GW has long recognized its need for a state-of-the-art science and engineering complex. With our enhanced focus on research, as well as with the strides we have made to become a leader in the higher education community, building this structure is more important today than ever before.

Scientific discovery drives progress in almost every aspect of life in the 21st century, from fighting disease to conserving energy. Engineering is equally critical to progress in our technology-driven economy.

Considerable thought has gone into the Science and Engineering Complex Benchmarking and Programming report that follows. We surveyed deans, department chairs, and faculty members to identify priorities that will shape the new building. We sought to use the space to maximum advantage and to build in opportunities for growth. We realized that the building has a highly strategic location and will link Poo Hall, home of the Medical Center, the Academic Center, a major campus academic facility, and the new commercial building at Square 54.

With the addition of the Science and Engineering Complex, this key area of campus will become much stronger and more unified.

What will the Science and Engineering Complex look like? Which programs will move there? How will the Complex affect the entire GW community?

Philosophically, our goal is to bring together selected, research-active departments in the sciences and engineering, creating opportunities for students, researchers, and professors to work collaboratively as well as individually.

Plans are for a building eight stories above ground, with two levels for programs below ground. There will be space for research and teaching labs and a number of faculty offices as well as for the dean’s suite for the School of Engineering and Applied Science. And there will be empty areas that will be used as needed as GW evolves in ways we cannot yet anticipate.

The Complex will have a positive effect throughout the GW campus. It will infuse our community with new energy and enthusiasm for science, engineering, and research. And it will free up much-needed room in other parts of campus for faculty offices and classrooms dedicated to disciplines such as the humanities and the social sciences.

In short, the Complex will lift GW to the next level of academic excellence through collaborative discovery and applications. We cannot move forward without it.

Sincerely,

Donald R. Lehman, Executive Vice President for Academic Affairs
PROJECT OVERVIEW: VISION / PROCESS / RESULTS

Strategy Drives Vision

The George Washington University selected Ballinger to conduct an intensely collaborative process to form the basis of a disciplinary and interdisciplinary science and engineering complex. This planning report describes the key ideas that will lead to the realization of a disciplinary and interdisciplinary teaching and research building in the heart of the Foggy Bottom campus. In substance, the report describes the basics of the program, the building organization, and the plan for realizing this transformational project.

The need for this project has long been established. For The George Washington University to continue its trajectory as a premier University, the leadership and faculty recognized the value of investment in a shared science and engineering facility. The Report of the Science and Engineering Building Academic Program Committee of 2007 laid the groundwork for this program, outlining a plan to bring selected departments of science and engineering disciplines together to foster a premier teaching and research environment that will transform these disciplines while raising the reputation of the University at large.

INTENSE COLLABORATION: PROCESS WITH STAKEHOLDERS

Reflecting both the importance of the project and the need for specialized expertise, the leadership selected Boston Properties and Ballinger Architects to work with stakeholders throughout the University community to engage in a collaborative process aimed at defining a program and clarifying GW’s vision for transforming the future of science/engineering teaching and research.

The programming process began with a series of individual interviews with Faculty, Department Chairs, Deans, and University Leadership. This led to a set of exploratory conversations about the nature of a collaborative program conducted during a series of interactive workshops:

- **Workshop 1** - The future potential of collaborative research.
- **Workshop 2/3** - The nature of the research/teaching neighborhood.
- **Workshop 4** - The public domain of the program teaching: symposia, outreach and shared commons.

These interactive sessions served as a springboard for testing ideal interrelationships and refining the building program. An outgrowth of these dialogues are the basic principles that will guide the project’s development in the months ahead.

Interspersed with these collaborations, regular operating and leadership committee sessions were held focused on refining the program and planning concepts. Four primary questions were analyzed that led to the program and planning concepts presented in this report:

1. What is the right balance of teaching and research for the long term (a 50 year view)?
2. What are the appropriate space benchmarks for teaching and research for the future of GW?
3. What provisions should be made for future growth beyond initial occupancy?
4. How can we create a showcase for teaching and research that will draw students, faculty and the larger community to the site and the University?

In addition to formulating the program and planning concepts for the building, three sub-committees were formed whose work is reflected in this report. The first group led by Can Korman, PhD., Professor and Associate Dean for Research and Graduate Studies and Randy M. Packer, PhD., Professor and Associate Dean for Special Projects, developed and conducted benchmarking activities related to space, cost and research productivity. The second group was the Systems Subcommittee which focused on defining the various building systems for the SEC. The third team focused on sustainability in the context of a campus-wide initiative led by Meghan Chapple-Brown, Director of the Office of Sustainability. Their findings lay the groundwork for this project as a model for urban sustainability.
Project Goals Drive Vision

A TRANSFORMATIVE RESULT

At the start of this process the team brainstormed the Project Goals and Design Criteria. These goals and criteria reflect both the impact of the project on the University at large and the special character of this building, which will emerge during the design process.

As the programming process unfolded a range of ideas were tested that led to a set of specific program and design principles described below.

I. TEACHING AND RESEARCH INTEGRATED

With an increased research profile at GW, the integration of teaching and research in science and engineering will be an important pedagogical connection to maintain and enhance. This led to the idea of the research/teaching neighborhood as a basic building block of both the program and design concept.

II. INCLUSION OF THE FULL SPECTRUM OF STUDENTS

All students who take courses in science and engineering should experience the building. As a result, class-labs were developed and located to engage the entire University community with sciences and engineering. To accomplish this, science and engineering major labs cluster with the research and non-major teaching labs are featured in the public zone of the building. The intent is to make these labs visible from both inside and outside the facility.

III. CLUSTERING OF FACULTY TO CREATE COMMUNITY AND INTERACTION

Consolidating space for science and engineering faculty that are currently located in multiple areas across the campus will enhance the sense of a common teaching and research community. By sharing support functions such as a copy center, mail room, convenience stations and conference rooms, both operational and community benefits can be achieved.

IV. THE PUBLIC DOMAIN: WELCOMING VISITORS AND THE LARGER COMMUNITY

The science and engineering complex will have spaces to support outreach, symposia and public events. The character of the ground floors is to be permeable with multiple entrances and daylight so that people are inspired to engage the building as a vibrant pathway and an important campus destination. Science and engineering displays and retail conveniences are intended to create a welcoming character to this pivotal building. Furthermore, the building should be visually appealing, reflective of the program and indicative of the importance of science and engineering at GW.

The University’s overarching goal of the project is to be holistically transformative: from how teaching and research are conducted, to how the project engages with the campus context, resulting in an enhancement to the quality and prestige of the University as a whole.

DESIGN CRITERIA

- Site Location: HUB
- Urban Sustainability
- Enhance Overall Reputation of GW
- Interaction
- No Barriers
- Open Character / “On Display”
- Integrate Research w/ Teaching
- Learning Commons
- Public Outreach
- Enhance GW Reputation
- Research Revenue
- Building Performance
- Cost / Delivery
- Flexible to Adapt
- Catalyst for Continued Growth of Science / Engineering / Research
THE SITE

Current Locations of CCAS / SEAS Departments

Overview
The CCAS and SEAS departments anticipated for inclusion in the SEC comprise approximately 155,000 net square feet and are currently located in 12 different buildings over multiple floors. The consolidation of space for these departments in the core of the campus is a significant opportunity to strengthen departmental foundation and to inspire collaborative interdisciplinary teaching and research activity.

Existing Site
Located immediately North of the SEC site, Square 54 is currently under development as a mixed-use town center featuring office, residential and first floor retail. This project will dramatically change the landscape of I Street and generate an active street environment north of the SEC.
The site for the SEC is in a unique location with frontages on four streets - 22nd, 23rd, H, and I. 23rd Street is a major regional artery and is an opportunity for the SEC to connect to the research activity in Ross Hall. H Street represents the University Corridor connecting to Kogan Plaza, the heart of the Campus and the "Campus Core." The primary façade of the building faces 22nd Street and the Academic Center to the East. With Square 54 currently under construction, I Street will be reinforced as a retail corridor and is an opportunity for the SEC to embrace the significant pedestrian activity generated by the Metro Station to the west. With anticipated entrances at each of these street frontages, the SEC will serve as an engaging pathway and vibrant destination that will position it as the campus scientific/engineering "hub."

Parking access is situated at the southwest corner of the site on H Street. The current parking garage to be demolished has approximately 1200 spaces and the new facility will accommodate 300-400 cars. This reduced parking count is expected to lessen traffic congestion in this area. Recognizing the confluence of the SEC and Duques Parking access, additional traffic study is required to optimize traffic flow in this campus sector. A service court accessed from I Street currently serves both Munson and JBKO Halls and is anticipated to provide service for the SEC. This combined service court will increase operational efficiencies and serve to minimize service access points.
THE ENGAGEMENT PROCESS

Workshop Process

<table>
<thead>
<tr>
<th>WORKSHOP</th>
<th>WORKSHOP FOCUS: KEY ISSUES / DISCUSSION</th>
</tr>
</thead>
</table>
| 1. November 3/4/5 | • Initial Department Chair, Deans & Leadership Interviews  
| | • Confirmation of Project Vision  
| | • Setting Processes & Formats |
| 2. November 17/18 | • Second Round of Program Interviews  
| | • Visits to On-Campus Facilities  
| | • Collaborative Session with Chairs: Department Focused (November 20: 10:00-12:00) |
| 3. Nov 30 / Dec. 4 (Tradeline: Dec. 2/3) | • Discuss Potential Site Visits  
| | • Initial Benchmarking Feedback  
| | • Faculty Forum (December 4: 10:00-12:00) |
| 4. December 15/16 | • Initial Program Draft  
| | • Impact of Systems & Sustainability on Program  
| | • Collaborative Session with Chairs: Research / Teaching Neighborhoods (December 18: 10:00-12:00) |
| 5. January 5/6 | • Review Benchmarking Study: Metrics  
| | • Discuss Additional Site Visits  
| | • Critique / Modify Program  
| | • Critique Blocking / Stacking Options  
| | • Faculty Forum (January 8: 10:00-12:00) |
| 6. January 19/20 | • Collaborative Session with Chairs: Options Discussion (January 29: 10:00-12:00)  
| | • Evaluate Block & Stack Alternatives |
| 7. February / March | • Faculty Senate (February 12/15)  
| | • SEC Board Committee (March 5: 10:00-12:00)  
| | • Deans | Chairs Forum / Faculty Forum (March 11/12)  
| | • Deans | Chairs Forum: Detailed Program Overview (March 26) |
**GROUND FLOOR AFFINITY EXERCISE**

**Deans | Chairs Forum**

1. **Teaching Lab Filter / Central Opening / Quiet Study / Segregated Support / Entrances @ Corners & Mid Block**
2. **Teaching Core @ Corner of H & 22nd / Coffee @ Central Opening / Munson Study Court / Entrances @ Mid Block**
3. **Science Display @ 22nd & I Street / Demonstration Research Space / Central Opening / No Entrance @ I Street**
4. **Tutoring Center / Re-Configurable Teaching Labs / Central Opening / Teaching Lab Filter / Entrances @ Corners & Mid Block**

**Overview of Collaborations**

The four month process for defining the program and conducting benchmarking engaged a wide range of constituencies with a number of multi-day workshops. Central to this collaborative process were a series of exercises performed by both the Deans / Chairs and in Faculty Forums. These block exercises started with an assessment of current and future research affinities and then transitioned to focus on ideal relationships of a teaching / research neighborhood. Recognizing that choices are an inherent part of the programming process, the faculty was then asked to prioritize the most important spaces that best define the teaching / research neighborhood. Finally, the Deans and Chairs were asked to define the public domain and to consider the programmatic choices for the ground floor in an exercise contextualized to the site. These exercises were of great significance for both inspiring collaboration between SEAS and CCAS departments and defining the program and spatial relationships outlined in this document.
PROGRAM DEVELOPMENT

Program Distribution

- Research & Upper Level Teaching Labs: 211,430
- Non-Majors Teaching Labs / Lecture / Commons: 37,850
- Departments / SEAS Dean: 26,920
- Building Support / Retail: 13,800

Key Program & Building Principles

- The Building should be constructed to maximize the site potential.
- The Building will include research/teaching/departmental office space.
- The building program includes faculty offices for departments with affiliated research as follows:
  1. 4 CCAS programs: Biology, Chemistry, Physics, Hominin Paleobiology
  2. 4 SEAS programs: Civil/Environmental, Computer Science, Electrical/Computer; Mechanical/Aerospace and SEAS Dean's Office
- The program will accommodate 10-Year Growth Projections for Faculty in CCAS/SEAS programs (+20 by 2014; +41 by 2019)
- Growth in Faculty will be faculty w/ either Funded or Fundable Research
- Space Requirements Assume Integration of Increased Number of Doctoral/Post-Doctoral and Graduate Students into Research Projects
- Faculty in Medical Center & Other University Collaborators Can Participate in the Building Through Centers/Institutes/Thematic Research
- Teaching Will Include Both Non-Major & Upper Level Teaching Labs
- Research and Upper-Level Teaching Space will be flexible to transition between these two uses over time.
- Research Space Will Be Shared and Allocated Based on Primarily External Funding
- Research Incubation Space Will Be Available to Faculty in the Building
- Departmental Shared Support Will Be Implemented to Assist in Space Efficiency
- The building should be visually striking and appealing, evocative of the Program, and reinforce the prominence of Science and Engineering at GW.

Program Summary

- **TOTAL NET SQUARE FEET**: 290,000
- **RESEARCH AND UPPER LEVEL TEACHING LAB SPACE (94 PI’S)**: 211,430
  - Research Labs / Lab Support: 78,870
  - PI Offices / Post Docs / RA Workstations (94 / 188 / 376): 33,840
  - Core Facilities & High Bay: 25,040
  - Team Rooms / Interaction Spaces / Support: 27,450
  - Admin Assistants / Hotel Offices (36): 4,320
  - Upper Level Teaching Labs / Lab Support (18): 32,670
  - Seminar Rooms (14): 9,240
- **NON-MAJOR TEACHING LABS & LECTURE / COMMON**: 37,850
  - Non-Major Studio Teaching Labs / Lab Support (10): 24,750
  - Lecture Hall: 4,000
  - Resource Center / Break-Out / Commons: 9,100
- **DEPARTMENTS & SEAS DEAN**: 26,920
  - 8 Departments / Faculty Offices (62): 16,920
  - SEAS Dean Suite & Associated Space: 10,000
- **BUILDING SUPPORT / RETAIL**: 13,800

Overview of the Program

The program is sized at 290,000 net square feet above and below grade and is organized into the four categories referenced above. To achieve the goal of transforming the research and teaching paradigm, the program development focused on the following:

1. **Faculty Growth**: The space program reflects a total net addition of 40+ new faculty across science and engineering in the next 10 years.
2. **Growth of Funded Research**: GW expects to grow its research in conjunction with the faculty growth. The program is based on an average space per PI (principle investigator) of 1,185 sf including lab, office and support. The underlying principle for research is to maximize the long term flexibility of this space and to assign space based on research productivity.
3. **Growth of Teaching (Majors and Non-Majors)**: Given student growth and the trend toward a new teaching paradigm, teaching in the building is focused on the class lab, a space that will allow flexibility in use and provide higher utilization. Shared teaching support space will vary by discipline, providing for preparation equipment and storage to allow for the most effective use of the teaching lab.
4. **Departmental Clustering and Shared Centers**: A guiding principle of the program has been the consolidation of space for science and engineering disciplines. Clustering of interrelated groups is envisioned to maximize the sense of community and to optimize support functions.
5. **Building Support / Retail**: This category of space includes support activities such as: support staff, loading dock, storage, mail room, et al. In addition, a 3,000 sf retail / food venue is planned for the I Street side of the building, reinforcing the retail corridor.
## Graphic Program Summary

### Research and Upper Level Teaching Labs
- **Research Lab/ Lab Support**: 12,375 NASF
- **Upper Level Teaching Labs**: 3,630 NASF

### Non-Majors Teaching Labs and Lecture / Commons
- **Seminar**: 1,320 NASF

### Department Offices / Dean
- **PI Offices**: 1,800 NASF
- **Post-Doc Workstations**: 1,800 NASF
- **RA Workstations**: 1,800 NASF

### Building Support / Retail
- **Stockroom / Central Glasswash**: 1,800 NASF
- **Receiving Area and Materials Storage**: 2,000 NASF

### Totals
- **G**: 24,820 NASF
- **LL1**: 23,250 NASF
- **LL2**: 25,165 NASF
- **Totals**: 290,000 NASF

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**Additional Information**

- **Research Lab/ Lab Support**: 3,200 NASF
- **Upper Level Teaching Labs**: 3,630 NASF
- **Seminar**: 1,320 NASF
- **Shared Instrument Cores**: 1,980 NASF
- **Department Offices / Dean**: 10,000 NASF
- **Building Support / Retail**: 10,000 NASF

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**June 2010**
Overview

The objective of the space program, in the generic form presented here, is to consider the needs of the science and engineering disciplines with a long term frame of reference. This means conceptualizing various scenarios for: the relationship between the campus community and a science and engineering community; the learning experiences of non-majors; the learning relationship between majors and researchers; the collaborative nature of interdisciplinary research; the technological devices of research and the infrastructure which supports them; and the communication of research to promote its application to the needs of society.

Each scenario should be able to be conceptually supported by the framework of building systems initiated in the design and construction of the building. The spatial fabric and the fundamental infrastructure of building systems should be designed in an open-ended fashion to allow additional investment to expand the capabilities of systems as required by evolving needs. In this way the capabilities of the building should be a catalyst for experimentation.

In each category of the space program, this principle of a long-term and open-ended view of the building’s use has been a guide to the structure and composition of the individual program components and their relationships.

The program provides research space for a total of 94 principal investigators (faculty) with space for 30 of these principal investigators designated as part of shelled space. On average, each principal investigator has 1,185 net assignable square feet of total research space. 825sf is lab and lab support space. 360sf is office and workstation space for one principal investigator, two post doctorate researchers, and four research assistants (undergraduate, graduate, and post-graduate students).

The research lab and lab support space is conceived as generic, flexible, and changeable space which allows a range of specialization to meet the detailed needs of specific research groups. Research layouts can accommodate shared open lab space or dedicated space. Various types of lab support spaces can be provided in a number of different configuration patterns. Lab furniture is movable such that it can be repositioned or replaced with equipment as desired. Fume hoods and sinks have plug-and-play characteristics, meaning they can be added and subtracted in predetermined locations, as required. Utilities are provided from the ceiling with quick disconnect fittings to make change-out of a lab space simple and with minimal cost.

The fabric of generic and flexible lab and lab support space will be grouped into wet and dry zones with different levels of HVAC and piped utilities service densities.

In proximity to the research labs, flexible upper level teaching labs are sized at 1,320sf to accommodate 16 students. The program concept of the labs allows the pedagogical integration of lecture and lab. 14 labs are provided (four as shelled space), which if utilized at a scheduling density of 20 two-hour sessions per week, it is projected that 93 course sections of 16 students can be accommodated. The critical factor in this level of utilization is the ability to change-out the materials in a lab between sessions by using mobile storage units that can be stored in an adjacent lab support core.

Ten seminar rooms seating 24 people are provided (four as shelled space). These spaces can be converted to five additional upper level teaching labs, which could accommodate an additional 33 course sections.

12,500sf of core facilities space is provided including 5,000sf of high bay space and 4,000sf of slab-on-grade space for vibration sensitive equipment. This space will have a more robust mechanical, electrical, and plumbing infrastructure to serve the greater needs of program spaces located here.
Ten studio teaching labs for non-major courses are provided on the public floors of the building. The labs are sized at 1,980sf to accommodate 36 students. As with the upper level labs, the program concept allows pedagogical integration of lecture and lab. With a utilization rate of 20 two hour sessions per week, it is projected that 66 course sections of 36 students can be accommodated. An adjacent lab support core to facilitate the change-out of materials in the lab supports this level of utilization.

Other program components that support non-majors use of the building are a 150 seat forum, a study resource center and a building commons that links these components spatially and socially with the non-majors studio labs.

Eight department centers are provided with 62 offices for faculty not directly associated with research space in the building. A 10,000sf allowance is provided for the SEAS Dean and associated program needs.

During the schematic design phase, the departmental and Dean’s office space outlined in the program will be developed in detail with GW, as an activity integral to the exploration of the design.

Building support program can be grouped into four categories: a retail / food venue, facilities to support the operation of the building, information technology services, and materials management.

During the schematic design phase the generic facilities outlined by the program will be developed in detail with GW, as an activity integral to the exploration of the building design.
The SEC is comprised of eight levels of program space above grade, two levels of program space below grade and four levels of parking. Lower level 1 and the ground floor are the primary public floors of the facility and consist of non-major studio labs, meeting space, resource center and building services. These two floors are interconnected by floor openings to the second floor which houses the SEAS Dean Suite, a concentration of upper level teaching labs and research space. Floors 3-4 are the primary floors for departmental offices and teaching/research neighborhoods. Floors 5-8 are programmed for research institutes/centers and include upper level teaching laboratories. Floors 7-8 are intentionally shelled to allow flexibility and to respond to future program requirements. Multiple floor openings in the Teaching/Research Neighborhoods and Institutes are envisioned to enhance interdisciplinary activity and allow for vertical flexibility of space assignments.
Section A (North / South)

Overview of Vertical Organization

All of the program floors are designed with 14’ floor-to-floor heights except lower level 2 which has 18’ floor-to-floor to accommodate scientific cores, vibration sensitive spaces and high bay facilities. With concrete construction, these floor-to-floor heights are optimized to provide flexibility for the future. The height of the building is restricted by zoning to 110’ above grade assuming a set zoning floor datum at H Street. With grade varying approximately 4’-6” from a high point at H Street to low points at I and 23rd Streets, the ground floor level is situated slightly above and below grade relative to this varying grade condition.

In addition to the 110’ height limit, zoning also imposes a 90’ height restriction at 23rd Street. Thus, levels 7 & 8 are setback from this street frontage to accommodate this height restriction. Furthermore, all rooftop penthouse space, equipment and screen is limited to 18’-6” above the roof level with a set back from the adjacent frontages equal to this height.

There are several below grade issues that will impact the design team in future phases. The below grade area at I Street is restricted by the WMATA tunnel where adjacent building foundations are required to remain above the 45 degree angle of repose set from the bottom of the tunnel. Bedrock varies from a high point at H Street to a low point at I Street. Finally, with the anticipation of two program areas below grade, local code official consultation will be required early in the next design phase to determine the extent of chemical quantity limitations and code enhancements required to accommodate the intended program.

Section B (East / West)
TEACHING / RESEARCH FLOORS & CENTERS

Shell: Future Centers / Institutes / Teaching:
Floors 7 / 8

Institutes / Centers / Upper Level Teaching Research:
Floors 5 / 6
The organizational strategy for these floors is to create a dynamic integrated environment focused on research / teaching neighborhoods. The organizational strategy minimizes corridor-like environments and prioritizes a comprehensible plan for simple orientation and circulation. Through the consolidation of workstations and teaming spaces around centralized common functions, interaction is prioritized to enhance collaborative interdisciplinary activity. With student access required for teaching laboratories and faculty offices, transparent gradients of security are denoted to provide visual integration with the research environment while limiting public access to these areas. Openings between floors with communicating stairs are strategically distributed to encourage floor-to-floor interaction and to support flexibility for space assignments. Varying dimensions of laboratory space provides a variety of research layouts consistent with the diversity of science and engineering disciplines inherent in the program. Abundant transparency between spaces is desired to promote collaboration, energize the environment and to provide visual access to natural light from all areas. Floors 7 & 8 are denoted as shell floors for future implementation and are anticipated to be organized with the same planning principals as the Teaching / Research floors below.

Key Building Principles

- Integrated Teaching & Research on Each Floor
- Sensitivity to Security For Certain Types of Research
- Centralized Shared Commons
- Centralized Department Support Space
- Maximize Opportunity for Daylight to Faculty/PI Offices
- Provide for Student Access to Faculty/PI Offices

Overview of Teaching / Research & Centers

The organizational strategy for these floors is to create a dynamic integrated environment focused on research / teaching neighborhoods. The organizational strategy minimizes corridor-like environments and prioritizes a comprehensible plan for simple orientation and circulation. Through the consolidation of workstations and teaming spaces around centralized common functions, interaction is prioritized to enhance collaborative interdisciplinary activity. With student access required for teaching laboratories and faculty offices, transparent gradients of security are denoted to provide visual integration with the research environment while limiting public access to these areas. Openings between floors with communicating stairs are strategically distributed to encourage floor-to-floor interaction and to support flexibility for space assignments. Varying dimensions of laboratory space provides a variety of research layouts consistent with the diversity of science and engineering disciplines inherent in the program. Abundant transparency between spaces is desired to promote collaboration, energize the environment and to provide visual access to natural light from all areas. Floors 7 & 8 are denoted as shell floors for future implementation and are anticipated to be organized with the same planning principals as the Teaching / Research floors below.
Key Building Principles: Public Floors

- Science & Engineering Teaching Showcase
- Science & Engineering Regional Hub (Symposiums)
- Open Character: Horizontal / Vertical
- Flexible Arrangement to Accommodate A Variety of Events
- Entries from Multiple Locations
- Provide Natural Light to Lower Level Teaching Environment

Overview of the Public Domain

The SEC will be a science and engineering “hub” for GW with these three floors representing the “Public Domain” of the facility. Multiple entrances connect to all street frontages and will promote the ground floor as an engaging pathway and vibrant destination. With a significant number of teaching spaces located on these three levels, a centralized stair and multiple floor openings will provide visual connections and easy access between floors. In addition to the teaching laboratories, a diversity of spaces including a demonstration research lab, resource center, interaction areas, study space, food amenities and a lecture hall / forum will enhance the vitality of the facility as a multi-purpose venue.

To provide efficient student accessibility, the ground and lower levels will house all of the non-major studio teaching labs. With an abundance of transparency, these teaching spaces are interspersed between entrances and bridge between inside / outside to create an engaging scientific and engineering environment. Complementing the teaching labs on the floors above, the second floor consolidates a significant component of the upper level teaching laboratories and provides public access to the SEAS Dean’s offices. Public circulation is organized around these spaces for easy orientation and is enhanced by natural light from multiple sources including transparency into the laboratory environments.
LOWER LEVEL 2 AND GARAGE LEVELS

Lower Level 2

Parking 1
Parking 2-4

Key Building Principles: Lower Level 2
- 18’ Floor-to-Floor for Flexibility
- Slab on Grade Location for Vibration Sensitive Facilities
- Large Service Elevator with Direct Connection to On-Grade Loading
- “Drive-in” High Bay Area

Key Building Principles: Parking Levels
- 300-400 Cars / 2 Way Circulation
- Speed Ramp @ 12% Max to Sloped Parking Levels @ 5% Max
- Ticket / Card Stations @ Garage Level 1
- Reversible Lane at Entrance / Exit Ramp
- 24 Hour Elevator Access from 23rd & 22nd Streets Separated from SEC

Overview of Lower Level & Parking
Lower Level 2 is programmed to include shared core facilities for the SEC. With an 18’ floor-to-floor height, this level is designed for significant flexibility and includes slab on grade area for highly sensitive vibration free spaces. In addition to server space, central stockroom/ glass wash and upper level of the high bay space on this level, a research neighborhood is also anticipated to accommodate light sensitive and high floor-to-floor space requirements. A large service elevator connects both this level and the high bay space to the ground floor loading zone. The lower level of the 28’ floor-to-floor high bay space has a slab on grade and drive in access from the adjacent garage.

Car access to the garage is via a combination straight / circular speed ramp and accommodates approximately 300 cars on 3 ½ sloped two – way circulation parking ramps and up to 400 cars may be accommodated with 1 additional level. People access the garage via two elevators that connect to both 22nd and 23rd street frontages and have 24/7 hour access outside the secure envelope of the SEC above. The west elevator is also anticipated to have dual openings to provide access to the adjacent series of mechanical rooms.
MECHANICAL BASE OPTION

Penthouse Room

Mechanical 1 - 3
Alternate Options

<table>
<thead>
<tr>
<th>Options</th>
<th>Chillers</th>
<th>Boilers</th>
<th>Cooling Towers</th>
<th>Emergency Generators</th>
<th>Co-Gen System</th>
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<td>#</td>
<td>Size</td>
<td>Type</td>
<td>Location</td>
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Overview of Mechanical System

The mechanical engineering concepts and options presented on this page are part of a larger effort of the Systems Subcommittee to shape the technical character of the design concept in parallel with the program presented on the previous pages.

The adjacent set of diagrammatic plans reflect the basis of design. Its origin is to serve the SEC building plus the three dormitory buildings on Square 55: JBKO, Fulbright and Munson. In this case, all equipment would be included in the SEC in a rooftop penthouse and on three levels of basement mechanical space.

In addition, several alternative possibilities were explored and are represented as alternates 1-4. The genesis of these alternates is the aged condition of the equipment in Ross Hall (37 years old) and the potential for realizing substantial savings by combining the needs of Ross Hall and Square 55. All alternates regarding Ross Hall proposed below utilize existing mechanical space and will not impact any program area in that facility. These four alternates will form the basis for decision in the schematic design phase.

Alternate #1:
This concept is based on the boilers and chillers in the SEC serving both Ross Hall and the Square 55 residential facilities.

Alternate #2:
This option has the same basis as option 1, and also includes feeding chilled water to Ross Hall. Additionally, the boilers in Ross Hall would be replaced. An underground utility connection below 23rd Street would allow the cross connection between the two sites as indicated in the key plan.

Alternate #3:
The third option involves replacing both Boiler and Chillers in Ross Hall that will also serve Square 55. This will result in reduced below grade mechanical space at the SEC.

Alternate #4:
The fourth option involves the same basic strategy as option 3, but adds a co-generation system to the concept.

Each of these options rely on the below grade utility connection under 23rd Street. Preliminary conversations and existing precedents suggest this is feasible.
SUSTAINABILITY

Sustainability Guiding Principals

Sustainability is a critical component of the programming and design for the SEC. With the University in the midst of the process of establishing a climate action plan, the SEC is a major opportunity to contribute to the goals and objectives of this initiative. Sustainability will be an integral component of the SEAS / CCAS program anticipated for this facility and the sustainable aspects of the building and systems should enhance the pedagogy of these programs. In addition, as a regional center for science and engineering, this facility represents a significant opportunity to showcase GW as a leader in urban sustainability.

Through a series of workshops attended by a broad set of campus constituencies, the following Guiding Principles and Strategic Ideas have been developed as a basis for guiding the forthcoming design process. With LEED Silver Certification as a foundation, these principles and strategies will position the facility as a significant contributor to GW’s sustainability goals and objectives.

Guiding Principle No.1

CREATE A CULTURE OF SUSTAINABILITY

The SEC will seek to signal the University’s commitment to sustainability and enable and inspire sustainable behavior.

STRATEGIC IDEAS

The SEC will seek to:

- Demonstrate the University’s commitment to its Climate Action Plan by striving for carbon neutrality (through energy efficiency and purchase of green power).
- Have large open spaces for the building community to gather.
- Maximize natural lighting.
- Provide inviting stairways which integrate social functions.
- Emphasize building features that will still be relevant in 100 years and facilitate the easy change of certain features (e.g. modular flooring, lighting upgrades).
- Focus on sustainability features with long-term impact such as efficiency of energy and water systems, waste energy capture and reuse, storm and waste water capture and reuse, and material waste reduction.
- Create a community gathering space that showcases sustainability features and research as a display.
- Use reclaimed materials whenever possible.
- Have signage highlighting the building’s sustainable features.
- Encourage locally-sourced whole food.
Guiding Principle No.2

ENGAGE WITH THE BUILDING AS A LEARNING LABORATORY

The SEC will seek to influence the behavior of students, faculty, and staff by way of active engagement with the building as a living laboratory which measures, monitors, and displays the performance of the building’s energy and water systems.

STRATEGIC IDEAS

The SEC will seek to:
1. Contain technology to view building energy and water performance to create learning opportunities to understand energy and water flows of the urban microclimate and watershed.
2. Provide “living laboratory” space for students to study sustainability and to further exploration of renewable technologies.
3. Demonstrate different types of renewable energy technologies and energy efficiency options.

Guiding Principle No.3

INTEGRATE THE BUILDING INTO THE URBAN ECOSYSTEM

The SEC will seek to be a positive contributor to the urban ecosystem that minimizes energy use, water use, and waste, supports low carbon transportation and sustainable food, provides sustainable landscapes, and low carbon technologies.

STRATEGIC IDEAS

The SEC will seek to:
1. Maximize energy efficient design and technologies.
2. Encourage sustainable commuting methods (e.g., showers and racks for bike commuting and charging stations for electric vehicles).
3. Protect the Potomac watershed by reducing/eliminating run-off, providing in-building water filtration to eliminate bottled water, minimizing water use in HVAC and other building systems, metering water use in laboratories, and using native, historical plantings.
4. Include examples of sustainable urban landscaping.
6. Have building floor-plates and building systems designed for longevity and changeability with the ability to change-out building program uses over time via the reuse/recycling of building components with minimal waste.
7. Support locally sourced organic whole food.
8. Integrate with the community at the street level by showcasing sustainability initiatives and research being conducted in the building.
BENCHMARKING STUDY: METRICS

Space Distribution

**OVERVIEW**

This Benchmarking Study was a parallel effort with the Programming Study and was used to gather information from peers and aspirational peers to inform the planning process for the new Science and Engineering Complex at The George Washington University. Two types of information were gathered: data related to space, faculty, and student metrics, and strategic information related to the planning and vision behind a new interdisciplinary research facility.

In addition to The George Washington University, the following eight schools participated in the study:

- Boston University
- Duke University
- New York University
- Northwestern University
- University of Maryland
- University of Virginia
- Wake Forest University
- Washington University

**SUMMARY OF FINDINGS**

**Space Distribution**

As indicated by the adjacent pie chart diagrams, the existing space allocation for GW reflects the current state of research activity at the University. The new facility, with increased emphasis on research, will more closely align with the research allocation at the benchmarked institutions.

**Research Space**

The amount of research space per full time faculty member was analyzed on multiple levels, including an overall combination of science and engineering, science only, engineering only, and also on an individual department basis. There was a broad range between the schools, with a significant higher average research allocation per faculty for the sciences (2,011 sf/faculty) than for the engineering disciplines (1,300 sf/faculty).

**Research Expenditure**

Research expenditure was analyzed on a research funding per square foot basis as well as a research funding per faculty basis. These data were analyzed at multiple levels, similar to the research space data metrics described above. The resulting findings showed an extremely broad range of funding per square foot in the sciences, with a much narrower range of funding per square foot in the engineering disciplines. Average funding per square foot in the sciences is approximately twice as much as that found in engineering.
RESEARCH SPACE / FACULTY

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Science

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RESEARCH EXPENDITURES / SQUARE FOOT

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NEW PEDAGOGY: STUDIO TEACHING LABS

Class Lab: Lecture Mode

Class Lab: Moveable Sitting Height Benches

Class Lab: Work Group / Technology
BENCHMARKING STUDY: STRATEGIC ISSUES

Academic Program Benchmarking - Summary of Responses to Key Issues

STRATEGY: WHO SETS THE VISION?

The strategy is set by both top-down and bottom-up approaches whereby the final academic vision and building plan is the result of a joint administration and faculty effort. While the University leadership usually identifies broad institutional objectives and priorities, the Deans and faculty eventually play a greater role in the specifics of how a certain strategy is to be realized. The trends of late are to focus more on interdisciplinary initiatives and buildings that complement existing disciplinary specific programs and buildings. While presidents and provosts play a greater role in championing across schools interdisciplinary programs, Deans play a much greater role in across department(s) interdisciplinary programs.

WHAT IS YOUR ACADEMIC PROGRAM STRUCTURE: RESEARCH/TEACHING?

All of the schools surveyed have strong departmental identities with designated department specific space, academic structure and promotion and tenure processes. Many institutions have created additional interdisciplinary research centers and institutes, typically housed in designated spaces to encourage cross fertilization. Some institutions have observed that even in interdisciplinary spaces, faculty tend to coalesce into department and subject specific groupings, so the level of success is mixed. The importance of clustering buildings in engineering, science and medicine was stressed in order to foster closer interaction among multiple disciplines. The importance of shared core facilities to draw interdisciplinary research groups was stressed.

It was stressed that curriculum must drive the activities in the building and the building design, rather than the other way around. The importance of designing flexibility into the building design was stressed repeatedly as initial plans do not always match the realities and the unexpected opportunities that present themselves once the building is completed. Increasingly, research plays a more prominent role in undergraduate studies, especially at those institutions where there is a structured research requirement built into undergraduate curricula. While it is important to have a building design that fosters greater visibility of research and research laboratories, it is critical that research be incorporated into the undergraduate curricula to foster undergraduate research. Almost all schools stressed the importance of having teaching facilities that enable both lecture and hands-on laboratory activities to take place in the same room (e.g., the studio model). Further, the importance of social space that encourages students and faculty to spend more time in the building and to foster more academic collaboration and idea exchanges was stressed.

WHAT IS YOUR ACADEMIC PROGRAM STRATEGY FOR THE FUTURE?

Due to the current economic climate, many of the universities have slowed down their new initiatives. Most initiatives are driven by new research programs rather than new teaching and pedagogy. In turn, these research initiatives are driven by several factors, such as, new funding opportunities for research centers and institutes, pressing needs to replace out of date physical infrastructure and the increasing need for collaboration across the science and engineering disciplines. Most universities are developing interdisciplinary research via the formation of new institutes where faculty are hired into the traditional departments but have a strong affiliation with institute activities. All universities appear to be challenged by the cost of providing both discipline specific space as well as space fostering interdisciplinary activity. Degrees continue to be largely administered by traditional departments at most universities, though some indicated that institutes develop and award degrees.

HOW DO YOU HANDLE FACULTY GROWTH - ESPECIALLY WITH RESPECT TO CHANGE?

The request for additional faculty usually comes from the departments and these requests are escalated to leadership. At the college level the need for growth in multiple areas is handled by a comparison of the respective merits of the proposals from the departments. The Deans address these requests based on programmatic needs and the opportunity to pursue funding opportunities in new areas of research. The space growth is handled by a combination of mechanisms, such as keeping some space in reserve that anticipates growth, reallocating space resources based on current and anticipated research funding and on occasion rental space (as a short term solution). The funds required to fund the salaries and start-up packages of new faculty are usually addressed at the provost level. Universities with well-established and well-funded institutes also utilize institute funds to support faculty salaries, space needs and start-up expenses.

HOW DO YOU HANDLE RESEARCH SUPPORT - STAFFING, LOCATION, ETC? / HOW IS SPACE ASSIGNED?

There was a common pattern across all universities in the manner in which space is allocated. The space allocations in the medical schools are done by clear metrics of dollars per square feet. However, the space allocation metrics for the science and engineering programs employ several factors, such as, current funding, anticipated research funding, and programmatic balance among disciplines. As such, the science and engineering schools tend to be more subjective in their approach of allocating space compared to the more formal metrics employed by their respective medical schools. Deans and provosts acknowledged that metrics become more important when there is an undersupply of space and when more urgent space demands need to be addressed.

Most universities have traditional department space and additional interdisciplinary research space. Typically, the latter category constitutes most of their newer space. In this context, most of the newer space is not “owned” by any given individual or program but is reallocated based on a broad productivity assessment by the Dean and school leadership. The space for research institutes and centers tend to be dispersed largely due to historical reasons where faculty from many disciplines were formally brought under the umbrella of an institute while continuing to use their space in their respective departments. There is a desire to collocate such activities (if and when resources can be identified) in new or renovated buildings to foster greater levels of collaboration.

Another common theme is the intermingling of research/teaching laboratories of multiple disciplines based on their common support and infrastructure needs, such as colocation of Chemistry and Biology laboratories on the same wing or hallway. Schools also emphasized the need to have a balance between the demands of the researchers vs. the necessity to allocate space for teaching and other programmatic needs. Hence, a purely research funding based space allocation model is not always applicable where there is a strong responsibility to ensure that adequate resources are allocated to fulfill the teaching mission.
HAVE YOU TAKEN ON ANY NEW PEDAGOGICAL STRATEGIES IN THE SCIENCES OR ENGINEERING?

All universities stressed the need to have more attractive and current space to meet their teaching needs. Boston University, in particular, stressed their need to have more studio type classrooms, since their current teaching space is of mixed quality. The University of Maryland was quite proud in the success of their mixed lecture/laboratory type teaching spaces in their new Kim Building. They emphasized that such facilities are used quite effectively by multiple courses and programs, hence increasing efficiency. Due to the success of such studio type teaching spaces, UMD plans to increase the number of such teaching spaces as more faculty are convinced of the value of such laboratories upon teaching in those rooms. University of Virginia highlighted their change in pedagogy enhanced by utilizing studio type laboratories, especially their new ITE Building. Among all the schools, the coupling of building design to pedagogy is particularly noteworthy for Northwestern University. They utilize open spaces, social spaces, and viable laboratories to foster a greater sense of student collaboration and academic engagement, as attested by their Associate Provost. This strategy has resulted in the increase in both the quality and quantity of student applications. Therefore, the GW team believes that this would be a good place to visit in order to explore how this strategy works and how it can be adapted to GW’s new building. In this context, another noteworthy example is the LINK Center at Duke University where social spaces, flexible teaching spaces and technical support have been cleverly designed and mixed into one floor/ wing of their library.

Most schools continued to administer new programs within their traditional department structures, with the noted exception of Duke, where new institutes develop new majors, such as in Neuroscience this is unusual since it is not administratively housed in a department, but in the Duke Institute for Brain Science and includes faculty from Neurobiology and Medical School.

OTHER/FOLLOW-UP ISSUES:

All of the academic and administrative leaders who contributed to this study were extremely helpful and offered to host GW visitors if or when visits to their respective institutions are planned. Visiting these institutions offers an opportunity to see first-hand what the buildings and spaces look like, learn about the academic experience of the faculty in such spaces, and understand how students utilize such spaces.

In closing, the Benchmarking Subcommittee would like to express their thanks to Elizabeth Mahon, Associate Principal and Ed Butler, Senior Associate of Ballinger for organizing and facilitating these valuable conversations.
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  Assistant Professor of Engineering and Applied Science

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- Vernon Weisenburg
  Information Systems Coordinator

SUSTAINABILITY FORUM

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  Director of Facilities Project Management
- Meghan Chapelle-Brown
  Director of the Office of Sustainability
- Susan-Anne Coda
  Director of Real Estate Planning & Project Management
- Jerry Feldman, PhD
  Associate Professor of Physics
- Gina Fernandes
  Director of Planning and Environmental Management
- Erica Hayton
  HR Strategic Development Manager
- Stephen Hsu, PhD
  Professor of Engineering and Applied Science
- Can Kornan, PhD
  Associate Dean for Research and Graduate Studies, Professor of Engineering & Applied Science
- Randall Packer, PhD
  Associate Dean for Special Projects, Professor of Biology
- Casey Anne Pietzchala
  Sustainability Project Assistant
- John Ralls
  Special Advisor for Community & Outreach
- Rumaana Riffat, PhD
  Professor of Civil Engineering
- W.M. Kim Roddis, PhD
  Chair of the Department of Civil & Environmental Engineering, Professor of Civil & Environmental Engineering
- Pedro Silva, PhD
  Associate Professor of Civil & Environmental Engineering
- Sophie Waskow
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STUDENT FORUM

- Alta Berger
  Student
- Jon Binetti
  Student
- Catherine Farney
  Student
- Jeryn Kortzinsky
  Student
- Will Rone
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- Evan Tusini
  Student
- Julie Binkeglass
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- Gina Fernandes
  Student
- Jon Binetti
  Student
- Dylan Pyne
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