CapitalBudgetRequest

Construct Global Systems Sciences Complex

Overview

Agency	Virginia Cooperative Extension and Agricultural Experiment Station (229)
Project Code	none
Project Type	New Construction
Biennium	2020-2022
Budget Round	Initial Bill
Request Type	Previously Submitted
Project Location	Roanoke Area
Facility/Campus	Other
Source of Request	Agency Request
Infrastructure Element	Laboratory
Contains O & M costs? Yes	
Contains significant technology costs? No	
Contains significant energy costs? No	
Possible that project will be used by other than a state or local governmental entity, or for research under sponsored programs (higher education)? No	

Agency Narrative

Agency Description

Executive Summary:

The Virginia agriculture industry represents a significant portion of commerce for the commonwealth, and the industry is calling for advances to meet the demands of food production. Virginia Tech's Cooperative Extension/Agriculture Experiment Station has leading faculty in key areas of expertise to support industry and is the most substantial, wide-reaching source for production and operation research to advance and protect these industries.

The focus of this capital project request is on facilities for program areas in need of improved facilities to sustain and advance the commonwealth's industries. This capital project request is in accordance with the governor's stated priorities of economic development, environment and clean energy, and public education.

The university has developed a cutting-edge research and extension program focused on solving complex problems across the nexus of natural and human systems associated with food and water supply. The program is identified as the Global Systems Sciences (GSS) initiative and brings together science disciplines for land, air, food, water, plant and animal production with advanced research, technology modeling, and instrumentation and computing resources. The initiative envisions active engagement with public and private partnerships working alongside Virginia Tech faculty in the GSS facility to provide training, research, and collaboration to support Virginia's agriculture and food industries. The major programs involved include the College of Agriculture and Life Sciences, the College of Natural Resources and Environment, and the College of Science.

This building will also be important to Virginia Tech's Agriculture and Natural Resource initiative and will help ensure Virginia Tech's Cooperative Extension/Agriculture Experiment Station remains at the forefront of supporting a sustainable global agricultural and natural resource industry through its translational research, technology innovation, and partnership and engagement with relevant private industries. The building is closely aligned with the governor's priorities. It will leverage state support and public-private partnerships and will train a workforce able to lead the agriculture and natural resource industry. These individuals and teams will be empowered to establish new businesses and create jobs for the development and commercialization of technologies, helping grow Virginia's economy. Agriculture and forestry is the largest private industry in Virginia in terms of economic impact, but its sustainability and growth relies on support from agency 229.

At present, the university has two facilities to support the Global Systems Sciences initiative, the Human and Biosciences Building constructed in 2013, and Latham Hall constructed in 2006. Once the GSS facility is constructed, a number of College of Agriculture and Life Sciences faculty will move from Latham Hall to GSS, making space on the third and fourth floor of Latham available for reassignment. The

renovation associated with this space reassignment is anticipated to be minimal.

The university requires an approximately 135,000 gross square foot (GSF) laboratory building to complete the facilities for a fully operational Global Systems Sciences program. The GSS facility will support an integrated approach to addressing the needs of Virginia's commercial and governmental activities in food, agriculture, and natural resources. The building will provide flexible research areas that can be reconfigured to encourage and accommodate multiple public and industrial research partnerships.

This project request is for authorization and funding to complete the proposed 135,000 gross square foot plant and environmental laboratory building as well as a 12,000 gross square foot light backfill renovation in Latham Hall for a total project budget of $135.7 million.

Project Description:

The 135,000 gross square foot GSS building brings together initiatives in science disciplines for land, air, food, water, and animal production with advanced technology modeling and computing resources. The building is envisioned as a three and a half story facility containing a combination of wet and dry research, core support, instructional, collaboration, student and researcher work areas, and GSS administrative spaces.

A unique aspect of the approach to GSS is that only a small percentage of the program space (approximately 5 percent) is allocated towards the administrative center of the facility. The remainder of the program is comprised of spaces that can be shared by several university research teams, have high utilization, or are flexible to accommodate changes in research and use over time. Virginia Tech intends to build upon resources already available within the existing campus buildings and provide only those facilities in GSS that enhance collaboration, research and discovery in support of the university's mission of solving complex problems across the nexus of natural and human systems associated with food and water supply.

The project envisions an organizational structure comprised of the following broad programmatic groupings that align with the four areas of inquiry for GSS:

1. Analyze (Macro): Spaces for advanced macro analysis though dry research and computing using big data immersion.
2. Diagnose (Micro): Intended for microanalysis research activities. This grouping will contain spaces for wet research, chemistry, microbiology, plant sciences, and instrumentation.
3. Make and Assemble: Intended for creating tools and devices in support of the research being conducted at GSS. This group will contain spaces for field sciences, material management and fabrication.
4. Community: Spaces that connect GSS and Virginia Tech communities through informal collaboration, discussion and meeting spaces within and outside the building.

The four areas of inquiry described above are organized as follows:

• Ten wet lab areas of roughly 4,750 assignable square feet each (ASF); 47,500 ASF total.
• Twelve dry lab areas of approximately 750 ASF each; 9,000 ASF total.
• Three highly sophisticated training rooms of approximately 1,250 ASF each; total 3,750 ASF.
• Eight project teamwork/collaboration areas of approximately 1,200 ASF each; 9,600 ASF total.
• Faculty offices within the building of 65 at 120 ASF each; 7,800 ASF total.
• Graduate research assistant workspace, 150 at 50 ASF each; 7,500 ASF total.
• Laboratory support areas, preparation and storage, totaling 2,400 ASF.
• Total ASF for the facility is 87,550. With an efficiency ratio of 65 percent, the gross area is approximately 135,000 GSF.

The proposed facility will include the following essential features:

• Advanced research computing that would allow for data immersion with 3-Dimension capable viewing.
• Smart reconfigurable greenhouses to provide controlled testing environments for research on plants and foods.
• Wet laboratories with exhaust hoods for chemical handling.
• Large dry laboratories for the investigation of pollen, sediments, soils, cores, tree samples, or plant and animal samples.
• Specialized laboratory support spaces including cold storage equipment, frozen storage equipment, and walk-in environmental chambers.
• Public training and meeting rooms with audiovisual technology, and lighting controls.

The building is a three and a half story (the smaller ground level is partially below grade) facility located in the heart of the Life Sciences and Technology District envisioned in Virginia Tech's 2018 master plan. The proposed location for the new building is adjacent to Steger Hall in the Life Sciences and Technology District. It is situated across from HABB1 and will create an important hub where ongoing research will be on display along a paved pedestrian accessibility pathway that will link existing and future academic, research and residential districts of the campus.

The construction of the GSS facility will allow College of Agriculture and Life Sciences (CALS) faculty to vacate a portion of Latham Hall, a research building shared with College of Natural Resources and Environment (CNRE). Reassignment of CALS occupied space in Latham would help to relieve a severe shortage of space for CNRE research programs. The exact number of labs and square footage to be reassigned

will be determined after the research themes for GSS are more clearly defined. Renovation to existing wet labs within this area should be relatively minimal; however, the use of those labs by CNRE will require the purchase of new equipment and the installation of additional bench mounted utilities.

The project scope, site development, and building configuration are consistent with Virginia Tech's master plan and campus design principles.

Justification

Program Description:

The Global Systems Sciences program is an integrated approach to solving complex challenges associated with the global and local food and water supply. The program includes disciplinary and interdisciplinary faculty of the College of Natural Resources and Environment, the College of Agriculture and Life Sciences, the College of Science, and other disciplines working in an interconnected environment forging scientific research, applied extension, and translational research. The program envisions active engagement with public and private partnerships working alongside Virginia Tech faculty in the facility to provide training, research, and collaboration to support Virginia's agriculture and food industries.

The overriding framework of the Global Systems Sciences program embraces complexity, crosses disciplinary boundaries, and encourages nimble and innovative approaches to complex problems. Research conducted under the Global Systems Sciences program will expand the Virginia Tech's expertise in microbial genomics, genome-assisted plant breeding, infectious diseases, and global and local food security, which is necessary to advance productivity for commercial growers and suppliers in the food supply and security industries.

To provide a facility that uses project dollars in the most effective manner, the university leadership focused on prioritizing program components that meet the following key objectives:

1. High Utilization: Spaces that can be occupied by occupants for both short- and long-term research through co-occupancy promoting collaboration and ensuring high and constant utilization of resources throughout the facility.
2. Shared Core facilities: The facility does not attempt to duplicate specialty core spaces that may be available within other campus facilities but instead focuses on program elements that serve the GSS mission and shared research. Therefore, core facilities such as smart greenhouses, autoclaves, glass wash areas, environmental rooms, and other program components have been programmed into the facility only to the extent they can clearly be shared in support of common research initiatives and goals.
3. Flexibility: Flexible research areas that can be reconfigured to encourage and accommodate multiple public and private research partnerships over time. The building's structural support systems will provide large open and unimpeded interior spaces in order to maximize long-term program functionality and adaptability to new program requirements and technology advancement.

The university strategic plan includes the following principal strategies that will be supported by this project:

• Increase and sustain excellence in research, discovery, and creativity.
• Increase teaching and learning excellence for a holistic education.
• Increase institutional impact and visibility. Achieve top US public land-grant ranking by 2024.
• Increase the four-year graduation rate for all undergraduate students to 70 percent as well as the three-year graduation rate for all undergraduate transfer students to 75 percent.
• Reduce the student average student loan debt per graduating senior to $25,000 by 2024.
• Increase representational diversity, cultural competency, and address critical societal issues impacting humanity and equity.
• Attract, retain, and develop the talents of students, faculty and staff prepared to serve both the local and global communities while also supporting lifelong engagement and learning.
• Continue to develop the physical campus and technology infrastructure.
• Increasing the number of programs recognized as among the best internationally.
• Inspiring and empowering people to learn, innovate, and serve beyond boundaries through a process of continuous evaluation, improvement, and lifelong learning.
• Creating meaningful partnerships with businesses and government entities to address complex problems by co-locating researchers and practitioners in "living laboratories."
• Increasing undergraduate involvement in meaningful research experiences and opportunities for experiential learning.
• Developing ways to integrate computational science/informatics and digital fluency for managing and analyzing complex data sets across a wide range of disciplines.

Existing Facilities:

Virginia Tech does not have sufficient modern laboratory space to meet the demands of the rapidly evolving areas of microbial genomics, genome-assisted plant breeding, and global and local food security.

Price Hall currently houses the department of Entomology and aspects of the School of Plant and Environmental Sciences. It was built in 1907 and has a facility condition index (FCI) of 64 percent in the FICAS system as of April 2019. The building's condition has progressed beyond the scope of normal operations and maintenance reserve repairs and modern scientific equipment is exceeding the capabilities of the existing mechanical, electrical, plumbing, and environmental control systems.

Other components of the School of Plant and Environmental Sciences are located in Smyth Hall, built in 1939 with a current FCI of 39

percent; Saunders Hall, built in 1931 with a current FCI of 49 percent; and Latham Hall, built in 2006. Latham Hall also houses ten other departments. These buildings are at maximum capacity and additional labs cannot be added.

Funding Plan:

The scope of this project is for Educational and General Programs of the Cooperative Extension/Agricultural Experiment Station; thus, the funding plan calls for 100 percent General Fund support for this $135.7 million project. Additional components of the project that could provide industry funded research facilities will be supported through non-general fund resources as those opportunities develop.

Options Considered:

Options considered but not pursued include leasing the space at an off-campus location or delaying the project. Leasing space off-campus is not feasible because the local inventory of facilities does not include the laboratory or technology required for the program operations. Delaying the project would prevent the program from growing and conducting additional research.

Methodology

Cost Explanation and Methodology:

A. Methods Used to Estimate Costs:

The method for estimating costs for the Construct Global Systems Sciences Complex project includes: 1) using unit costs in the Division of Engineering and Buildings' Construction Costs Database updated March 2018 with a regional market multiplier and a multiplier for soft costs; and 2) comparables as shown in the CR-1. Both methods are escalated to a construction midpoint of 2023 at four and a half percent escalation in accordance with the instructions for developing the Six-Year Capital Outlay Plan.

On a total project cost basis, inclusive of design, construction, and equipment, the unit costs are $923 per gross square foot. The unit construction costs of the project are $677 per gross square foot, including self-performed construction work. The building types in this request reflect a combination of science wet laboratory, dry laboratory, and research laboratory spaces in the Division of Engineering and Buildings' Virginia Construction Costs Database.

The university's project cost estimates are derived from a database of on-campus construction costs of comparable project types. Virginia Tech building construction reflects the high level of quality, durability, and tradition that makes Virginia Tech a distinctive and memorable place for students. The estimates also include the cost of technology, specialized instruction, and energy efficiency goals of the institution.

Construction Manager at risk is the intended delivery method for this project.

B. The proposed costs include the following critical considerations to ensure the project fully meets the needs of the program and the university:

1) The GSS project incorporates a large rooftop Biotron/Smart Greenhouse element that will allow for the creation of a multitude of simultaneous research experiments, each with tightly controlled and highly specialized environmental conditions. This feature is essential to GSS research and will distinguish the university among its peers.

2) The building envelope will be comprised primarily of Hokie Stone with precast concrete accents consistent with university standards as affirmed by the Board of Visitors. Brick, metal panels, and siding materials are not permitted as substitutions for Hokie Stone. The stone is a four-inch thick nominal stone thickness with a two-inch nominal air barrier over moisture resistant sheathing. Stainless steel anchoring straps and load bearing shelf angles and stainless steel flashings comprise the structural support and flashings system. The university owns the stone quarries and provisions the cut material to the building; thus, the material costs are carried in the Other Costs section of the proposed budget while the construction budget carries all erection, final stone dressing, installation and intensive quality assurance inspection costs.

3) Mechanical equipment and building automation systems are designed and selected to meet performance requirements and to optimize total costs of ownership inclusive of energy costs and operations and maintenance costs. System selections are justified based on a 30-year economic life cycle analysis. Mechanical equipment will be covered and secured to maximize equipment life and service.

4) Academic buildings include interior glazing for energy efficiency, lighting for academic work, and to enhance pedagogy.

5) Ceiling heights will be appropriate for proper sound attenuation.

6) Building structural support systems will accommodate large open and unimpeded interior spaces to maximize long-term programmatic functionality and adaptation to new program space and technology arrangements. This includes raised floor systems for maximum adaptation.

7) High-capacity wireless networks to support multiple devices (laptop computer, tablet computer, smartphone, and other WIFI devices) to retrieve information and to communicate and to connect digitally with sites around campus and around the world. Testing can utilize online applications requiring the capacity for an entire classroom to be connected simultaneously.

8) Power outlets corresponding to the seat/station count and power outlets in common areas will exceed the minimum code requirements by approximately 30 percent.

9) Automated audiovisual and lighting controls are included for all office and laboratory spaces.

10) Climate controlled technology server rooms, 10 feet by 10 feet, on each floor of the building or as required to provide efficient distribution of services.

11) Communications infrastructure, both wired and wireless, is installed by a university operated auxiliary; thus, these costs are shown in the Other Costs section of the proposed budget.

12) Site development costs in this region are historically in the medium to high range and require generally significant subsurface rock excavation and removal and deep foundations. Site costs may also require the relocation of parking spaces at the planned location.

13) Utilities (power, steam, chilled water, domestic water, gas, sanitary sewer, technology, and storm water infrastructure) do not terminate at the building site and their extension or on-site provision is anticipated to be a sizable cost driver for this project.

14) Restricted site access in a dense and active part of campus will increase mobilization and site logistics costs. Limited material lay-down areas increase material costs and risks due to necessitating just in time delivery and/or off-site storage.

15) Site costs are expected to be above average for this project due to grade and accessibility challenges.

Funding Request

Phase	Year	Subobject	Fund	Amount
Full Funding	2021	2322 - Construction, Buildings	01000 - General Fund	$135,700,000
			Total	$135,700,000

Project Costs

Cost Type	Requested Funding
Acquisition Cost	$0
Building & Built-in Equipment	$99,511,067
Sitework & Utility Construction	$0
Construction Cost Total	**$99,511,067**
DESIGN & RELATED SERVICE ITEMS	
A/E Basic Services	$14,070,865
A/E Reimbursables	$0
Specialty Consultants (Food Service, Acoustics, etc.)	$19,902
CM Design Phase Services	$1,024,964
Subsurface Investigations (Geotech, Soil Borings)	$149,267
Land Survey	$0
Archeological Survey	$0
Hazmat Survey & Design	$0
Value Engineering Services	$0
Cost Estimating Services	$19,902
Other Design & Related Services	$208,973
Design & Related Services Total	**$15,493,873**
INSPECTION & TESTING SERVICE ITEMS	
Project Inspection Services (inhouse or consultant)	$726,431
Project Testing Services (conc., steel, roofing, etc.)	$736,382
Inspection & Testing Services Total	**$1,462,813**
PROJECT MANAGEMENT & OTHER COST ITEMS	
Project Management (inhouse or consultant)	$1,044,865
Work By Owner	$1,395,778
BCOM Services	$49,756

Advertisements	$378
Printing & Reproduction	$9,951
Moving & Relocation Expenses	$119,413
A/V Cabling	$0
IT Cabling	$0
Telephone Cabling	$0
A/V Equipment	$0
IT Equipment	$1,194,133
Telephone Equipment	$0
Signage	$89,560
Demolition	$0
Hazardous Material Abatement	$0
Utility Connection Fees	$0
Utility Relocations	$3,462,985
Commissioning	$1,492,666
Miscellaneous Other Costs	$1,383,204
Project Management & Other Costs Total	**$10,242,689**
Furnishings & Movable Equipment	$6,999,337
Construction Contingency	$1,990,221
TOTAL PROJECT COST	**$135,700,000**

Size and Scope

Cost Type	Unit of Measure	Units	Cost Per Unit
Acquisition Cost		0	$0
Construction Cost	GSF	147,000	$677
Total Project Cost	GSF	147,000	$923

Operating and Maintenance Costs

Cost Type	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026
GF Dollars	$0	$0	$0	$2,059,447	$2,121,230	$2,184,867
NGF Dollars	$0	$0	$0	$0	$0	$0
GF Positions	0.00	0.00	0.00	10.63	10.63	10.63
NGF Positions	0.00	0.00	0.00	0.00	0.00	0.00
GF Transfer	$0	$0	$0	$0	$0	$0
GF Revenue	$0	$0	$0	$0	$0	$0
Layoffs	0	0	0	0	0	0

Planned start date of new O&M costs (if different than the beginning of the fiscal year):---

Supporting Documents

File Name	File Size	Uploaded By	Upload Date	Comment
GSS Feasibility Study FINAL 5.17.2019.pdf	29,963,167	Cassidy Limer	7/23/2019	
229-1- Global Systems Sciences Program Chart.pdf	435,031	Cassidy Limer	7/24/2019	
229-1 - CR-1e Project Planner-Global Systems Sciences Buildings-VIRGINIA TECH-State Version.xlsx	617,272	Cassidy Limer	7/29/2019	

Workflow History				
User Name	**Claimed**	**Submitted**	**Step Name**	**Submit Action**
Cassidy Limer	07/16/2019 03:56 PM	07/16/2019 03:56 PM	Enter Capital Budget Request	Continue Working
Cassidy Limer	07/16/2019 03:56 PM	07/24/2019 05:02 PM	Continue Drafting	Continue Working
Cassidy Limer	07/24/2019 05:28 PM	07/24/2019 05:28 PM	Continue Drafting	Continue Working
Cassidy Limer	07/25/2019 10:02 AM	07/25/2019 10:18 AM	Continue Drafting	Submit for Agency Review
Rob Mann	07/25/2019 04:37 PM	07/25/2019 04:37 PM	Agency Review Step 1	Return for Further Data Entry
Cassidy Limer	07/25/2019 04:45 PM	07/25/2019 05:28 PM	Continue Drafting	Continue Working
Cassidy Limer	07/26/2019 08:49 AM	07/26/2019 12:38 PM	Continue Drafting	Submit for Agency Review
Rob Mann	07/26/2019 02:18 PM	07/26/2019 02:23 PM	Agency Review Step 1	Ready for DPB Bulk Submit
Rob Mann	07/26/2019 02:37 PM	07/26/2019 02:37 PM	Ready for DPB Submission	Submit to DPB
Anne Smith	07/26/2019 05:12 PM	07/26/2019 05:12 PM	DPB Review	Return to Previous Submitter
Rob Mann	07/29/2019 10:07 AM	07/29/2019 10:08 AM	Agency Review Step 1	Return for Further Data Entry
Cassidy Limer	07/29/2019 02:27 PM	07/29/2019 02:43 PM	Continue Drafting	Continue Working
Jennifer Hundley	07/30/2019 10:46 AM	07/30/2019 10:51 AM	Continue Drafting	Submit for Agency Review
Rob Mann	07/30/2019 12:31 PM	07/30/2019 12:31 PM	Agency Review Step 1	Return for Further Data Entry
Cassidy Limer	07/30/2019 04:44 PM	07/30/2019 04:44 PM	Continue Drafting	Submit for Agency Review
Rob Mann	07/31/2019 10:35 AM	07/31/2019 10:38 AM	Agency Review Step 1	Ready for DPB Bulk Submit
Rob Mann	07/31/2019 03:29 PM	07/31/2019 03:29 PM	Ready for DPB Submission	Submit to DPB
Anne Smith	07/31/2019 05:31 PM	07/31/2019 05:31 PM	DPB Review	Continue Review
			DPB Review	