Remaking the Engineering Building

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Remaking the Engineering Building:

Repositioning Strategies for Success

By Victor J. Cardona, AIA and Christopher P. Vanneste

Borrowing a page from a playbook more familiar to real estate turnaround experts, a number of research-based institutions are talking today about how they are "repositioning" their engineering facilities. The approach— sometimes part of an overhaul extending into various departments—is seen as a way to remake existing, purpose-built centers to better serve today's research activities and student-centered academics. Many of the university leaders see it as a cyclical need, where every so often the engineering building evolves and re- emerges as a refreshed, improved platform for the disciplines.

The University of Maryland's Jeong H. Kim Engineering Building serves as a successful example of repositioning where the building was transformed from a collection of classrooms to a showcase center, replete with cutting-edge bioengineering labs, MEMS cleanrooms, intelligent transportation simulation areas and spaces for microelectronics instruction. Another example is the Martin Kelly Engineering Building at Oregon State University, which opened up its interior with a bright, sunny atrium featuring an e-café, collaborative learning research suites and open labs to burnish its reputation as a hub of scientific socialization.

In both cases, the bottom line of the aggressive repositioning included better student and faculty experience, more effective grant applications and awards, innovative research and a bit of campus buzz. These examples—as well as projects like the Brown Hall addition at the Colorado School of Mines—show that engineering buildings are hardly a static concept, and repositioning is far more than a real estate notion. In fact, it's essential to advancing the institutional mission and program value.

What can other research organizations learn from these repositioning stories? The first big takeaway is that they reflect and fuel institutional transformation, with the universities seeking new ways to win research grants and recruit new students, faculty and staff. Second, they act as proof to how updated and specialized research environments can perform better than previous standards for labs and other engineering facilities. Third, they suggest how the next generation of buildings will support people and their interactions within vibrant, world-class engineering programs.

Left:
The Kim Engineering Building was transformed from a collection of classrooms to a showcase center.

Overall, these repositioning projects indicate how engineering, more than ever, is empowering today's research activities. The buildings ignore traditional boundaries, supporting every science and providing a seemingly unlimited range of tools. The programs and facilities that support them are multidisciplinary and interdisciplinary; collaborative and interactive, with a student-centered attitude; a showcase of research successes; becoming more energy efficient and sustainable; and increasingly used as a teaching tool.

Interdisciplinary Supports Funding

The trend toward balanced learning and research programs supports both aspects of today's funding challenges. The powerhouse research programs at University of Michigan, Massachusetts Institute of Technology and University of Illinois, for example, previously focused on applied science with indirect cost recovery. The great learning programs at other universities would recover costs mainly through tuition, but state caps on tuition increases are limiting their revenue options. The emerging model will potentially equalize the two, and offer an integrated, stable learning and research program.

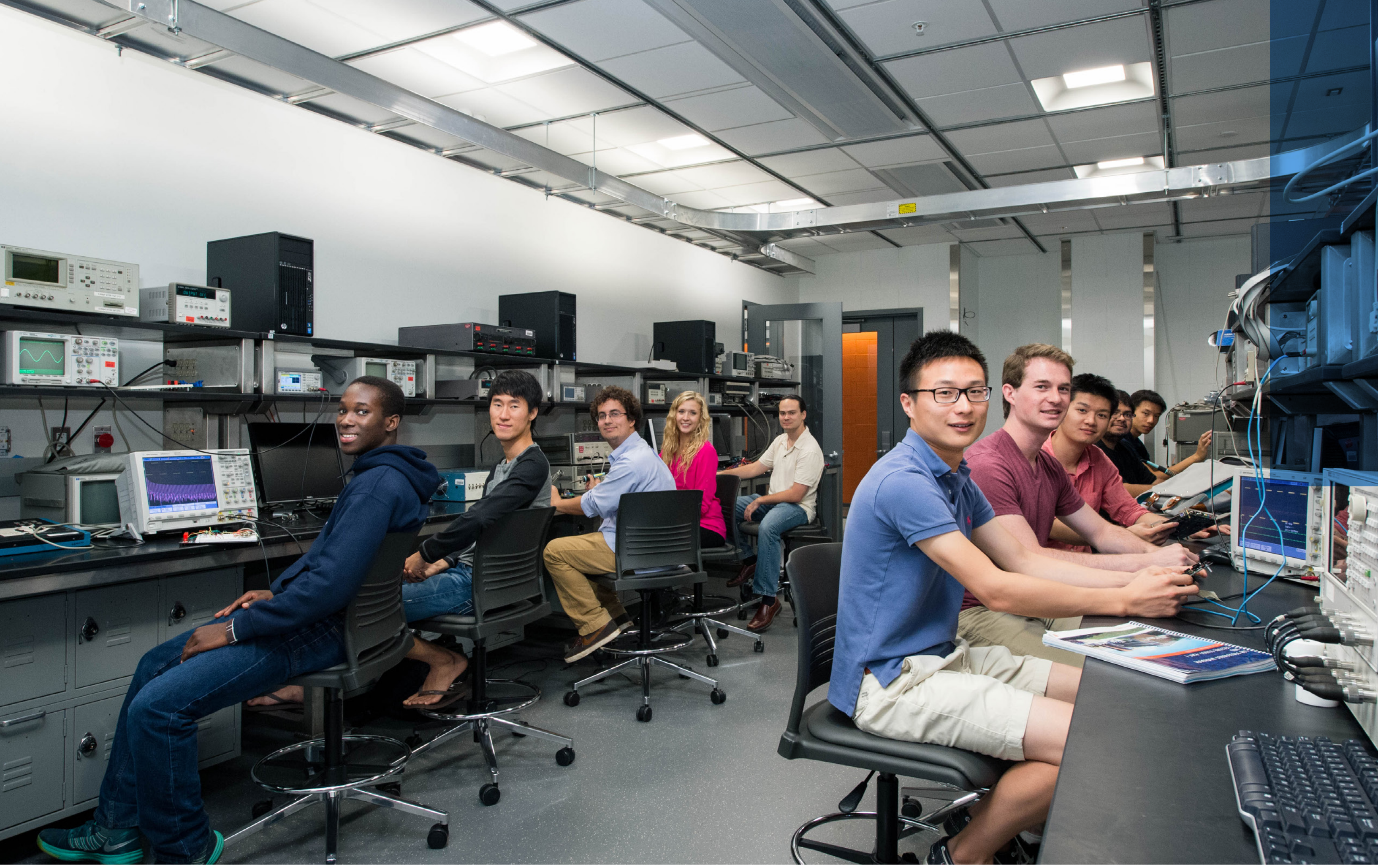
Beyond this macro trend, there are new directions in engineering research that should be reflected in facilities and infrastructure. As mentioned, it is quickly expanding beyond its traditional core, with new interdisciplinary growth involving biology, medicine, materials science and nanotechnology, as engineering enables a variety of sciences. For example, there is excitement about the rapid changes in bioengineering, with its theoretical branch combining mathematical modeling and computer simulations with practical physical applications.

New funding initiatives reflect this cross-disciplinary interaction. The very face of funding has also changed—basic research is on the downswing, while applied sciences, such as alternative energy and smart grids, are powerful magnets for new research dollars. In addition, collaboration with professional groups, corporations and international partners is more prevalent than ever and results in a full research and development cycle.

Repositioning for the Trends

Faced with these very real and pressing challenges, how do universities react and adapt? What are the specific building approaches that yield an innovative yet balanced learning-research platform? A number of elemental strategies can help determine the value and success of a repositioning effort. Those include:

1. ***Create flexible bioengineering labs and support zones.*** Where it makes sense, engineering schools need labor spaces that are convertible from dry to wet—that is to say, from bench to device fabrication, as recently planned at the University of Arizona. This provides an appropriate amount of lab space for each science type commensurable to research funding. In addition, bioengineering labs are generally underserved in terms of lab support. Instead, expand with shared lab support zones areas that are not dedicated to a specific principal investigator (PI). Examples include vivarium facilities and anatomy labs.
2. ***Turn buildings into teaching tools.*** This is a longstanding idea that has new legs. Among the best examples is the new classroom/lab at the University of Illinois' Electrical and Computer Engineering Building, where the building



actually becomes part of the research environment and study platform. Installations and equipment are used to both power the building and energize teaching and research into solar and wind power, fuel cell performance, energy storage and hydrogen and algae biofuel conversion. Some curricula also incorporate energy modeling of new buildings and repositioned engineering buildings into core academics.

3. ***Explore the total research cycle.*** Instead of only building facilities for certain phases of research, engineering programs are readying for full R&D capacity. This allows them to address total lifecycle from basic investigation to applied research to prototyping and full product development.

   With this in mind, some engineering schools have expanded or converted their building infrastructure to handle the product design and/or development stages. Examples include computational labs, for initial numerical modeling of design problems, as well as labs suited to discovery and small-scale simulations. Additionally, there are visualization theaters for 3-D modeling and detailed simulations, as well as fabrication rooms for prototype manufacturing. Some engineering schools are collaborating with industry partners to enhance their production capabilities.

4. ***Enhance facilities for student experience and enthusiasm.*** One way to leverage a repositioning project is by addressing opportunities to improve student resources and lifestyle. For example, ease of access to faculty and facility resources helps students make more of their engineering experience. One campus decided to add computer modeling and simulation areas to each floor of the

Above:
University of Illinois, Electrical and Computer Engineering Building became part of the research environment.

engineering building, which facilitated team interaction and communication while increasing research output and productivity.

Yet, the bigger picture is attracting top-flight engineering students and raising program retention rates for those that matriculate. One way to increase retention is by making the learning experience more enticing, absorbing and enriched. Some schools showcase their class labs and facilities by using glass partitions, so that architectural transparency puts "engineering on display." Others celebrate their legacies and achievements, such as the University of Maryland's Engineering Alumni Hall of Fame. In a related move, some programs have dedicated area to hosting engineering clubs and societies. While some groups need offices and meeting rooms, such as Women in Science and Engineering (WISE), others highly value available shop space for testing robots, building solar cars, installing Rube Goldberg entries and the like. In some cases, engineering schools are grouping the club spaces with senior design areas, and branding the combination as a "student innovation center.

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Other facility repositioning efforts enrich the educational environment with thematic instruction, hands-on learning methods like studio labs, or group pedagogy as seen in team-based learning. In some cases, simply by thematically arranging instructional areas into clusters or pods, the engineering environment becomes more conducive to collaboration, interaction and sharing of resources. The Electrical and Computer Engineering Building at the University of Illinois is a good example, where ten pod types were designed for everything from optical imaging to robotics to a cleanroom for study of integrated circuits.

Oakland University's Engineering Center was designed around the needs of special design studios and coursework, such as the spaces for dedicated capstone courses—typically team-based, senior design courses that include a semester of project design and planning followed by a semester of project execution. SmithGroup has created a capstone space allocation range, which is approximately 100 sf for a medium project to about 200 sf for larger endeavors. (Computer-related projects, which are usually categorized smaller, are assimilated into other program areas.) In general, the capstone projects undertaken vary widely in complexity and scale; for most programs the rule of thumb is to allocate 60% of the space for large projects, 30% for small ones and the balance for computer-based projects.

Right:
Oakland University Engineering Center was designed around the needs of special studios and coursework.

Above:
Banner Health Ironwood — branded interior experienc

Collaboration and Social Life

These last few examples signify what many consider to be the future of world-class engineering programs: The buildings are becoming hives of social activity where opportunities for collaboration—and spaces that best support them—drive success in both academics and research. Examples include buildings with a great variety of meeting spaces such as lounges, display areas, open study areas and tour aisles. Some also build their collected intelligence into the facility walls, too, using next-generation sensing systems and novel materials as a way to turn the engineering building into a living, breathing test bed for tomorrow's technology. For faculty, students and staff, approaches like this create an environment of greater interaction and enthusiasm.

At the University of Maryland, success came from a multidisciplinary approach to create learning-research clusters. The concept also made the building more flexible, modular and ready for future changes. As a conceptual overlay, engineering schools have also embraced the notion of the building as a passive learning tool itself, with exposed mechanical systems, structural elements and displays. The University of Colorado at Boulder was one of the first to use this passive educational approach, creating a sensation among students.

The socialization of engineering programs benefited both the Maryland and Boulder projects, thanks to their repositioning work. Other programs have seized on this success, such as Oregon State with its Kelley Engineering Center, which sits among a complex of engineering buildings, enticing students and faculty alike to congregate in its big,

Above:
Colorado School of Mines, Brown Hall upgraded the research environment. (Design Architect: AMD Architects, Denver)

bright atrium. The space quickly became a social hub and program touchstone for the entire school, and a gateway to its wireless café, open computer labs and meeting spaces.

In every case, creating better learning spaces must be matched by methods for upgrading the research environment. In what will be seen as a classic repositioning case study, the Colorado School of Mines (Image 4) recently applied that by augmenting an already vibrant program with a tactical building addition. With their expanded research presence and a retooled platform for hands-on learning, Colorado School of Mines is positioned—or repositioned—for a stimulating new era of growth.

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