NC STATE UNIVERSITY

College of Engineering
Expansion Space Need Assessment | 2023

TECHNICAL DOCUMENT

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A Vision for the College of Engineering

EXECUTIVESUMMARY

INTRODUCTION

Engineers are the foundation of our high-tech economy. The explosive growth of computer science and engineering, as well as domestic investment in advanced manufacturing and materials science, is driving unprecedented demand for graduate engineers. Bureau of Labor Statistics projections indicate that 120,000 new engineers are required annually to accommodate growth and retirement. This trend is expected to continue at least through the 2030's, as both Boomers and Gen-Xers age out of the labor force.

As a hotbed of high-tech research and development, North Carolina is central to these economic and demographic trends. The internationally recognized biotech community in Research Triangle Park has recently been joined by software giants like Apple and Google, increasing the opportunity, and need, for more highly qualified engineers. Recognizing this, the State has provided initial funding to start expanding NC State's College of Engineering (CoE). This initiative projects growing over 4,000 students in engineering and computer science disciplines, raising enrollment at the College of Engineering to 13,550 students and pushing NC State over the 40,000-student mark.

GOALS

This study explores the space required to accommodate the primary goals of the College including opportunities to grow student enrollment, foster experiential learning, enhance interdisciplinary collaboration and research, strengthen industry partnerships, advance core research facilities, consolidate to Centennial Campus, and relinquish costly off-campus leased space.

North Carolina is at the forefront of student enrollment demand and depends on NC State to produce well-trained graduates to fill the ranks of its tech companies. An increasing number of qualified applicants are applying to CoE. In response to these pressures, the State has appropriated initial funds to start expanding the enrollment by over 4,000 students over the next decade.

This once-in-a-generation investment for growth will not only expand capacity but realign resources and space to position CoE as a leader in Engineering by creating:

- An Engineering Hub that emphasizes NC State's distinctive brand of experiential learning and collaboration.
  - First-year instruction across a range of disciplines and settings
  - High-flex classrooms and class labs
  - Student project space—maker, modeling, immersive
  - Student success—counseling, tutoring, engagement
  - Showcase student exhibition
  - Industry participation
  - Equity, persistence, and attainment

  The comprehensive nature of these facilities makes them central to the experience and identity of the school. These campus "living rooms" bring together the entire College with faculty, staff, students, and industry partners in the shared pursuit of excellence.

- Interdisciplinary research space designed for flexible uses to bring together programs within the University and form new partnerships with engineers and scientists from industry and government agencies to find innovative solutions to problems facing NC and the world.
  - Flexible space would complement departmental-specific research space
  - Creating new shared research core equipment/facilities

- A concentration of academic activity on the Centennial Campus that will transform engineering teaching, training, and research.
  - Migrating first- year instruction to this campus would allow students to experience the full range of engineering disciplines before choosing a specialty.

The Brown-Kopel Engineering Student Achievement Center at Auburn University *provides a variety of settings and services, including dedicated space for learning communities, maker space, and advising. The resulting building has become the "front-door" to the college.*

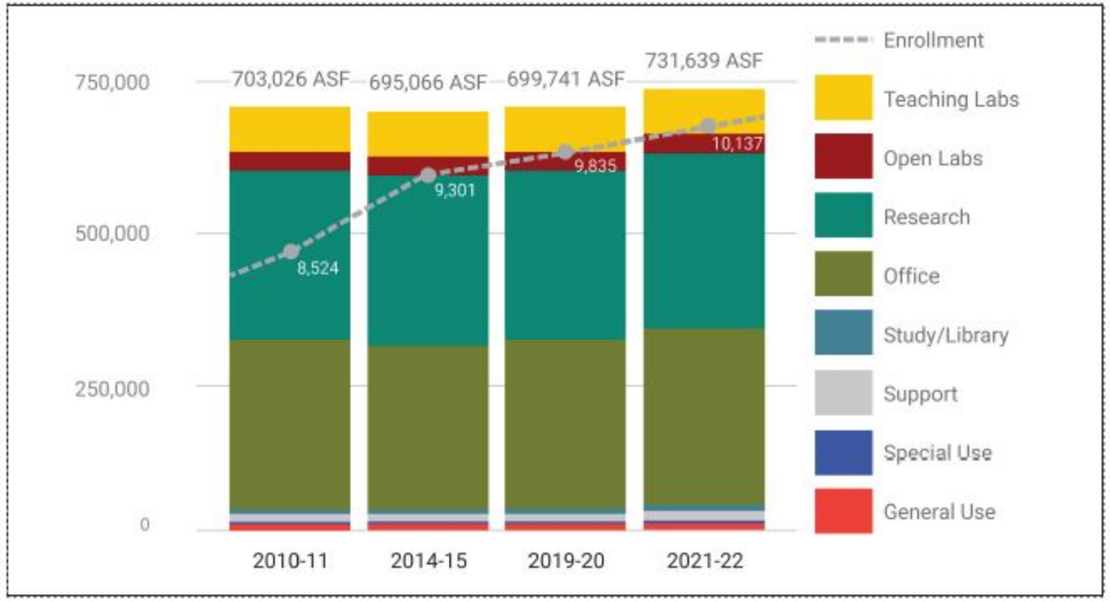
ANALYSIS

The data analysis incorporates College enrollment and staffing projections, expectations for shared use of teaching and research laboratories, and the informal learning and collaboration space essential to contemporary pedagogy.

Data was provided by the University and the College. A facilities inventory, course file, and staffing information were provided by the University. The College provided enrollment, faculty, and staff growth projections by department. A tour of existing facilities and discussion with each department informed the appropriate guidelines to be applied.

The College has been transitioning to Centennial Campus over the last 25 years. This shift has provided better quality space and positioned NC State as a leader in Engineering but only resulted in a 4.1% increase in space. Over this same timeframe, there was an 18.9% growth in student enrollment and 50% increase in research funding.

COLLEGE OF ENGINEERING SPACE AND ENROLLMENT TRENDS



"NC State is providing the workforce, research and partnerships that are fueling our flourishing tech industry."

Chancellor Randy Woodson

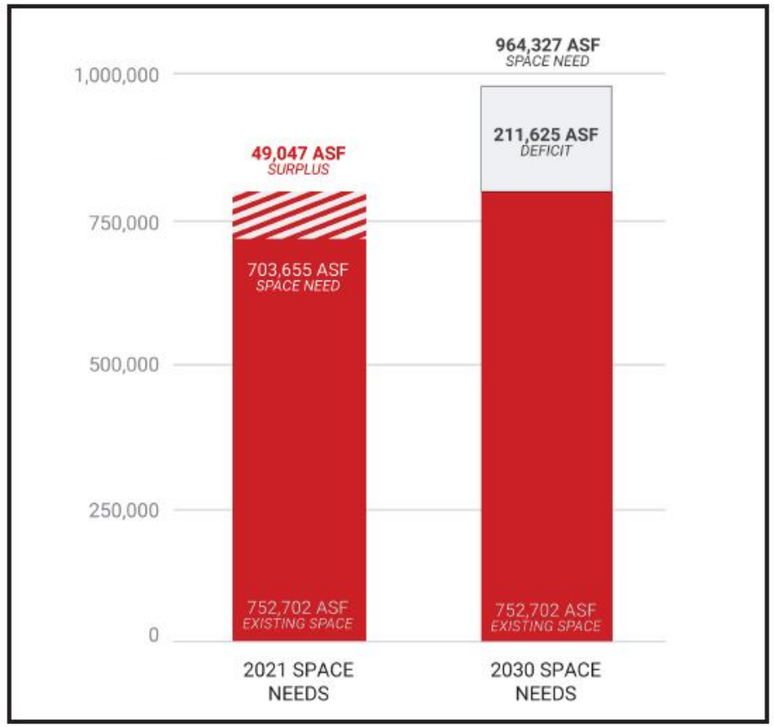
STUDENT ENROLLMENT

Department	Fall 2021 Enrollment	Enrollment Increase	Projected Enrollment
College (undergraduates are first year)	2,150	842	2,992
Biomedical Engineering	364	150	514
Chemical and Biomolecular Engineering	640	180	820
Civil, Construction and Environmental Engineering	891	312	1,203
Computer Science	1,816	634	2,450
Electrical and Computer Engineering	1,583	504	2,087
Industrial and Systems Engineering	622	177	799
Materials Science and Engineering	238	117	355
Mechanical and Aerospace Engineering	1,610	477	2,087
Nuclear Engineering	226	17	243
College of Engineering Total	**10,140**	**3,410**	**13,550**

The Fall 2021 base year includes some growth towards the 40% College of Engineering enrollment increase by 2030.

In 2021, the College had a surplus of space overall of 49,047 ASF. Applying the guidelines to the projected 2030 enrollment and personnel numbers generates a deficit of 211,625 ASF. Office space will be right-sized, and the surplus will be repurposed for other uses. As a long-term strategy this might be possible only as current buildings undergo renovations and updating.

SPACE NEED SUMMARY

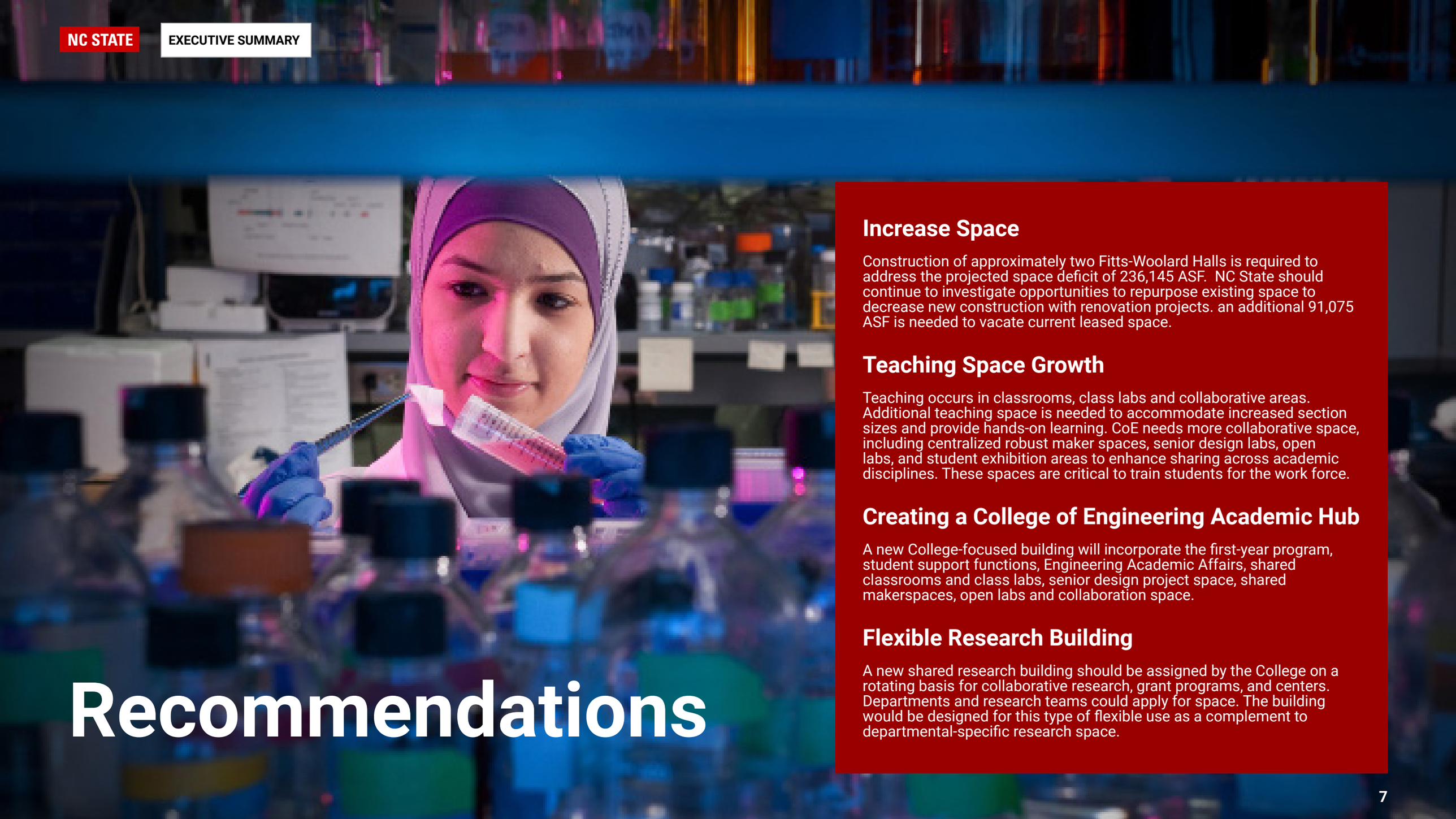


GUIDING PRINCIPLES

Guiding Principles that influence the development of the space program were created during College and departmental discussions to provide a framework for recommendations.

- The academic programs of the College will not change substantially. Space types that are substantially different from those currently occupied by the College will not be required to accommodate new programs, nor will space become obsolete due to the elimination of any programs.
- Classroom space and teaching laboratories can be located separate from departmental office and research space.
- Course section sizes will increase as enrollment increases.
- Academic departments are currently located discretely, typically two departments per building separated by floor or building wing. Although departmental synergy is important, new space is needed to bring together faculty across disciplines to enhance collaborative research.
- Office and research space should be collocated wherever possible.
- The consolidation of all engineering disciplines on the Centennial Campus should include the first-year academic program. This will expose first-year students to a broad range of engineering opportunities.
- The College prefers to vacate/reduce the currently occupied space in leased buildings.

Virginia Tech's Innovation Campus Academic Building I, *establishes new models for teaching Computer Science and Computer Engineering. A significant portion of the facility is dedicated to team-based student project space, including computational "studios" and flex labs for hardware development.*



Recommendations

Increase Space

Construction of approximately two Fitts-Woolard Halls is required to address the projected space deficit of 236,145 ASF. NC State should continue to investigate opportunities to repurpose existing space to decrease new construction with renovation projects. an additional 91,075 ASF is needed to vacate current leased space.

Teaching Space Growth

Teaching occurs in classrooms, class labs and collaborative areas. Additional teaching space is needed to accommodate increased section sizes and provide hands-on learning. CoE needs more collaborative space, including centralized robust maker spaces, senior design labs, open labs, and student exhibition areas to enhance sharing across academic disciplines. These spaces are critical to train students for the work force.

Creating a College of Engineering Academic Hub

A new College-focused building will incorporate the first-year program, student support functions, Engineering Academic Affairs, shared classrooms and class labs, senior design project space, shared makerspaces, open labs and collaboration space.

Flexible Research Building

A new shared research building should be assigned by the College on a rotating basis for collaborative research, grant programs, and centers. Departments and research teams could apply for space. The building would be designed for this type of flexible use as a complement to departmental-specific research space.

Applying the facilities, enrollment, and personnel data and space guidelines yields the space needs. The 2021 analysis establishes a base for comparison by determining the quantity of space the College needed in Fall 2021. The 2030 analysis defines future space needs. In 2021, the College had a surplus, almost exclusively this is office space due to the application of newly developed office space guidelines which includes a high-level approach to hybrid office use. In the target year, 75% of employee types of professional staff, technical, administrative support, and graduate assistants; 85% of directors/department heads, associate directors, and assistant directors will be assumed to be on campus; and 100% of all other employee types. The 2030 analysis assumes that newly constructed and renovated space will adhere to the new space guidelines. The University will continue to investigate opportunities to repurpose existing space, with the intent to decrease the amount of new construction needs. The office analysis applied the same space standards for existing and new employees. The result is a quantitative overage, but it is not necessarily cost effective or realistic to renovate existing office space to align with new standards in every case. This information is addressed on page 13 of the technical report

PLANNING ASSUMPTIONS

STUDENT ENROLLMENT

COLLEGE ENROLLMENT PROJECTION

The College has established enrollment increase projections for each department, totaling 3,410 students over the next 10 years. The following chart indicates overall Fall 2021 enrollment per department, the total projected enrollment, and the enrollment increase. The department labeled “College” includes the first-year engineering students that have not been assigned to a department or program. The enrollment projection is applied to the space guidelines to determine the quantity of future classroom, class lab, open lab, and collaboration space needed.

STUDENT ENROLLMENT

Department	Fall 2021 Enrollment	Enrollment Increase	Projected Enrollment
College (undergraduates are first year)	2,150	842	2,992
Biomedical Engineering	364	150	514
Chemical and Biomolecular Engineering	640	180	820
Civil, Construction and Environmental Engineering	891	312	1,203
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College of Engineering Total	**10,140**	**3,410**	**13,550**

The Fall 2021 base year includes some growth towards the 40% College of Engineering enrollment increase by 2030.

BACHELOR'S ENROLLMENT PROJECTION

Enrollment in bachelor's degree programs is projected to grow by 29%, from 7,047 students to 9,078 students, an increase of 2,031 students. First-year student enrollment is anticipated to increase by 852 students. Departmental percentage increases range from 15% to 35%.

BACHELOR'S ENROLLMENT PROJECTIONS

Department	2021 Bachelor's Fall Enrollment	Projected 2030 Bachelor's Increase	2030 Bachelor's Enrollment	Bachelor's Percentage Increase
College (undergraduates are first year)	2,080	837	2,917	40%
Biomanufacturing	-	-	-	-
Biomedical Engineering	291	101	392	35%
Chemical and Biomolecular Engineering	413	67	480	16%
Civil, Construction and Environmental Engineering	587	152	739	26%
Computer Science	1,098	240	1,338	22%
Electrical and Computer Engineering	845	184	1,029	22%
Industrial and Systems Engineering	327	50	377	15%
Materials Science and Engineering	111	24	135	22%
Mechanical and Aerospace Engineering	1,205	349	1,554	29%
Nuclear Engineering	90	27	117	30%
College of Engineering Total	**7,047**	**2,031**	**9,078**	**29%**

MASTER'S ENROLLMENT PROJECTION

Enrollment in master's degree programs is projected to grow by 43%, from 1,840 students to 2,628 students, an increase of 788 students. Departmental percentage increases range from 7% to 231%.

MASTER'S ENROLLMENT PROJECTIONS

Department	Master's Fall 2021 Enrollment	Projected 2030 Master's Increase	2030 Master's Enrollment	Master's Percentage Increase
College	70	5	75	7%
Biomanufacturing	-	-	-	-
Biomedical Engineering	13	30	43	231%
Chemical and Biomolecular Engineering	93	27	120	29%
Civil, Construction and Environmental Engineering	149	127	276	85%
Computer Science	511	281	792	55%
Electrical and Computer Engineering	457	131	588	29%
Industrial and Systems Engineering	208	99	307	48%
Materials Science and Engineering	43	47	90	109%
Mechanical and Aerospace Engineering	254	51	305	20%
Nuclear Engineering	42	-10	32	-24%
College of Engineering Total	**1,840**	**788**	**2,628**	**43%**

DOCTORATE ENROLLMENT PROJECTION

Enrollment in doctoral degree programs is projected to grow by 47%, from 1,253 students to 1,844 students, an increase of 591 students. Departmental percentage increases range from 21% to 67%.

DOCTORATE ENROLLMENT PROJECTIONS

Department	Doctorate Fall 2021 Enrollment	Projected 2030 Doctorate Increase	2030 Doctorate Enrollment	Doctorate Percentage Increase
College	-	-	-	-
Biomanufacturing	-	-	-	-
Biomedical Engineering	60	19	79	32%
Chemical and Biomolecular Engineering	134	86	220	64%
Civil, Construction and Environmental Engineering	155	33	188	21%
Computer Science	207	113	320	55%
Electrical and Computer Engineering	281	189	470	67%
Industrial and Systems Engineering	87	28	115	32%
Materials Science and Engineering	84	46	130	55%
Mechanical and Aerospace Engineering	151	77	228	51%
Nuclear Engineering	94	0	94	0%
College of Engineering Total	**1,253**	**591**	**1,844**	**47%**

PERSONNEL PROJECTION

The University staffing file data for Fall 2021 and future staffing projected by the College are indicated in the following chart. Personnel are defined as the total of all administrators, faculty, and support staff allocated a workspace by the College.

PERSONNEL PROJECTIONS

Department	Fall 2021 Personnel	Fall 2021 Faculty	2030 Personnel	2030 Faculty
College	111	5	132	5
Biomanufacturing	47	2	51	2
Biomedical Engineering	55	23	61	27
Chemical and Biomolecular Engineering	62	32	77	42
Civil, Construction and Environmental Engineering	85	49	97	56
Computer Science	104	59	138	79
Electrical and Computer Engineering	159	84	197	112
Industrial and Systems Engineering	51	24	63	31
Materials Science and Engineering	58	25	67	30
Mechanical and Aerospace Engineering	87	54	112	70
Nuclear Engineering	49	24	56	29
College of Engineering Total	**868**	**381**	**1,051**	**483**

EXISTING SPACE

The College of Engineering occupies space in 24 buildings. Existing space assigned to the College in 2021 totals 698,011 ASF, including 91,075 ASF in leased buildings. The College is the primary user of 54,691 ASF of classroom space, primarily on the Centennial Campus. This classroom space is included in the total 752,702 ASF identified in the space analysis. The allocation of existing space by space type by department is defined in the table below.

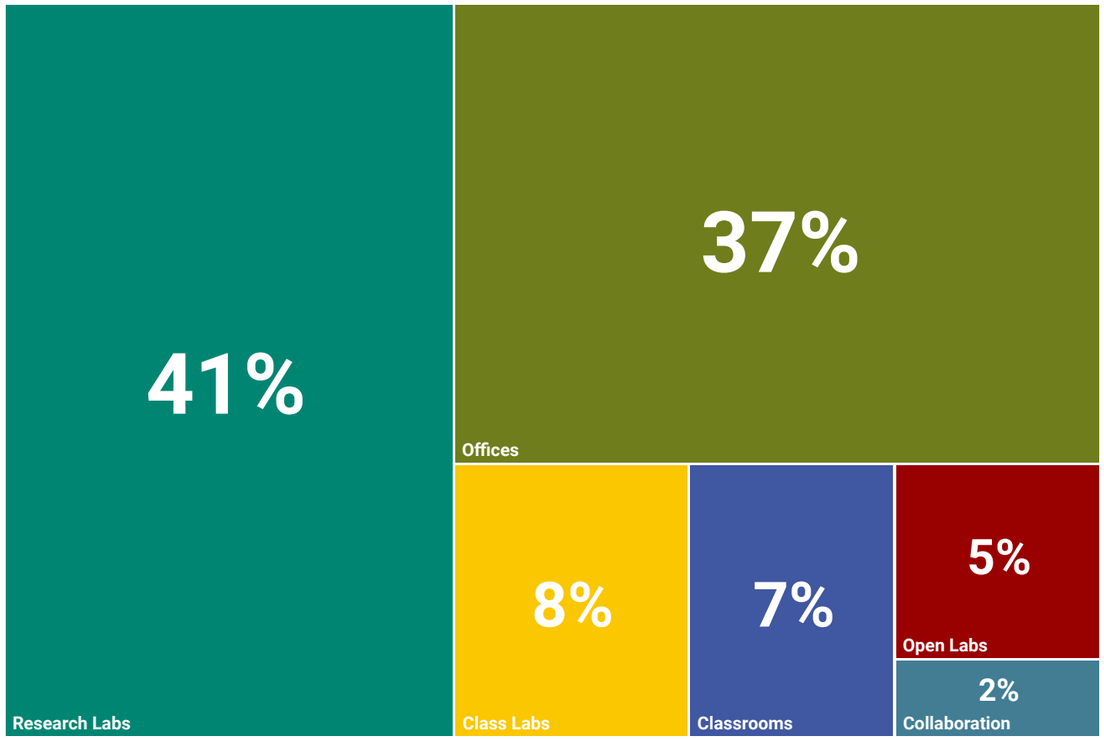
EXISTING SPACE

Existing Space	Classrooms	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total
College	-	2,764	539	37,095	24,080	6,051	70,529
Biomanufacturing	-	25,166	5,229	5,577	4,187	-	40,159
Biomedical Engineering	-	4,276	-	16,302	20,519	105	41,202
Chemical and Biomolecular Engineering	-	3,248	-	22,933	31,787	-	57,968
Civil, Construction and Environmental En	-	7,045	2,335	26,022	41,916	-	77,318
Computer Science	-	5,418	4,233	30,679	17,461	1,752	59,543
Electrical and Computer Engineering	-	2,933	10,198	51,367	48,474	2,192	115,164
Industrial and Systems Engineering	-	2,993	5,581	20,383	23,070	468	52,495
Materials Science and Engineering	-	875	996	21,978	36,266	-	60,115
Mechanical and Aerospace Engineering	-	3,805	5,831	27,318	42,230	3,963	83,147
Nuclear Engineering	-	1,628	400	17,273	20,459	611	40,371
Classrooms	54,691	-	-	-	-	-	54,691
Total	**54,691**	**60,151**	**35,342**	**276,927**	**310,449**	**15,142**	**752,702**

EXISTING SPACE

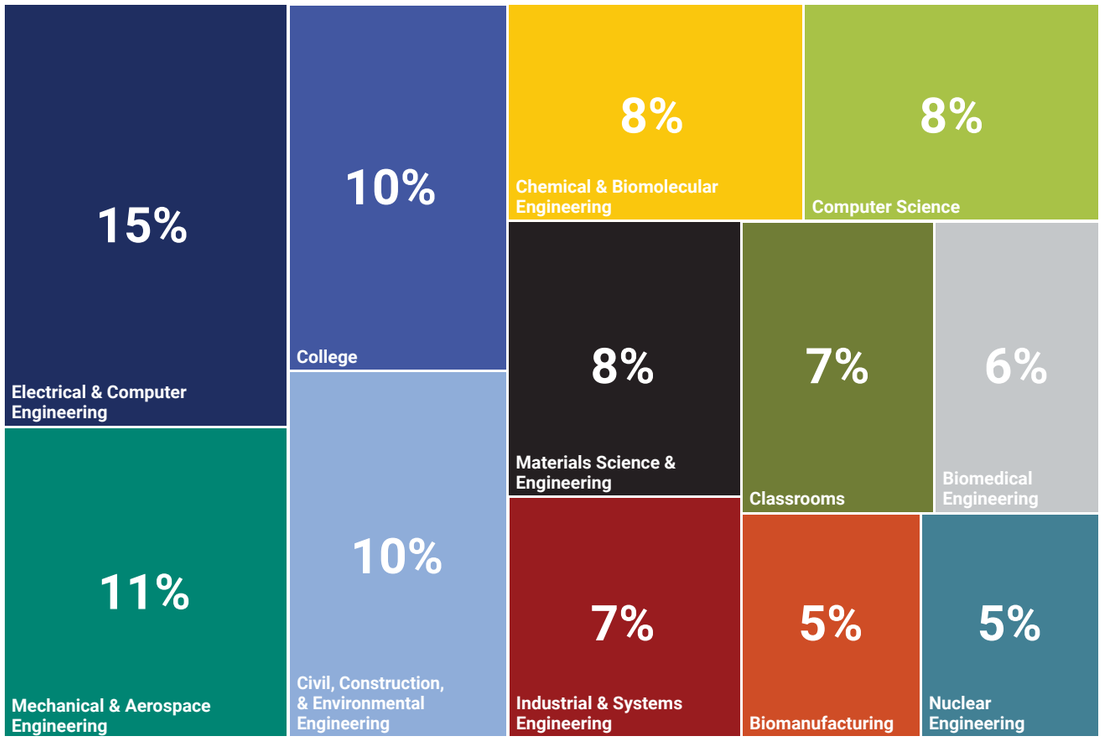
EXISTING SPACE BY TYPE

Existing space by space type is represented in the chart. Office and research space comprise 78% of the total space. Classrooms, class labs, open labs, and collaboration space are 22%.



EXISTING SPACE BY DEPARTMENT

The percentage of College space assigned to each department is represented in the chart.



SPACE NEED SUMMARY

Applying the facilities, enrollment, and personnel data and space guidelines yields the following space needs. The 2021 analysis establishes a base for comparison by determining the quantity of space the College needed in Fall 2021. The 2030 analysis defines future space need.

In 2021, the College had a surplus of space overall of 49,047 ASF. Applying the guidelines to the projected 2030 enrollment and personnel numbers generates a deficit of 211,625 ASF.

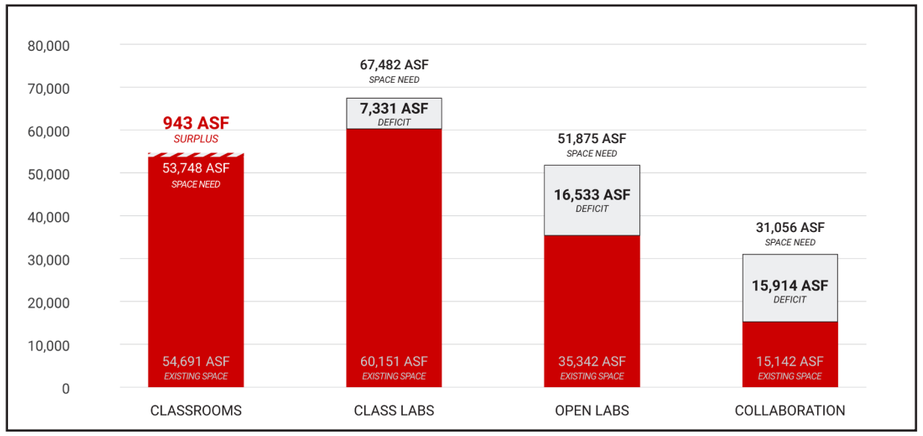
The 2021 surplus is due to the application of current office space guidelines which generate a need for 110,183 ASF less space than exists. All other space categories are in deficit except for classrooms which, at less than 1,000 ASF of surplus, are considered balanced.

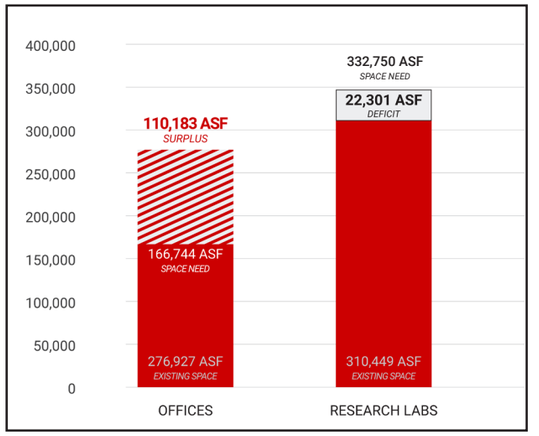
SPACE NEED SUMMARY

	Existing Space	2021 Space Need	2030 Space Need
Total	752,702	703,655	964,327
Surplus / (Deficit)		49,047	(211,625)

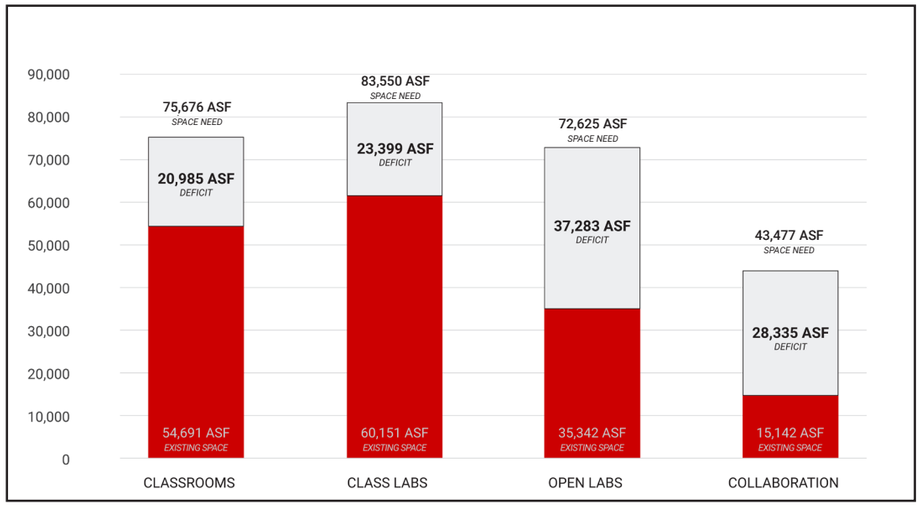
The space need analysis was completed prior to final adjustments to enrollment projections. At the time of the analysis, all departments were projected to increase enrollment from 2021 to 2030, with an overall College Enrollment increase of 40%.

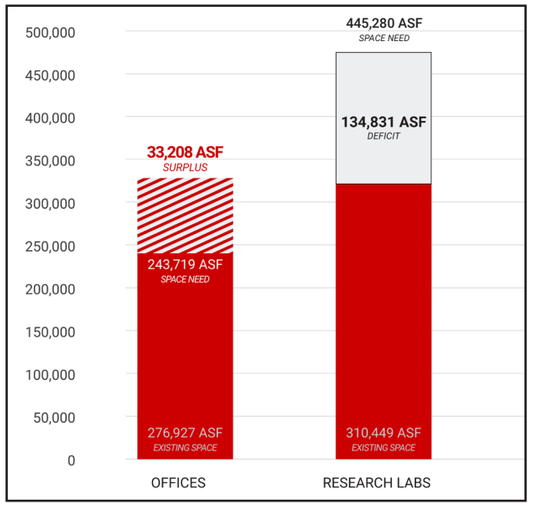
SPACE NEED SUMMARY 2021





SPACE NEED SUMMARY 2030





2021 SPACE NEED

Department	Classrooms	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total
College	4,018	0	10,750	17,077	20,000	7,850	59,695
Biomanufacturing		25,166	0	7,096	4,000	0	36,262
Biomedical Engineering	1,645	4,513	3,075	9,373	25,500	2,004	46,110
Chemical and Biomolecular Engineering	2,853	2,550	3,200	12,514	27,200	1,833	50,150
Civil, Construction and Environmental Engineering	5,641	2,675	4,455	17,749	47,500	2,581	80,601
Computer Science	12,247	11,164	9,080	22,109	14,700	5,003	74,303
Electrical and Computer Engineering	11,691	3,821	7,915	30,723	45,300	4,099	103,549
Industrial and Systems Engineering	3,447	6,465	3,030	11,140	19,500	1,575	45,157
Materials Science and Engineering	2,585	225	1,190	10,696	20,400	578	35,674
Mechanical and Aerospace Engineering	8,747	10,815	8,050	18,286	60,000	5,025	110,923
Nuclear Engineering	874	88	1,130	9,981	18,400	508	30,981
Core Facilities					30,250		30,250
Total Current Need	53,748	67,482	51,875	166,744	332,750	31,056	703,655

2030 SPACE NEED

Department	Classrooms	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total
College	5,553	0	14,980	20,780	25,000	10,850	77,163
Biomanufacturing		25,166	0	6,913	4,000	0	36,079
Biomedical Engineering	2,120	5,721	4,045	13,461	33,000	2,606	60,953
Chemical and Biomolecular Engineering	3,864	3,502	4,415	19,683	37,200	2,496	71,160
Civil, Construction and Environmental Engineering	7,125	3,304	5,665	24,107	59,000	3,291	102,492
Computer Science	17,994	16,567	13,325	35,279	21,000	7,444	111,609
Electrical and Computer Engineering	17,713	5,881	11,860	49,158	64,800	6,315	155,727
Industrial and Systems Engineering	4,745	9,135	4,215	15,889	27,000	2,241	63,225
Materials Science and Engineering	3,842	337	1,740	14,770	25,600	868	47,157
Mechanical and Aerospace Engineering	11,412	13,837	10,700	30,037	84,600	6,568	157,154
Nuclear Engineering	1,308	100	1,680	13,642	23,600	798	41,128
Core Facilities					40,480		40,480
Total	75,676	83,550	72,625	243,719	445,280	43,477	964,327

SPACE GUIDELINES

Definitions of the space types in the study and the metrics used to develop space need are explained in this section. Guidelines were established through discussion with University representatives.

CLASSROOMS

General assignment classrooms are scheduled university wide. They are not assigned to academic colleges or departments. The space needed for classrooms is typically determined at an institutional level. Classrooms are included in this study to establish the classroom space need generated by the College to compare the need to the space available on the Centennial Campus and to inform the quantity of space that would be required in a new academic building.

Classroom guidelines have three components:

- Weekly Room Hours (WRH), the number of hours per week a room is expected to be schedule on average
- Seat Fill Rate (SFR), the percentage of student stations or seats expected to be occupied when the room is in use
- ASF/seat, the average square feet in the room for each student station or seat

The classroom guidelines used in the study are: 35 WRH, 75% SFR, 25 ASF/seat.

Classroom need generated by the College of Engineering departments is represented in the chart.

CLASS LABS

Class labs are rooms used primarily for regularly scheduled classes in a discipline or discipline group that require special purpose equipment for group instruction, participation, observation, experimentation, or practice. Space requirements are calculated using a formula that is similar to that used to determine classroom space with the exception that the ASF per student varies by discipline. The following space allocation metrics are used in this study.

The scheduled use expectation is 24 Weekly Room Hours with an 80% Seat Fill Rate.

OPEN LABS

Open labs are rooms available for unscheduled or informally scheduled instruction and individual or collaborative student use in a particular discipline or discipline group. Types of rooms in this category typically include computer labs with specialized software, maker space, project rooms, tutoring facilities, and academic club facilities. At NC State, teaching labs are expected to provide a complimentary use to fulfill the need for open labs.

Open Lab space is allocated at 5 ASF per student as established by the Physical Master Plan. Headcount enrollment is used for the College of Engineering analysis.

CoE often uses open labs for Class Labs; therefore, the space needs for these two categories need to be reviewed together.

CLASSROOM SPACE NEED

Department	2021	2030
College	4,018	5,553
Biomedical Engineering	1,645	2,120
Chemical and Biomolecular Engineering	2,853	3,864
Civil, Construction and Environmental Engineering	5,641	7,125
Computer Science	12,247	17,994
Electrical and Computer Engineering	11,691	17,713
Industrial and Systems Engineering	3,447	4,745
Materials Science and Engineering	2,585	3,842
Mechanical and Aerospace Engineering	8,747	11,412
Nuclear Engineering	874	1,308
Total	**53,748**	**75,676**

CLASS LAB SPACE GUIDELINE

Class Lab Space Guideline	Total Space Allocation
Biomedical Engineering	80 ASF
Chemical and Biomolecular Engineering	80 ASF
Civil, Construction and Environmental Engineering	80 ASF
Computer Science	35 ASF
Electrical and Computer Engineering	35 ASF
Industrial and Systems Engineering	80 ASF
Materials Science and Engineering	80 ASF
Mechanical and Aerospace Engineering	80 ASF
Nuclear Engineering	80 ASF

OFFICE SPACE

Office space includes individual workspace in various configurations from private offices to shared open office configurations. The space allocation is per person and includes conference and service space such as storage and break rooms. NC State has established office space guidelines, which are incorporated into the allocations indicated below. These allocations are also used for the Physical Master Plan.

Existing campus office space was designed prior to the implementation of these space guidelines, so the application of these space guidelines generates a surplus of office space. Wholesale floor plate renovations would be needed for buildings constructed/renovated prior to the mid-2000's to comply with today's standards. In the target year, 75% of employee types of professional staff, technical, administrative support, and graduate assistants; 85% of directors/department heads, associate directors, and assistant directors will be assumed to be on campus; and 100% of all other employee types.

COLLABORATIVE LEARNING SPACE

Collaborative learning space is informal study space located outside of a library. It is typically adjacent to scheduled teaching space to facilitate group and individual study prior to class and as a place to continue class discussions outside of the classroom. It might also be located in the "hub" of an academic unit to reinforce program identity and build community.

Collaborative Learning Space is allocated per student according to a formula established by the Master Plan. Headcount enrollment is used for the College of engineering analysis.

- 25 ASF for 15% of the undergraduate enrollment
- 25 ASF for 5% of the graduate student enrollment

OFFICE SPACE

Office and Service Space	Total Space Allocation
Dean	270 ASF
Associate Dean	240 ASF
Assistant Dean	240 ASF
Administrative Executive	240 ASF
Director	220 ASF
Associate Director	180 ASF
Faculty	180 ASF
Research Faculty	180 ASF
Lecturer	180 ASF
Postdoctoral	120 ASF
Professional	180 ASF
Research Professional/Technical	140 ASF
Administrative Support	140 ASF
Technical/Clerical	140 ASF
Graduate Assistant	60 ASF

RESEARCH SPACE

Research space need is established using a factor per researcher. This approach determines an overall quantity of space per discipline which can be allocated according to individual researcher productivity and need. The space allocation factor per discipline was established through review of existing research space allocations in the College, discussion with the departments regarding the effectiveness of existing research space, and current research space trends in engineering schools. Research expenditures have increased by 50% from 2010 - 2021 with only a 4.1% space growth.

Space is allocated for 80% of full-time faculty members, a percentage established by the University based on documented research activity. Space is allocated per post-doc, at 50% of the researcher allocation per discipline. The allocation generates a total quantity of research space for the academic discipline and recognizes that individual research initiatives require different quantities of space per project team.

An additional space allocation for collaborative research initiatives is assigned to the College and a separate space factor is established for shared core facilities.

The 2021 analysis generates a need for 332,750 ASF of research space.

With additional research personnel, the 2030 research space need increases to 445,280 ASF.

2021 RESEARCH SPACE ANALYSIS

Department	Fall 2021 Faculty	Fall 2021 PI	ASF/PI	Fall 2021 Post Doc	ASF/ Post Doc	2021 Research Space Need
College (Interdisciplinary Research and Centers)		-	-	-	-	20,000
Biomanufacturing	-	-	-	-	-	4,000
Biomedical Engineering	23	18	1,000	15	500	25,500
Chemical and Biomolecular Engineering	32	26	800	16	400	27,200
Civil, Construction and Environmental Engineering	49	39	1,000	17	500	47,500
Computer Science Engineering	59	47	300	4	150	14,700
Electrical and Computer Engineering	84	67	600	17	300	45,300
Industrial and Systems Engineering	24	19	1,000	1	500	19,500
Materials Science Engineering	25	20	800	11	400	20,400
Mechanical and Aerospace Engineering	54	43	1,200	14	600	60,000
Nuclear Engineering	24	19	800	8	400	18,400
Core Facilities	-	-	-	-	-	30,250
College of Engineering Total						**332,750**

2030 RESEARCH SPACE ANALYSIS

Department	Fall 2021 Faculty	Fall 2021 PI	ASF/PI	Fall 2021 Post Doc	ASF/ Post Doc	2021 Research Space Need
College (Interdisciplinary Research and Centers)		-	-	-	-	25,000
Biomanufacturing	-	-	-	-	-	4,000
Biomedical Engineering	29	23	1,000	20	500	33,000
Chemical and Biomolecular Engineering	44	35	800	23	400	37,200
Civil, Construction and Environmental Engineering	60	48	1,000	22	500	59,000
Computer Science Engineering	84	67	300	6	150	21,000
Electrical and Computer Engineering	119	95	600	26	300	64,800
Industrial and Systems Engineering	33	26	1,000	2	500	27,000
Materials Science Engineering	31	25	800	14	400	25,600
Mechanical and Aerospace Engineering	75	60	1,200	21	600	84,600
Nuclear Engineering	30	24	800	11	400	23,600
Core Facilities	-	-	-	-	-	40,480
College of Engineering Total						**445,280**

SPACE NEED BY DEPARTMENT

The following tables indicate the space needed by each of the College of Engineering departments. While the need is generated by department data, the space indicated should not necessarily by allocated to the department.

Research and office space is department focused space. Classrooms, class labs, open labs, and collaboration space should be considered as potential shared space. Collaboration space should be primarily collocated with shared classrooms. To meet the utilization expectations for class labs, they will need to be multi-use, shared between courses and departments. Open labs include cross-discipline spaces such as makerspaces, senior project space, tutoring, and student support space.

COLLEGE ADMINISTRATION AND FIRST YEAR

Without Classrooms

	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total	Surplus (Deficit)
Existing Space	2,764	539	37,095	24,080	6,051	**70,529**	-
2021 Space Need	-	10,750	17,077	20,000	7,850	**55,677**	**14,852**
2030 Space Need	-	14,980	20,780	25,000	10,850	**71,610**	**(1,081)**

BIOMANUFACTURING

Without Classrooms

	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total	Surplus (Deficit)
Existing Space	25,166	5,229	5,577	4,187	-	**40,159**	-
2021 Space Need	25,166	-	7,096	4,000	-	**36,262**	**3,897**
2030 Space Need	25,166	-	6,913	4,000	-	**36,079**	**4,080**

BIOMEDICAL ENGINEERING

Without Classrooms

	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total	Surplus (Deficit)
Existing Space	4,276	-	16,302	20,519	105	**41,202**	-
2021 Space Need	4,513	3,075	9,373	25,500	2,004	**44,465**	**(3,263)**
2030 Space Need	5,721	4,045	13,461	33,000	2,606	**58,833**	**(17,631)**

SPACE NEED BY DEPARTMENT

CHEMICAL AND BIOMOLECULAR ENGINEERING

Without Classrooms

	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total	Surplus (Deficit)
Existing Space	3,248	-	22,933	31,787	-	**57,968**	**-**
2021 Space Need	2,550	3,200	12,514	27,200	1,833	**47,297**	**10,671**
2030 Space Need	3,502	4,415	19,683	37,200	2,496	**67,296**	**(9,328)**

CIVIL, CONSTRUCTION, AND ENVIRONMENTAL ENGINEERING

Without Classrooms

	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total	Surplus (Deficit)
Existing Space	7,045	2,335	26,022	41,916	-	**77,318**	**-**
2021 Space Need	2,675	4,455	17,749	47,500	2,581	**74,960**	**2,358**
2030 Space Need	3,304	5,665	24,107	59,000	3,291	**95,367**	**(18,049)**

COMPUTER SCIENCE

Without Classrooms

	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total	Surplus (Deficit)
Existing Space	5,418	4,233	30,679	17,461	1,752	**59,543**	**-**
2021 Space Need	11,164	9,080	22,109	14,700	5,003	**62,056**	**(2,513)**
2030 Space Need	16,567	13,325	35,279	21,000	7,444	**93,615**	**(34,072)**

ELECTRICAL AND COMPUTER ENGINEERING

Without Classrooms

	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total	Surplus (Deficit)
Existing Space	2,933	10,198	51,367	48,474	2,192	**115,164**	**-**
2021 Space Need	3,821	7,915	30,723	45,300	4,099	**91,858**	**23,306**
2030 Space Need	5,881	11,860	49,158	64,800	6,315	**138,014**	**(22,850)**

INDUSTRIAL AND SYSTEMS ENGINEERING

Without Classrooms

	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total	Surplus (Deficit)
Existing Space	2,993	5,581	20,383	23,070	468	**52,495**	**-**
2021 Space Need	6,465	3,030	11,140	19,500	1,575	**41,710**	**10,785**
2030 Space Need	9,135	4,215	15,889	27,000	2,241	**58,480**	**(5,985)**

MATERIALS SCIENCE AND ENGINEERING

Without Classrooms

	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total	Surplus (Deficit)
Existing Space	875	996	21,978	36,266	-	**60,115**	**-**
2021 Space Need	225	1,190	10,696	20,400	578	**33,089**	**27,026**
2030 Space Need	337	1,740	14,770	25,600	868	**43,315**	**16,800**

MECHANICAL AND AEROSPACE ENGINEERING

Without Classrooms

	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total	Surplus (Deficit)
Existing Space	3,805	5,831	27,318	42,230	3,963	**83,147**	**-**
2021 Space Need	10,815	8,050	18,286	60,000	5,025	**102,176**	**(19,029)**
2030 Space Need	13,837	10,700	30,037	84,600	6,568	**145,742**	**(62,595)**

NUCLEAR ENGINEERING

Without Classrooms

	Class Labs	Open Labs	Offices	Research Labs	Collaboration	Total	Surplus (Deficit)
Existing Space	1,628	400	17,273	20,459	611	**40,371**	**-**
2021 Space Need	88	1,130	9,981	18,400	508	**30,107**	**10,264**
2030 Space Need	100	1,680	13,642	23,600	798	**39,820**	**551**

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