Some Themes for the Asbjornson Innovation Center (Rev. 2)

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Montana State University College of Engineering has a long tradition of taking new students—many of them Montanans from small and large towns across the state—and enabling them to launch successful careers based on solid technical knowledge, hands-on engineering, and a work ethic of persistence and tenacity. MSU students don't just read about science and technology, they actually get involved directly in designing, inventing, and implementing new and innovative systems and devices.

What would the faculty like to see in this "dream facility," the Asbjornson Innovation Center? In no particular order, here are some of the ideas mentioned so far:

Theme 1: Modern prototype fabrication facilities for students and faculty

Create a three-facet configuration of "**MSU Fab Centers**." Each of the three Fab Centers would be ~5,000 sq. ft. (70'x70'), and support both externally-funded R&D projects as well as project-based work by undergraduate students. Funding for equipment and skilled supervisory staff is assumed.

- Sector 1 is for electro-mechanical engineering, featuring modern 3-D printers, advanced CNC tools (e.g., ShopBot), circuit board prototype fabrication, microprocessor system integration, and related design and prototype assembly systems.

- Sector 2 of the Fab Center is a modern micro/nano fabrication (clean room) area with design and assembly capability for micro- and nano-mechanical and electronic systems. Suitable air-handling and chemical safety provisions will be necessary, of course.

- Sector 3 is a bio/chemical design and fabrication area for biosystems engineering, including bio-reactors, alternative fuel research, chemical remediation, etc. Suitable chemical and biosafety concerns will need to be addressed.

Theme 2: senior capstone design flex space

With our growing enrollment and our emphasis on hands-on work, the Innovation Center needs to provide a world-class set of large, flexible, open spaces with benches, lockers, tools, meeting areas, and other support for the Capstone design project experience. Locating the Capstone flex space adjacent to the MSU Fab Centers (Theme 1) would be perfect.

Theme 3: innovative interdisciplinary collaborative faculty framework

Create a special institute, the "Innovation Alley," for a group of faculty members who comprise a three-year cross-disciplinary project team. Faculty from engineering, with colleagues from all over campus, are eligible to join via proposals that involve truly interdisciplinary learning, discovery and engagement among colleagues from multiple units on campus. After a selection process, the associated faculty move their offices to the Innovation Alley facility for the three-year period. At the end of the period they resume regular duties in their original unit—or propose to be part of a new three-year project team.

The "Alley" comprises a suite of perhaps 8-10 faculty offices, reception area, conference rooms, an integrated group meeting area, and collaborative laboratory facilities. The Innovation Alley faculty

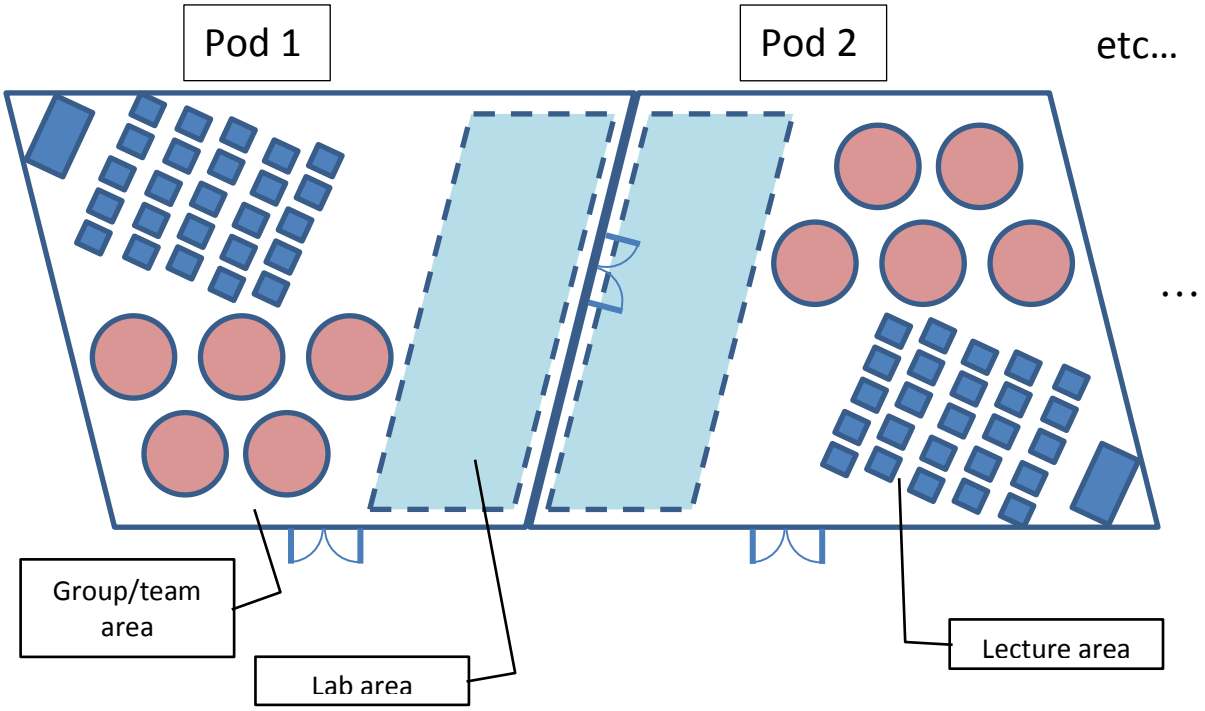
develop special team-taught courses, research projects and proposals, and prepare public outreach and education events –fully embracing all three mission components.

Theme 4: sky's the limit

Ensure full use of the building's roof for instruction and research. Provision for solar voltaic and solar thermal panels, space and terrestrial communication antennas, astronomical telescopes, optical remote sensing platforms, a UAV helipad, and other features to take advantage of the sky view. We need to include freight elevator systems that serve the roof and all floors of the building.

Theme 5: innovative instructional space

Create a set of integrated teaching/learning labs, or "pods," which incorporate a lecture/presentation area, a group project team area, and a hands-on laboratory area. Each pod would be approximately 40'x40' (1,600 sq. ft.). The integrated facilities would include a mechanical systems pod, a building systems pod, a chemical/biological systems pod, an electrical systems pod, an engineering mechanics pod, and a few general-purpose instructional pods.



Another approach would be to have flexible Technology-Enhanced Active Learning ("TEAL") instructional spaces situated adjacent to the prototype fabrication areas (Theme 1) so that instructional use could quickly flow from the classroom setting to the Fab Center setting.

Theme 6: shared campus resources

Among the key attributes of successful interdisciplinary facilities across the country is the presence of shared campus facilities that bring people from other parts of campus into the building on a regular, if not daily, basis. The suggestion is to have the Innovation Center be the home of facilities like:

- Imaging and Chemical Analysis Laboratory (ICAL)
- Research Computing (Computer Cluster) facilities
- Montana Microfabrication Facility (see Fab Center Sector 2, mentioned above in Theme 1)
- In fact, how about hosting the whole VPR operation! (VP-Research office, Sponsored Programs, Tech Transfer, and Research Compliance)

With the shared facilities, having the ability to host moderate-sized conferences and training sessions would be important. This means provision for catering/dining, coffee breaks, pre-event gathering areas, and similar functions.

Theme 7: "conventional" classrooms, conference rooms, meeting rooms

Along with all the fancy labs and pioneering facilities in the Innovation Center, it's important also to include a great set of classrooms, conference rooms, and similar areas suitable for seminars, conventional lecture classes, study groups, and team meetings. These instructional facilities must allow instructors to teach using best practices such as active learning, guided inquiry learning, etc.

Theme 8: it's a 24/7/365 world

Students and faculty should look forward to spending time in the building. Include provision for comfortable, informal, and inviting spaces that attract students and enable everyone to be productive around the clock. While some portions of the building may need to be locked except for regular business hours, we need to recognize that some individuals or teams may work best in the morning, while others prefer the dinner hour and still others do their best work late at night or on weekends. Configure appropriate portions of the building to be available 24/7.

Theme 9: first impressions, open impressions

The building needs to have an entrance area that impresses and informs our visitors. Make really careful consideration of the lobby theme, the use of transparency in corridor and laboratory walls, and clever use of transition spaces between wings, floors, classrooms, and laboratories, to have the building seem open, accessible, and exciting.

Theme 10: intuitive entry, access and intra-building flow

Unlike too many of our existing academic buildings, the Innovation Center needs to be intuitive to navigate. For example, visitors to existing buildings such as EPS, Cobleigh, Reid, Wilson, Johnson, etc., are presented with a bewildering lobby and corridors that lead off in various directions having no obvious purpose or guidance to assist a visitor. This isn't just a matter of providing beaucoup signage: the building's design needs to have a deliberately conceived entries, corridors, elevators/stairways/ramps, and general human-flow arrangements that enable first-time users as well as permanent occupants to find their destinations efficiently and intuitively.

Theme 11: break-out rooms for scheduled and spontaneous group meetings

Encourage hands-on interdisciplinary work by including space for project teams to gather for discussion, status updates, and brainstorming. Because these teams will not be tied to a particular department or administrative unit, a traditional departmental conference room or meeting area is inappropriate. The

building needs to include gathering areas for students/faculty to get together on an informal basis and work for short periods of time.

Theme 12: student success services

Create an *Engineering Welcome Center* that accommodates recruiting prospective students, advising and tutoring existing students, handles alumni services, and generally supports student success in all phases.

Theme 13: the Software Factory

Provide a software design lab and entrepreneurial environment allowing students and faculty from Computer Science, Business, Design, and other areas to work together on a focused, goal-oriented, real-world problem, from beginning to end, using the Software Factory model. Modern software systems require a development environment in many ways analogous to the design, configuration, tooling, and quality control principles used in traditional physical manufacturing. Software development using the Software Factory approach exploits established and proven practices, templates, architectures, and reusable code modules that allow greater productivity and quality compared to clean-slate custom software design.

Theme 14: the MSU Digital Storytelling center

Increasingly, the creation of important and compelling digital media is coming from individuals and small groups outside of the traditional domain of professional film and music production, graphic design, and journalism. This emerging area of individual everyday creativity is known as *Digital Storytelling* (Wikipedia: http://en.wikipedia.org/wiki/Digital_storytelling). The explosion of social media, and the soaring popularity of file sharing sites like YouTube, indicates that everyday people (including engineering students, business students, etc.) will benefit from developing these skills for the future.

Theme 15: Engineering Adventure Center (discovery, games, tourism, adventure, etc.)

This theme falls more in the campus gateway category than in a traditional academic category. The concept would be to have a lobby area set aside for public visitors, providing a set of “gee whiz” demonstrations, history, maybe some big screen educational videos, and so forth. It would be an engineering “Visitor Center,” managed cooperatively with MSU Communications, MoR, Burns Telecom Center, Innovation Campus, and maybe even the local economic development authority.

Theme 16: secure spaces

Include spaces that can be secured appropriately for research involving proprietary industrial work, Biosafety-secure space, and research subject to export control restrictions, such as the Department of Commerce's Export Administration Regulations (EAR), the Department of State's International Traffic In Arms Regulations (ITAR), or the Treasury Department's Office of Foreign Assets Control (OFAC).

Theme 17: engineering all around us

Engineers are responsible for executing the design and overseeing the construction of our built environment. This environment is essential to our physical well-being, and further manifests elements of our culture and its values. Therefore, *the building itself* can present ways to teach and to learn if the building's design enables it. The building should 1) expose and showcase features of its engineering design for students and public to learn from, both from a technical and societal perspective, and 2) provide ongoing opportunities to demonstrate and monitor the performance of emerging infrastructure technologies being developed at MSU and elsewhere.

(to be continued!)