

**MILWAUKEE SCHOOL OF ENGINEERING
B.S. COMPUTER ENGINEERING
INDUSTRY ADVISORY COMMITTEE
Friday, May 25, 2018**

Attendees

Industry Members

Mr. Lon Bushweiler, Plexus
Mr. Bryce Ferguson, Rockwell Collins
Mr. Joe Izzo, Rockwell Automation
Mr. Tom Kraus, GE Healthcare
Ms. Cyndi Przybylski, Rockwell Automation
Mr. Joel Rondeau, Cognex
Mr. Greg Treichel, RW Baird
Mr. Jeff Zingsheim, IAC Chair, SysLogic

Student Representatives

Mr. Thomas Burbach '21
Ms. Jessica Flock '19
Mr. Paul Scarbrough, '19

CE Faculty

Dr. Eric Durant, Program Director
Dr. Adam Livingston
Dr. Russ Meier
Dr. Darrin Rothe

Recorded by: Dr. Durant
Meeting called to order at approximately 8:30 a.m.

Note: All items on the agenda were discussed, but several informational items are not repeated in these minutes.

Welcome and Introductions

IAC Chair Mr. Zingsheim welcomed the members and invited everyone present to introduce themselves.

Previous Minutes

Dr. Durant asked the members to review the fall meeting minutes, which are available on the website, and to send him any corrections or additions in the next few days.

New MSOE Mission and Vision / PEO Articulation

Dr. Durant presented MSOE's new mission and vision statements after summarizing the strategic planning process that led to them, among many other things. Mr. Treichel appreciated that the focus on "leadership" in new mission/vision is especially relevant to Baird

– this recognizes the **technical** leadership role. Baird is leaning even more heavily on its technical leaders.

The IAC reviewed PEOs (CE Program Educational Objectives) and agreed that they are in line with MSOE's updated vision and mission and that they remain relevant to CEs at their companies.

New CS Program, First Freshmen in Fall, 2018

Members asked about the role of the new CS program, which Dr. Durant summarized. It was noted that a few articles recently highlighted ours along with CMU's as new, AI-focused programs. CS is a popular area now. There is not a lot of cannibalization — CE enrollment numbers are up for fall and SE's are not down too much. Dr. Meier said some students have concerns that with CS being hot they may be in less demand. Mr. Kraus noted that **both** are important to the whole system. The industry members are excited about CS, but CE and SE, etc. are still critical and will be for what they do.

Mr. Treichel noted that the STEM demand statistics show that demand greatly exceeds the number of grads, so there are opportunities across the board. And each student should remember that their degree is just a starting point for the direction their career will go.

Dr. Meier said that a lot of student perception is based on how companies advertise. Many listings require 5 years of experience. Mr. Kraus noted this is done since it is easier for companies to go down to the applicant than to raise the available compensation for an approved line. The CE faculty do already advise student to consider this when applying.

Mr. Bushweiler noted that MSOE has so many projects that students do that this helps them promote their skills when they contact an employer.

Fall, 2018 Meeting

Rockwell Automation agreed to host the CE IAC's fall meeting on a date TBD. They have some new facilities that will be included in a tour in conjunction with the meeting.

Senior Design and Industry Involvement

Dr. Rothe gave an overview of senior design process. Most teams are set with project ideas for the fall. If a company representative has a project idea that they think would work well, please let Dr. Rothe know and he'll share with the advisors and teams. Dr. Meier suggested the program start more aggressively soliciting industry projects again. Dr. Rothe and others have considered this before, including assigning industry projects to students. But, many student groups don't move towards the industry-sponsored projects.

Mr. Kraus asked why many of the students avoid industry-sponsored projects. Dr. Rothe said that the reason isn't clear. The program receives great project ideas from companies that seem relevant and exciting to the faculty, but many of the students want to more fully own their

project, so they gravitate toward their own ideas. Some of these aren't as good as the industry-sponsored ones.

Mr. Kraus would like to follow-up with Dr. Rothe and Dr. Meier after this meeting. GE Healthcare is sponsoring two projects now. MSOE should either now or soon have on campus a full ultrasound system. This could support a senior design project in the coming years.

Ms. Przybyski noted that when she was doing senior design, a lot of the industry projects weren't "flashy" even though the underlying technology may have been exciting. Dr. Rothe said that there is a balance and that the sponsor needs to give the students a certain level of freedom with the project. Dr. Livingston noted that EE and BE seem to do a better job at having many of the projects be industry-sponsored. Dr. Rothe noted that BE had until very recently done three-year design projects, which allowed more time to actively seek sponsors. EE and CE are similar in senior design structure, but EE is somewhat bigger, and they do have some perennial sponsors such as Milwaukee Tool that are very well known to students. Dr. Meier noted that some of the students may have a fear of failure with working with companies.

Ms. Przybyski said that there were also concerns about scope when working with companies. Mr. Ferguson noted that the program should promote to students that there is more stability in industry-sponsored projects, and the expectations are more realistic. So, the program might turn a perceived disadvantage into a benefit.

Mr. Zingsheim noted that the senior design faculty should encourage students to seek out experts, regardless of whether their projects are sponsored. Dr. Rothe noted that ME does have a lot of sponsored projects, and additionally the students need to recruit a faculty member to be an advisor on their proposal. CE does that in a limited sense by helping students improve their proposals.

IEEE Student Group

Dr. Meier noted that the IEEE student group is more energized and active this year. There are over eighty student members making MSOE's chapter the largest in Wisconsin and the second largest in the Chicago-Milwaukee region. Next year's group is equally energized and planning events. They did a tour this spring to Laird [N.B.: Laird recently acquired LS Research] with about fifteen students and are planning another tour for the coming year. They ran a LinkedIn workshop and will run another one in fall; it was very useful although the first one wasn't well attended; this should be rectified by scheduling and partnerships with other student groups this fall. Dr. Meier had a phase-out plan in place this year since he has growing international responsibilities with IEEE. Dr. Jen Bonniwell has been ramping up as an IEEE advisor and is now the official student chapter advisor. As part of the MSOE Giving Day a funding stream was established for the group that will support soldering workshops and other events. There is always interest in tours, especially where there are exciting things to see at the company location and to interact with the practicing engineers.

Senior Debriefing Results and Discussion

Dr. Durant summarized some of the senior debriefing feedback. Some key points were:

- Student feedback is overall very positive regarding advising, the faculty, the curriculum, and career prospects.
- Students would like more opportunities to work with students in non-engineering disciplines. There may be opportunities to facilitate this in business courses that CE requires its students to take.
- The portfolio that the UX (user experience) program requires its students to make would also be useful to engineers in their job search.
- Students would appreciate additional structure and support in finding internships. The faculty already regularly raise this in advising and through emails to students about particular opportunities, but there is a desire for more from students.
- Based on advising advice many seniors took OR402 in their sophomore year instead of the scheduled junior year. They reflected positively on the increased value, which was the hope when we made this advising change a few years ago. Following up on senior feedback, Dr. Durant has asked HSC, the department that offers OR402, to consider formally lowering the prerequisite to sophomore standing; that is now on their agenda.

Expanding on the point regarding working with non-engineering students, Dr. Durant asked Mr. Scarbrough and Ms. Flock to give a BA3423 overview. Business plan, talked about starting businesses, estimating costs, summarizing to executives, simulating starting a business. Main goal, according to Ms. Flock, was as a team to put together a business plan. One team member came up with an original business idea. They were 9- 30-page documents covering management team, risk management, legal issues, product descriptions. Then did a shark tank pitch in 20-minute format for their final exam.

Advisors noted that UX is becoming a popular minor.

Dr. Durant's asked members about VHDL vs. Verilog responding to questions in the senior debriefing about which is prominent in industry. GE uses VHDL. Mr. Ferguson noted that knowing VHDL only help knowledge. Mr. Izzo will check with people at RA and get back to us about what they're using. Dr. Livingston noted one of his electives will be retooling our digital design elective and may incorporate a mix of VHDL, Verilog, and system C. He'd like to make it as useful as possible.

The members took a 10-minute break and then returned for further discussion.

Recent and Upcoming Electives

CE4930 Computer Architecture II, Winter 2017-18

Dr. Meier taught this non-lab class that covered the evolution of architectures from 1990s through the present.

[CE4100/EE4100 Embedded System Fabrication, Fall, 2017 and Spring, 2019](#)

Dr. Rothe taught this class that has now run for about three years. Students are given a prototype design that they turn into a production prototype. Students select parts, look at whether parts are active, who the vendors and distributors are, etc. Then students develop a circuit board from schematic capture, through layout, through fabrication. Students also design an enclosure with mounting holes, assignment of device locations, etc.

Dr. Rothe shared that the EECS department benefitted greatly this year in receiving a donation from an alumnus for a maker space. This went online last summer. The department has four full-featured soldering stations, basic SMT tools, a reflow oven, power bench tools, and 3-D printers for fabricating enclosures. Two sections ran in fall 2017, but we're moving it to spring in the coming AY. Fall is preferred to support senior design, but the department needed to move it in the coming year due to other constraints.

Dr. Meier noted that faculty have thought many times about making this a required class. The students love it. Dr. Meier asked what job titles (engineers, technicians, etc.) perform this work at the various companies. Ms. Przybyski says that the engineers, including engineering interns at RA did this. Mr. Rondeau said that at Cognex EEs and some MEs do this, but not many CEs. Dr. Rothe noted that the awareness can be important even if the CE doesn't do this. Mr. Bushweiler would also like to see this in the curriculum. Mr. Ferguson took the course in its first offering and it was very useful. The team he is on now does a lot of hardware/software integration, including parts selection and integration, so this is very useful. Mr. Bushweiler noted the timing is good – ideally by fall of the senior year. If the program did this, it would ideally target having it in spring of the junior year.

[CS4980 Fault Tolerant Design, Winter, 2018-2019](#)

Dr. Meier noted that we removed Embedded System IV from the curriculum beginning with the current juniors; this course included some uptime/fault tolerance material. So, we now have an opportunity to have an elective in this area for 10 weeks instead of 3-4 on fault-tolerance. Mr. Izzo is happy about this since it is the area he works in; he plans to follow-up over the summer with Dr. Meier as the course is developed.

[CS493 Advanced digital design, Spring, 2019](#)

Dr. Livingston is redeveloping this. He will make sure it differs from Bonniwell's elective. It will go beyond Logic 2/Embedded 3's pre-packaged interfacing components, for example approaching interfacing of two complex systems. He plans a deep dive on VHDL modules, testbenches, phases of design, and the architecture-controller split. Also, he plans to include some Verilog in this course. Dr. Livingston would like to know what members are doing at their companies in these areas to ensure the course is relevant.

[Feedback from Students](#)

Ms. Flock found an internship this summer at Master Lock. She didn't have a lot of assistance from MSOE. When she talks to some CEs, they're asking about finding internships. She thinks the resources are there, but that students don't know how to access them. Mr. Scarbrough agrees. It would be good to make students aware of the opportunities more than MSOE and the

program are now. Mr. Rondeau is typically on campus fall and spring interviewing interns for Cognex; the junior IAC members didn't know about this. Mr. Scarbrough noted that the Handshake emails aren't always very clear if you don't dig through them. Students get a lot of email and although they do pay more attention to messages directly from faculty, there is email overload. Dr. Meier noted that in the strategic planning committee how to get messages out efficiently and not relying on email so much are being discussed.

Dr. Durant said that he would ask Dr. Spencer, director of career services, if CE faculty can get view-only accounts to see internship postings, etc. [N.B.: This was done on May 29, 2018.]

Ms. Przybyski noted the importance of a process such as filtering to handle email overload. Two years ago, Dr. Durant gave a presentation on GTD (the Getting Things Done approach) and technology integration to the MSOE faculty and staff. IAC members suggested that the right approach for students may be search vs. sort like Google/Gmail does.

Mr. DeFields's Written Comments

Dr. Durant summarized Mr. DeFields comments as a student member, which he provided in writing since he was unable to attend the meeting: "The digital logic courses thoroughly prepared me for the Computer Architecture class. I felt confident going into each class that I had the knowledge to complete each lab and understand each lecture.

"In terms of the Computer Architecture class I think the removal of the multicycle processor was a necessary move and gave us more time to cover the more important/relevant pipeline design.

"My only comment on the quarter as a whole is the use of the DE10 Lite. I really enjoyed using it but would've loved to do something with the GPIO pins. I don't know if we will do more in the future with the devices but I think that, since the devices are ours, we (myself as well as a couple freshman I talked to) would've used them in our everyday life. The GPIO pins would allow us to use the devices in more ways than just the 7-segment displays. The freshmen I had talked to mostly agreed that the DE10s were fun to use and would've loved to use them outside the classroom, provided the knowledge to use them in a variety of ways.

Dr. Meier talked about the memory-mapped I/O additions to computer architecture. CE2801 is a critical retention point, which is why the CE faculty added this and Thumb in CE1921.

Feedback from Industry Members

Ms. Przybyski is glad to see the increased emphasis on security and said that this will be important at Rockwell Automation going forward.

Mr. Ferguson suggested more focus on embedded issues in OS. Dr. Meier noted that this has been considered in our CS3841, but the program wants to keep a balance for students who go into fields where they need non-embedded OS experience. Dr. Rothe expanded and said that with the DE0, the CE faculty were looking into an embedded Linux and it is still high on the list,

but for various other reasons we went to DE10-Lite. Also, our CS3841/CS3210/CE496x classes do give exposure to tools that an engineer uses with an embedded Linux. So, there are more opportunities here to give exposure to supporting items. Drs. Meier and Rothe noted that an elective in this area would also be valuable. Mr. Ferguson noted that for his daily work embedded Linux is critical; in a curriculum it would give good systems exposure, so there could be some embedded III tie-ins. Mr. Rondeau agrees that embedded Linux is important since it provides a platform for better debugging. Mr. Ferguson also noted that there is excellent scaling from embedded through user applications in Linux. Mr. Rondeau notes that bare-metal understanding is still critical. Dr. Meier says that the CE faculty need to balance these needs in the curriculum. Mr. Izzo cautions that to do this the program will need to pick a particular RTOS, but must be sure to teach generalizable topics. In Rockwell Automation's applications, they won't use embedded Linux, and ROK currently uses their own system; whatever they use must be safety certified. Mr. Zingsheim noted that there are a variety of embedded Linux technologies, but they die and are acquired very quickly. He agrees that it is important to focus on constructs and concepts, not too specific of a technology. Mr. Ferguson noted that the systems-level look at an embedded OS is key, including integrating hardware topics. Mr. Zingsheim noted that it is important to understand critical concepts like non-deterministic performance. So, understanding task-switching, preemption, etc. are critical. Mr. Ferguson noted that the link to, e.g., hardware timers, is a good tie-in. Dr. Meier noted that the CE program could do this by repurposing our CS3841 class to go to an embedded OS. Mr. Zingsheim noted that now is a good time to consider differentiation from CS, which is supported by the focus on the embedded world including performance concerns.

Dr. Meier noted that the CE faculty are reconsidering the freshman software sequence for CEs including potentially introducing C as a first language. Mr. Zingsheim noted that it may be easier to start at the embedded side and scale up where you need to as opposed to starting on high-end systems and then scaling down to embedded. Mr. Izzo said that he was very surprised that CE's OS class does not have an already real time focus. Mr. Izzo thinks it's okay to start in Java, but ideally would lean towards C. Dr. Rothe noted that our Embedded I/II/III incorporate real-time concepts before students get to OS: interrupts, jitter, task scheduling. Mr. Rondeau asked the juniors if it was a problem when they moved from Java to C. Ms. Flock said that it wasn't a problem, but it was a big jump. Mr. Scarbrough agreed and noted that in the first two years of the curriculum he did a fair amount of VHDL and C, so the low-level understanding was helpful. Mr. Ferguson noted as a college freshman [N.B.: in 2012] he started in Java without HS programming experience, and it was valuable to not have to worry about the low-level details such as managing memory right away. Dr. Livingston noted that many students, counter to the juniors' experience, do have trouble making the jump to managing memory.

Adjournment

At approximately 11:10 AM the meeting was adjourned and a group picture was taken. Most members then proceeded to the senior design show held outside the meeting room in the library.