NBBJ’s renovation of Benedum Hall and addition of the Mascaro Center for Sustainable Innovation increases usable area by 14%. This allows the Swanson School of Engineering to accommodate a 30% increase in enrollment, raise the stature of its programs, create a more productive learning environment for advanced research and offer a more creative interdisciplinary approach to advanced research.
The engineering discipline is undergoing a typological redefinition and the University of Pittsburgh viewed upgrading its facilities as essential to remaining globally competitive. Its 2006 Master Plan set the framework for new concepts in labs, departments and teaching spaces.

Relocating Benedum Hall’s mechanical space from the core to the periphery freed up significant amounts of space on each floor enabling a radical modernization of the interiors. The design of a small addition for the Mascaro Center for Sustainable Innovation provided a new home for the program and the swing space necessary to enable an efficient renovation of Benedum Hall.

Both the addition and renovation foster collaborative science in an environment that can easily adapt to changing needs. The 14% increase in usable area in Benedum Hall allows the school to surpass current space needs and plan for future growth without increasing its land use.

Initial investments in human talent and equipment weren’t sufficient to keep the Swanson School of Engineering competitive and relevant without a physical environment capable of supporting change and growth.
From medical lasers to disease-resistant crops, 20th-century innovations can trace their origins, at least in part, to science and engineering research. Pitt’s Swanson School of Engineering has been engaged in the pursuit of engineering-based innovation for over 100 years. Today, the school’s research is generating the knowledge needed to enhance national security, improve human health, produce a stronger economy and create a cleaner environment in the 21st century. Its focus on energy systems, bioengineering, nanosystems, computational modeling and advanced materials development is driving collaboration between engineering disciplines in ways that require a radically different approach to its research facilities.

The location of the 1960s-era building, on Pitt’s main campus, presented significant barriers as the school sought to address this shifting landscape in engineering education and research. When Benedum Hall was originally built, collaborative discourse—and the social spaces that support this—was not a formal part of the academic program. Engineering research was characterized by segmentation: fields of knowledge were isolated in order to delve deep into an issue. The goal of this project was to transform the existing building into the optimal environment for this new age of multidisciplinary research.

The original Brutalist-inspired building was composed of three articulated parts: a 12-story laboratory classroom tower and a separate single-story auditorium block, sitting on top of a two-story raised entry. Benedum Hall tower was separated from an adjacent auditorium and the elevated plaza was separated from the street.

Given the constraints of the site and the limited amount of free floor area, the design team decided to build up, over the low-rise auditorium building. To mitigate the structural and physical complexities involved in intervening on top of and around existing structures and plazas, the design team employed angled columns that connect multiple loading points in the existing structure with the new building structure. The design of the columns, a direct expression of these structural forces, became an iconic element.

By reorganizing and reshaping spaces within Benedum Hall and the addition of the Mascaro Center, the design integrates a new center dedicated to sustainable research with the renovated tower. In addition to the new Mascaro Center, the building design features a mezzanine level in the existing building, as well as a library, café, labs, offices, classrooms and an upgraded building mechanical system.
THE MASCARO CENTER FOR SUSTAINABLE INNOVATION: LEADING THE TRANSFORMATION

While Pitt was planning the renovation of Benedum Hall, an idea was launched between alumnus Jack Mascaro, Pitt Facilities Management, NBBJ and Swanson School faculty to create a dedicated facility for the Mascaro Center for Sustainable Innovation. The new institute integrates engineering, applied sciences and sustainable research with the goal of improving products, processes and policies affecting everyday life.

The adaptive reuse of the auditorium space allows for 42,000 square feet of dry laboratory and administrative space integrated with the existing engineering building and serves as the headquarters for the institute. The addition now connects what was previously the engineering auditorium to the second floor of the main tower across the existing plaza. Originally an essentially separate building only connected by the basement and sub-basement levels, the auditorium was reconfigured from its original 528-seat space into five separate classrooms. The second floor of Benedum Hall is also part of the new institute and has been completely renovated to meet MCSI’s needs for new research and administrative space.

The LEED Gold building serves as a tangible example of Pitt’s leadership in green construction. It employs many green practices and is sufficiently flexible to allow testing of new enabling technology and long-term monitoring of green building performance.

“We’re seeing collaborations develop that we wouldn’t have seen if it weren’t for the space, to a great extent because these faculty and their students are neighbors now.”

GENA KOVALCICK | MCSI CO-DIRECTOR
Benedum Hall’s existing tower floors contained a rigid and repetitive arrangement of classrooms, laboratories and offices. Today, the learning paradigm is more fluid as teams convene from crossover disciplines and grant cycles turn over faster. NBBJ’s renovation relocates mechanical space; creates a flexible lab-planning concept that achieves a better workflow; raises student and faculty satisfaction; increases collaboration; and delivers higher sustainability, safety and health standards.

**PRE-RENOVATION FLOOR PLAN**

**NEW FLOOR PLAN**

**RECONFIGURING FOR COLLABORATION & EFFICIENCY**

By reconfiguring and repositioning the mechanical infrastructure of Benedum Hall, the design team increased usable net square feet by 12 to 20% on each floor. This was achieved by providing open labs in lieu of some closed labs and improving the flexibility of wet/dry labs.

**12-20% more usable area**

**INCREASED USABLE FLOOR SPACE**

Before renovation, low floor-to-floor heights and hard-walled lab space meant that only one-third of the labs had access to daylight. The reconfigured floors double the amount of lab space with natural light.

**TWICE THE AMOUNT OF DAYLIGHT**

**BALANCING OPEN AND CLOSED**

Closed zones house all workspaces requiring walls for light and acoustically sensitive research, cold rooms and fume hoods. The lab’s other zones are all open, flexible and devoid of casework or walls. Furniture includes carts, stands, tables and racks that can be easily moved and reconfigured.

**MEP SPACE DECREASE; LAB SPACE INCREASE**

The existing utility corridors—“utildors”—were essentially horizontal mechanical shafts bisecting the floorplate (noted in yellow above), limiting the size of lab modules. By reconfiguring the “utildors” into vertical shafts and moving them to the exterior perimeter of the floors, larger labs are introduced, with increased flexibility within the lab to support the fabrication and applied research needs prevalent in engineering research.

**MEP space ↓ 70%**

**CLASSROOMS FOR ACTIVE LEARNING**

Faculty and students are able to work effectively in a dynamic interactive mode throughout the building; in addition to the classrooms. Therefore, the building is used more hours of the day and students are exposed to a greater range of problem-based learning opportunities.

**WET AND DRY AS EQUAL PARTNERS**

Open, flexible lab modules allow for wet and dry labs to evolve over time. They also promote shorter distances — physically and pedagogically — between application and analysis.
Engineering research focuses heavily on content creation and evaluation through a problem-based curriculum. It requires student collaboration before, during and after class. For Benedum Hall, this meant encouraging intellectual pursuits in different places—classrooms, labs, information spaces, and a re-purposed library.

The renovated hallways support group conversations that often migrate here, because the classrooms must be vacated for the next class. Work surfaces and places where pairs and small groups can start or finish a discussion help teachers leverage those elusive teachable moments and put tools at hand for students to work together.
THE IDEA: DRIVE NEW SYNERGIES

“Found” space in any renovation project is highly valuable. The reconfigured floors freed up significant space and the Dean saw an opportunity to further drive interdisciplinary synergies among researchers who work on complementary problems. Three floors were designated as non-departmental and house centers for computation, energy and innovation. These research centers bring researchers and students together from across the school to address some of the world’s most pressing issues. These floors have highly flexible wet and dry lab space for special interdisciplinary projects.

THE DESIGN: CROSSOVER COLLABORATION

NBBJ reorganized the building by concentrating commonly used amenities and classrooms, the engineering learning center, library and café into a daylit basement level, and concentrating upper-division student research higher in the tower. Departments are arranged so that likely collaborators are as close to one another as possible and cross-disciplinary departments are dispersed throughout the building. The result is a learning environment with both structured and informal learning spaces, facilitating better collaboration between all disciplines within the school.
MAKING THE MOST OUT OF SPACE

BEFORE

Hallways and corridors now have welcoming seating areas for study and collaboration.

Classrooms are brighter and can be reconfigured easily for different teaching approaches.

Reconfigurable wall systems allow for flexible use – for teaching, breakouts, or events.

AFTER

Hard-walled labs have given way to open co-laboratories.
Laboratory spaces previously cramped, dark and separated are now open and flooded with natural light. These research areas were also designed with flexibility in mind. Much of the furniture is movable and spaces are interchangeable to shift with demand.

An open-lab concept was introduced. It is significantly different from that of the “closed” lab of the past, which was based on accommodating single disciplines. In open labs, researchers share not only the space, equipment and bench spaces but also ideas. The open lab format facilitates communication between students and makes the lab more easily adaptable for future needs.

Flexible engineering services—supply and exhaust air, water, electricity, voice/data, vacuum systems—were important to the lab spaces. The labs feature easy connects/disconnects at the walls and ceiling that allow fast, affordable hookups of equipment. The engineering systems are designed to enable lab benches or equipment to be removed or added, to allow the space to be changed from one type of lab environment to another or from lab to classroom and then back again.
BIM SUPPORTS SEQUENCED RENOVATION

Building Information Modeling tools were used to support a three-phase construction process. The diagrams illustrate how lab, classroom, administrative, and support space moves were sequenced during the first phase.

The building and its systems had to remain operational throughout the multi-year construction period, so highly detailed planning was necessary. A complete, multi-phase construction process that grew from the building’s basic configuration was developed, allowing two-thirds of the facility to continue in operation at all times.

The multi-phased work required the entire team to view the project as a “musical chairs” construction sequence. The phasing allowed the adjacent labs in unrenovated areas to remain in service during construction. Sections undergoing renovations were cleared, and all equipment and researchers were relocated to swing space.

Building Information Modeling was used in tandem with advanced scheduling. The design team modeled a six-month scenario, fully simulating which departments, programs, and circulation could be reconfigured and sequenced the moves over time. The simulation showed that MCSI had to be built first to create swing space in which Benedum programs could move during renovation.

Pitt’s campus has many older buildings that were constructed long before energy efficiency was a consideration, including Benedum Hall. But the University chose to develop a campus sustainable plan where a building’s senior status didn’t preclude it from receiving an environmentally friendly upgrade. The renovation at Benedum Hall has met the requirements for LEED Gold certification. It features the University’s first living green roof—a plant and soil expanse that reduces water runoff and heat absorption—along with heat recovery equipment to recapture the heat from exhaust air. The University has also implemented a rigorous program of reusing and recycling construction waste. For the Benedum Hall renovation, more than 75 percent of construction debris had been recycled.

- All paints, coatings, carpets, woods, adhesives, and sealants are low-VOC emitting.
- The core and shell project included the installation of the University's first green roof over Benedum Auditorium.
- All Benedum Hall windows have been replaced with an energy efficient Low-E curtainwall system.
- Occupancy sensors are installed in all new and renovated areas.
- Daylighting features reduce the need for artificial lighting.
- The Mascaro addition is equipped with high-performance glazing for energy efficiency.
- Low-flow plumbing fixtures use one-third less water than traditional fixtures.
- The angled primary façade of MCSI allows for optimized exposure to daylight within the building.
- Heat recovery equipment captures heat from exhaust air, and exhaust fans will be equipped with energy-saving variable frequency drives.
CLIENT
University of Pittsburgh

SIZE
408,000 SF

COMPLETION DATE
2014

COMPONENTS
Wet and dry labs, offices, smart classrooms, conference and seminar rooms, 24-hour computer lab, lecture halls, library, administration spaces, café, courtyard

SERVICES PROVIDED
Programming, planning, architectural design, interior design, lab planning, workplace design

DESIGN ARCHITECT
NBBJ

ARCHITECT OF RECORD
EDGE Studio

AWARDS
AIA Pittsburgh Design Pittsburgh Award, 2011
AIA Columbus Honor Award, 2010

SUSTAINABILITY
LEED Gold Accredited
ABOUT NBBJ

NBBJ is an award-winning global design and architecture firm focused on helping clients capitalize on the relationship between people and the design of physical space to enhance organizational performance.

From academic research and university medical schools to simulation centers and campus planning, NBBJ is a global leader in creating performance-based learning environments. Consistently recognized by clients for our creative and professional design process, NBBJ has partnered with 12 of *U.S. News & World Report*’s Top 25 Universities, including Harvard, Stanford, Duke and the University of Cambridge. Our expertise encompasses multiple disciplines, with architects, lab specialists, economists and sustainability experts working together to design innovative centers for learning.

NBBJ’s network of offices enables us to deliver quality projects that are regionally and locally appropriate. It allows us to act as a single creative force—leveraging the latest thinking from NBBJ colleagues in other locations, bringing a rich blend of expertise to each project.

NBBJ SERVICES

Architecture  Master Planning
Interior Design  Campus and Land-Use Planning
Change Management  Lighting Design
Construction Administration  Programming
Facility Planning  Project and Cost Management
Financial Analysis  Retail Planning and Design
Graphic Design and Signage  Space Planning
Laboratory Design  Workplace Consulting