field Test is that it provides a standardized method of comparing our students’ performance and the efficacy of the program to other programs across the nation. Michele informed committee members that every 5 years the test is changed and this year it was changed. She noted that the test is not comparable to previous tests. The new comparison data was added when it became available after the IAB meeting.

Montana Tech students take the Proficiency Profile test near the end of their junior year. In general, Montana Tech students perform very well on the test and CS/SE students outperform their Montana Tech peers in all reading, writing, critical thinking, and math categories except one .

**Computer Science Major Field Test**

**Test 4CMF (given 2006-11)**

	Mean*	2008		2009		2010		2011	
		Score	Percentile	Score	Percentile	Score	Percentile	Score	Percentile
Total Score	148	160	85%	167	95%	164	95%	163	90%
Programming Fundamentals	55%	74%	95%	71%	90%	75%	95%	76%	95%
Discrete Structures and Algorithms	35%	47%	90%	55%	95%	46%	85%	48%	90%
Systems (Architecture, OS, DB, Networking)	42%	45%	55%	62%	95%	60%	95%	48%	70%
#students	9095	7		3		4		3	

\*Mean is based on 232 institutions

**Test 4HMF (given 2012)**

	Mean*	2012	
		Score	Percentile
Total Score	149.5	164	92%
Programming Fundamentals & SE	50%	61%	83%
Discrete Structures and Algorithms	40%	54%	90%
Systems (Architecture, OS, DB, Networking)	40%	57%	98%
#students	1214	7	

\*Mean is based on 107 institutions

**Proficiency Profile**

**2011-2012 Department Summaries**

Students at all ranks N total = 327		Critical								
		Reading Level 1	Reading Level 2	Thinking Level 3	Writing Level 1	Writing Level 2	Writing Level 3	Math Level 1	Math Level 2	Math Level 3
Montana Tech	Proficient	81%	53%	13%	73%	24%	8%	86%	68%	37%
	Marginal	10%	21%	35%	20%	44%	36%	10%	18%	25%
	Not Proficient	9%	26%	53%	8%	32%	56%	4%	14%	37%
Computer Science & Software Engineering (N = 5)	Proficient	80%	80%	20%	80%	40%	40%	100%	100%	80%
	Marginal	20%	0%	40%	20%	40%	40%	0%	0%	20%
	Not Proficient	0%	20%	40%	0%	20%	20%	0%	0%	0%
Proficient (masters comprehensive, N-schools = 137,		59%	31%	5%	57%	16%	6%	47%	23%	6%
Marginal (masters comprehensive, N-schools = 137,		21%	18%	14%	28%	34%	23%	26%	24%	13%
Not Proficient (masters comprehensive, N-schools = 137,		20%	51%	81%	14%	50%	71%	27%	53%	81%
Proficient (Doctoral I & II, N-schools = 48, N-students =		66%	39%	9%	65%	23%	10%	58%	36%	13%
Marginal (Doctoral I & II, N-schools = 48, N-students =		18%	17%	19%	25%	35%	28%	21%	22%	18%
Not Proficient (Doctoral I & II, N-schools = 48, N-students =		16%	43%	73%	11%	42%	63%	21%	42%	69%

## Industry Update (IAB Members)

- **Greg Waring, Energy Laboratories, Inc:**

**Industry trends:** Company had position openings last year; however, hiring is tighter this year.

**Preferred skills for new-hires:** Critical thinking and problem solving skills, Microsoft.NET Framework, C#, and SQL database.

**Development Process and Tools:** Waterfall development process for larger team projects. Projects with a two to three month development cycle use an Agile development process.

- **Tyler Dusek, Schweitzer Engineering Laboratories (SEL):**

**Industry trends:** Company had approximately 60 software positions open. The company has hired 40 to 50 new software developers within the last year. Company has 250 unskilled assembly work positions open.

**Preferred skills for new-hires:** OOP, Java, C, C++, .NET, database, scripting, SQL, high level design skills and cross platform development

**Development Process and Tools:** Strict Waterfall development process. Heavy with project planning, specifications, code, and test documentation.

- **Terry Brandt, Zoot Enterprises, Inc:**

**Industry trends:** Zoot has been consistently hiring for approximately ten months. Company still has a few position openings. Need to hire more, but cautious and waiting for hiring approvals.

**Preferred skills for new-hires:** Code security, Java, C, C++, Python, database management, MySQL, XML transforms, ability to think and solve problems, critical thinking, people that take initiative to solve problems, ability to learn and find answers, ability to work on a team.

**Development Process and Tools:** Agile development process is used by product development teams. Daily status meetings similar to a scrum. A strict Waterfall development process is used for the client development with thin development slices the clients can look at.

- **Bill Ivanich, EchoStar**

**Industry Trends:** Hiring is at a stable point. Company has engaged in an internship process where most interns fill permanent positions; people are waiting to come into the company.

**Preferred skills for new-hires:** An embedded system environment and strong in C, likes students with the Control System option.

**Development Process and Tools:** Agile, scrum, sprint 32, analyze what was done in the past, write stories, define stories to complete a task, whiteboard, sticky note process. Perform daily scrums and keep items written in an open area. Perform a burn down to better estimate times for future projects.

- **Justin Malsam, Micron:**

**Industry Trends:** Company is hiring. The company is having a hard time finding qualified people. People applying for positions lack experience. His feedback indicates an unemployment rate of 2% in IT and those that are still looking are unemployed for a reason.

**Preferred skills for new-hires:** Microsoft.NET Framework, C#, database management, oracle experience, SQL server, Java, what other work experience do they have, good work ethics, can work in a team environment and ability to think.

**Development Process and Tools:** “Wet” agile development process with a large customer involvement upfront and in six weeks they try to get all components to work together. Use software simulators and web application development tools.

- **Craig Spannring, TeeJet Technologies:**

**Industry Trends:** Company has positions open; hard to find qualified people to fill positions.

**Preferred skills for new-hires:** Critical thinking skills, problem solving skills, research skills, C skills with kernel coding, C++, desktop systems using .NET, python, a solid math background in differential equations and statistics.

**Development Process and Tools:** Going back to large systems, moving away from scrum techniques. No longer have daily scrum meetings. Device driver software – company does its own driver work.

**Visiting high schools in Montana** (Keith Vertanen)

Keith informed IAB members that Doug Coe, Dean of the College of Letters, Sciences and Professional Studies agreed to funding a course buy out to allow a faculty member to focus on visiting high schools for recruiting purposes. Keith informed members that he will be visiting ten high schools in Montana. He asked for IAB members input on how to present computer science to students. Some of Keith’s ideas for presentations are programming with an iPhone, iPad, cell phone, and NAO Robot.

**IAB Members/Students Suggestions:**

- Programming with Kinect
- Lego Mindstorms
- Develop something with social networks
- Invite a former student to visit the high school
- Target the high school’s STEM classes
  - Belgrade has one that uses robots part of the year
- Target private high schools
- Target women in technical careers
  - Target high school freshman/sophomores, perhaps over lunch

**Funding the R.E.A.L. Scholarship** (Luke Meyer)

Luke gave an overview of the REAL Scholarship funding stating that there are eighteen students that are presently receiving funds from the scholarship in the amount of \$5400 per year. He emphasized that the combined foundation funds between the Computer Science Department and the R.E.A.L. Scholarship is \$9200 (before paying for the 2012-13 scholarships). Luke asked for input from the IAB members on how to approach their companies to sponsor the scholarship. The scholarship has one corporate sponsor which is Zoot. He informed the members that the scholarship is a great recruiting and retention tool. He also informed members that their company sponsors would be promoted on the department website or by a promotional banner that would hang in student labs. Luke stressed that it is a good investment for companies to invest in a student that could one day work for them.

**Student Testimonial:**

The R.E.A.L. Scholarship made my choice to attend Montana Tech. (Brent Donovan, CS Student)

**NASA Visit** (Michele Van Dyne)

Accompanied by a PowerPoint presentation Michele gave an overview of her NASA Ames visit on May 21 – 25, 2012.

**FACULTY CONNECTIONS PROGRAM**



**Goal:** Developing new collaborations, projects and proposals to foster the growth of NASA related funded research at Montana institutions

**PROCESS:**

Selected faculty work with Montana Space Grant Consortium (MSGC) members to identify and set up a visit to an appropriate NASA research facility.

MSGC covers the cost of travel for a week visit at the selected facility and assists in setting up contacts and an agenda of meetings for that week.

Faculty members agree to write a report after the visit outlining contacts made and projects considered, and also to make a presentation to the campus concerning the visit and any opportunities identified.

**NASA AMES: INTELLIGENT SYSTEMS DIVISION**

Technical Research Areas at the Intelligent Systems Division:

- Autonomous Systems and Robotics
- Collaborative and Assistant Systems
- Discovery and Systems Health
- Robust Software Engineering

Contact: Ann Patterson-Hine, Technical Area Lead for Discovery and Systems Health

**CONTACTS/POTENTIAL COLLABORATION**

- Joe Coughlan, Robust Software Engineering, Technical Lead
  - Static code analysis triage
  - Curriculum collaboration
  - Mars drilling
    - Suggested collaborating with Mining Engineering
- Ashok Srivastava, Discovery and Health Systems; Group Lead, Intelligent Data Understanding
  - Text Mining for sentiment analysis
    - 100,000 documents available
    - Google-ish approach
- Krishna
  - Virtual Keyboard

**Department Improvements (IAB Members)**

- Suggest one thing the CS Dept. should start doing or do differently
- Suggest one thing the CS Dept. should stop doing

**IAB Members Suggestions:**

- Add unit testing or any other testing
- Make sure OOP is covered in the curriculum since Object Oriented Programming course was removed.
- Cover techniques for parallel and multithreaded programming
  - Higher level than semaphores/mutex.
- Cover functional programming (e.g., F#)
- Add error checking and debugging
- Build a simple system; continue building system on a five year- life cycle.
  - Add small features at freshmen level programming courses
  - Ties in with unit testing
  - Would be like an “internship” within a class

- Use existing libraries
  - It's good students know how data structures and algorithms work, but most won't rewrite existing libs
- Cover more tools
  - Little more CPPUnit
  - Add static code analysis tools (e.g., Lint, ReSharper)
- Remove computer architecture course from SE curriculum
  - Or make it an elective in SE
- Keep socket programming in Networks
- Manage student expectations that they will work on the coolest, most recent software
- Manage student expectations to rewrite code
  - 75% work mostly in software maintenance
  - Produce modules or add on's to existing systems
  - Industry never gets to take anything out of their systems
- Add code security – problems with each language
  - Use of error trapping to fail gracefully
  - Look at ethical hacking courses at other universities
  - Security is often an afterthought, normally focus on frontend user experience
- Maintain challenge and stress problem solving
  - Protect courses like Embedded Systems, Architecture, Operating System, Software Engineering
- Add Agile development and version control to SE
- Add more integration with existing systems and clouds
  - Potential Web Science topics
    - Facebook integration
    - Office in the cloud
  - Using Network APIs
- No suggestions were made on things that could be removed from the programs.

### **Discussion and Wrap-Up**

Jeff gave a brief summary of today's meeting and thanked the members for their input and support.

Jeff informed the IAB members that the department was considering a new System Testing course in the Software Engineering program. IAB members supported more system testing in the SE program, but they suggested incorporating more testing into existing courses. A suggestion to possibly create a one-credit course covering system testing was made, but little support one way or the other was noted.

Jeff asked IAB if the topics addressed today were appropriate and what topics would they like to address at the next Industry Advisory Board meeting?

### **IAB Members Suggestion:**

- Curriculum overview
- Focus on SQL in an advanced course, possibly in a project course

Meeting adjourned.

Respectfully submitted,

Tami Windham