Biological Systems Engineering at Virginia Tech: The First Century

Seitz Hall, completed in 1939 and home to administrative staff, classrooms, laboratories, graduate students and faculty.

Author's Foreword

The seeds of Virginia Tech's Department of Biological Systems Engineering (BSE) were planted at the inception of Virginia Tech itself (or, as it was known then, Virginia Agricultural and Mechanical College). Though it took nearly a half-century, the Department was officially created in 1920 and has evolved over the following century into a vital, innovative force for integrating biological principles into engineering design to the benefit of the Commonwealth and beyond.

Many peer departments in the U.S. have histories similar to our own; they originated within Departments, Schools and Colleges of Agriculture, they were organized as individual departments as the result of their unique expertise and value, they entered into cooperative arrangements between Colleges of Agriculture and Engineering as a result of professionally overlapping functions, and they revised their department and degree names to better reflect the distinct characteristics of the profession. But BSE at Virginia Tech has a history that diverges in some important ways. While many (but not all) peer departments have survived as a separate academic units, fewer have survived for a century, still fewer have taken the same huge risks to survive and thrive in the technologically-driven and interconnected global economy. Perhaps none have emerged from both the common and unique challenges as prepared to thrive in the future as BSE at Virginia Tech. This rich history, as well as future achievements, can be attributed to the ability and willingness of all in the Department to innovate, to take risks, to work for the common good, and to constantly adapt. And above all, past and future successes can be credited to overarching devotion to *Ut Prosim* – "That I May Serve," Virginia Tech's motto – in its fullest sense.

This short history was developed in connection with BSE's Centennial Celebration, held October 16-17, 2020. It is not intended as a detailed history, but rather an overview of how the Department began, how it reached its 100th birthday, and what the future might hold for it. The content of this history might appear as "Department Head-centric" due to the fact that each Department Head appears, whereas far fewer of BSE's other students, faculty and staff are specifically mentioned. This is done simply as a technique of dividing BSE's timeline into discrete and manageable segments, and nothing more. The heart of any organization is its people – all its people – without whom nothing can be achieved. A fuller, more detailed account that appropriately recognizes the contributions of all who have been a part of BSE's history is highly desirable and would be a treasured addition to current resources on the topic.

Finally, it is not lost on the author that writing a 100-year history after less than a year with the Department is at least somewhat presumptuous. The more detailed accounts previously written by early Department Heads Charles E. Seitz and Earl T. Swink have been extremely valuable and were consulted extensively. They and others who have supported this history are to be credited where it is correct. Any errors can be laid at the feet of the author, who will happily make any corrections as identified.

Dwayne R. Edwards, Professor and Department Head, October 16, 2020.

Biological Systems Engineering at Virginia Tech: The First Century

1862 – 1913: Setting the Stage

The history of what is now known as the Department of Biological Systems Engineering can be said to have begun during Virginia Tech's first years, and well before Virginia Tech was known by its current name. In fact, it can be considered that the seeds of our department, and perhaps even the profession, were sown during one of the Nation's most consequential struggles.

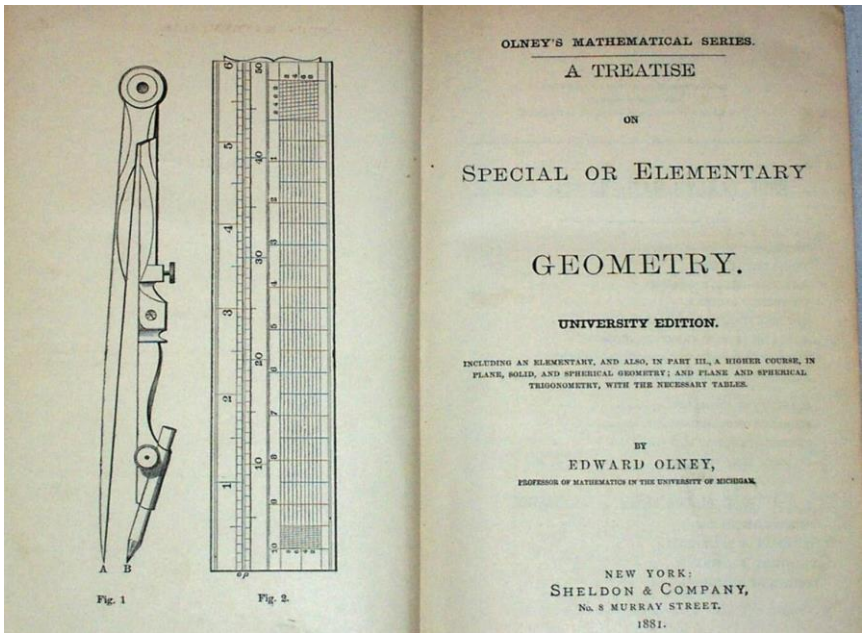
In 1862, in the early stages of the American Civil War, President Abraham Lincoln signed into law what would become known as the Morrill Act, or the Land Grant College Act. The Morrill Act was named after its most noteworthy proponent and champion, U.S. Representative (later U.S. Senator) Justin S. Morrill of Vermont. The Morrill Act proposed to "*establish at least one college in every State upon a sure and perpetual foundation, accessible to all, but especially to the sons of toil, where all of needful science for the practical avocations of life shall be taught, where neither the higher graces of classical studies nor that military drill our country now so greatly appreciates will be entirely ignored, and where agriculture, the foundation of all present and future prosperity, may look for troops of earnest friends, studying its familiar and recondite economies, and at last elevating it to that higher level where it may fearlessly invoke comparison with the most advanced standards of the world*." Critically, though, the Morrill Act would also grant to each state 30,000 acres of Federally-owned land per Member of Congress as of the 1860 census; this land and/or the proceeds from its sale would provide the initial investment necessary to create these colleges.

Justin Morrill, 1810 - 1898

After the conclusion of the Civil War, the Morrill Act was extended to be applicable to states that had seceded from the Union prior to its passage. On March 19th, 1872, the Virginia General Assembly finalized the sale of Virginia's grant of federal lands and provided that two-thirds of the proceeds would be used to establish Virginia Agricultural and Mechanical College, to be sited in Blacksburg. Governor Gilbert C. Walker appointed the College's first Board of Visitors, who began meeting almost immediately to organize and staff the nascent institution.

Virginia A&M College's initial organization bore no resemblance to the system of Colleges and Departments now familiar to more recent graduates, consisting initially of only a President and three Professors who were experts in the areas of Chemistry and Natural Philosophy, Mathematics and Modern Languages, and Technical Agriculture and Mechanics. The first Board of Visitors anticipated the evolution of the College's mission and organization, however, and scrutinized the models provided by European universities for inspiration on courses of instruction that would enable the College to fulfill its mission. Recognizing the potential for engineering principles and methods to advance agriculture within the Commonwealth, the Board of Visitors specified that the very first curriculum for agricultural students would include a course on "Geometry, Plane Trigonometry and Mensuration, Surveying and *Agricultural Engineering*" to be completed during the second year of study. Agricultural engineering was thus considered a part of Virginia A&M's original scope of responsibility, before any designated agricultural engineering faculty, before a formal degree program, before an academic department, even

before a profession would organize itself around the expertise and services provided by engineers working in the field of agriculture.



Nineteenth century text on geometry

For the next forty years, the term "Agricultural Engineering" at Virginia Tech would refer largely to courses on the application of engineering principles in an agricultural context, and was considered more closely related to agriculture than to engineering. As the years passed, practitioners of the emerging profession of Agricultural Engineering would adapt a growing body of knowledge originating from better-known engineering disciplines to the unique challenges of advancing agriculture and serving farmers in the Commonwealth. In particular, expertise traditionally associated with Civil Engineering (surveying, flood control, transportation) and Mechanical Engineering (engines and machinery) was increasingly integrated into Agricultural Engineering courses and practiced by graduates of the College.

In the early 20th century, broader developments would have significant implications on Agricultural Engineering. Under the highly consequential tenure of President J.M. McBryde, Virginia A&M College was renamed as in 1896 as Virginia Agricultural and Mechanical College and Polytechnic Institute, commonly (and perhaps understandably) shortened to Virginia Polytechnic Institute or "VPI." McBryde further reformed the institution by forming four departments, each headed by a dean, in 1903: the Academics, Agriculture, Engineering and Scientific Departments. This new organization reinforced the identification of Agricultural Engineering with Agriculture and its related fields of knowledge while, at the same time, creating an administrative structure that could better capitalize on the potential value of Agricultural Engineering. At roughly the same time, Jay Brownlee Davidson, a professor at then-named Iowa State College was working diligently to establish Agricultural Engineering as a profession in its own right. Brownlee's efforts led to the founding of the American Society of Agricultural Engineers in 1907, with the 27-year-old Brownlee named as its first President. Davidson's professional contributions were far from complete, and he went on to publish the first textbook for Agricultural Engineering in 1913, *Agricultural Engineering: A Text Book for Students of Secondary Schools of Agriculture, Colleges Offering a General Course in the Subject, and the General Reader,* a 554-page text covering topics such as drainage, irrigation, roads, farm structures, septic tanks and electricity.

J.B. Davidson, 1880-1957

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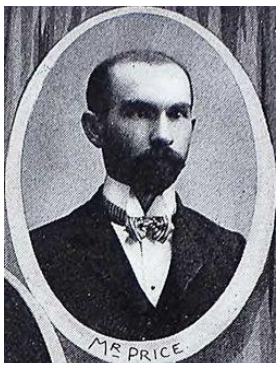
Table of contents of Davidson's 1913 textbook

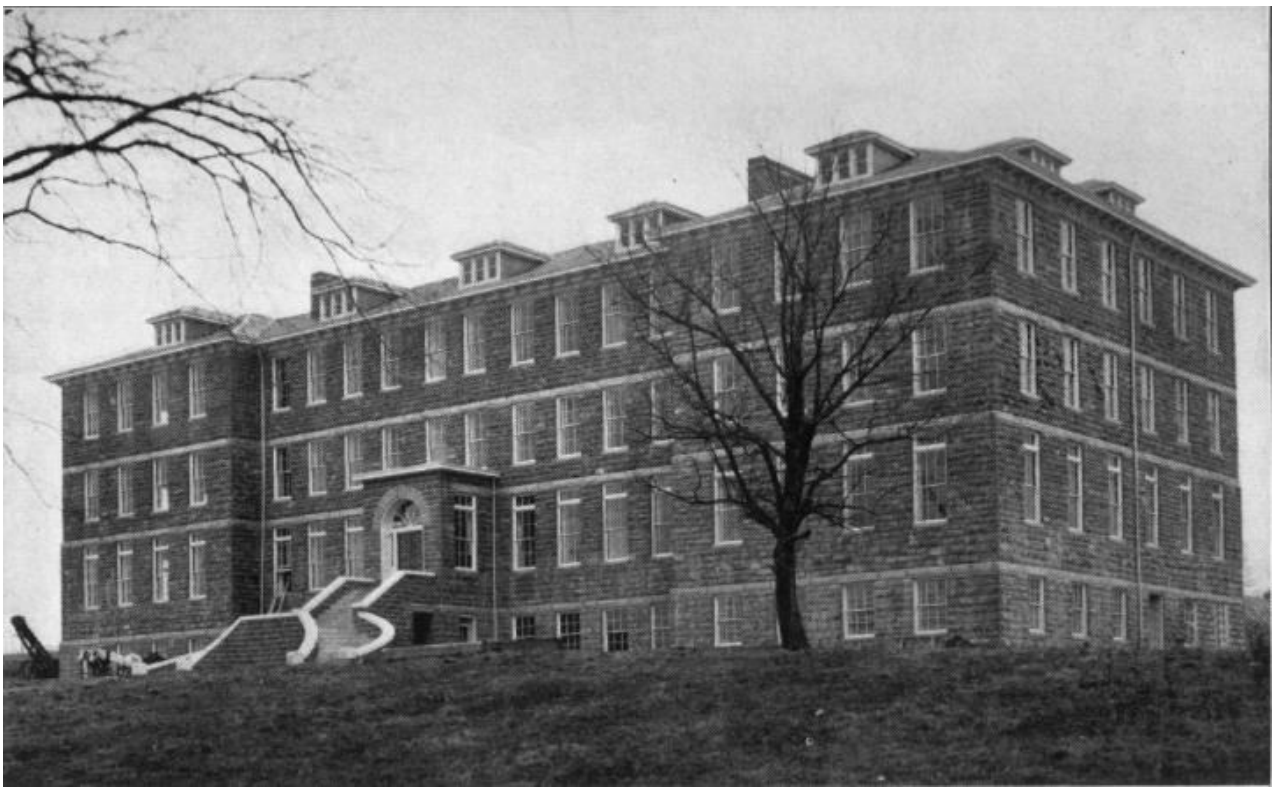
1913 – 1920: Founding

The combination of a professional society, a landmark text, a facilitative administrative structure and progressive leadership created the conditions for Agricultural Engineering's next stage of development. Joseph D. Eggleston, Jr. was the President of VPI, and Harvey L. Price was the Dean of the Department of Agriculture when a formal curriculum leading to a Bachelor's Degree in Agricultural Engineering was implemented in 1913. The Smith-Lever Act of 1914 was signed into law the following year, establishing Extension as the third and final mission component for Land Grant Universities and fundamentally altering the way that the universities interacted with the citizens of their states. That same year, Price hired Charles E. Seitz in 1914 as VPI's first agricultural engineer. Seitz, a native of Reno, Nevada and a drainage specialist hired as part of the Department of Agriculture's transforming extension program, was initially stationed in Burkeville but moved to Blacksburg after about a year. The future of Agricultural Engineering at VPI seemed bright, but a key component of a viable program was still missing. In the absence of a dedicated faculty consisting of trained professionals, the Agricultural Engineering curriculum never gained momentum – only three individuals registered for it in the years 1913 – 1919. Additional challenges arose in the form of the Great War, later known as World War I (in which Seitz would serve), and the 1918 flu pandemic which began in the U.S. in early 1918 and would claim up to 850,000 lives over the two years. Among his first acts following his selection as President, Dr. Julian Burress eliminated the struggling curriculum in 1919. In a wide-ranging series of initiatives thereafter, however, President Burress elevated the Department of Agriculture to the School of Agriculture, creating a structure within which academic departments could be created and administered. Despite the setback of curriculum elimination, the quality and scope of services rendered by Charles Seitz established the value of Agricultural Engineering within the new School of Agriculture. As a result, Seitz and Price were able to successfully make the case that more, not less, should be invested in this developing profession, and the Department of Agricultural Engineering was established in 1920, housed in the still-new Agricultural Hall (now known as Price Hall) with Seitz as its first Department Head.



Harvey L. Price, 1874 - 1951

Construction of terraces in the early 20th century.



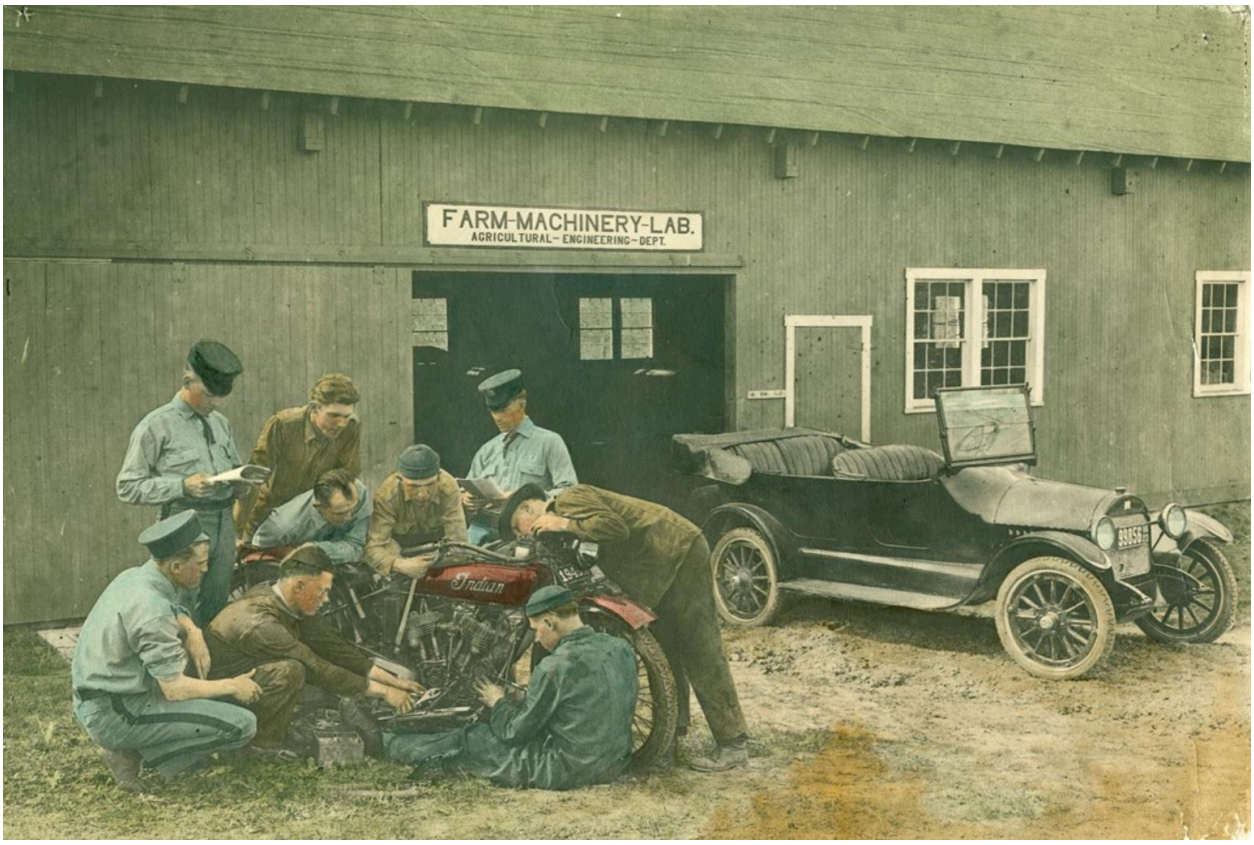
Newly-constructed Agricultural Hall (now Price Hall) as it appeared in 1908

1920 – 1954: Charting the Course

Seitz would prove to be an inspired choice as the Department of Agricultural Engineering's first leader, and his first years in the role would be marked by a flurry of activity. A 50' x 160' wood frame building was constructed in 1920 and would be used to store farm machinery and equipment for teaching, extension and later research. The Department immediately took responsibility for instruction of all Agricultural Engineering courses, and two years after its founding, joined five other states (Iowa, Nebraska, Kansas, Missouri and Texas) in offering a professional curriculum leading to a Bachelor's Degree in Agricultural Engineering. Additions to the faculty and staff followed, and the Department initiated research activities in 1926 to complement its already-existing extension and teaching programs. Within a decade of its establishment, the Department had firmly established its unique portfolio in each of the three traditional mission areas common to all Land Grant Universities.

INSTRUCTOR IN AGRICULTURAL ENGINEERING. The department of agricultural engineering of the Virginia Polytechnic Institute has an opening for an instructor to handle farm surveying, farm buildings, farm concrete, and rural architecture. He will also devote part time to extension work. Write Charles E. Seitz, department of agricultural engineering, Virginia Polytechnic Institute, Blacksburg, Virginia. PO-5.

Position advertisement posted by Charles E. Seitz in 1923



The Agricultural Engineering Farm Machinery Lab. The motorcycle is a 1920's model Scout by Indian Motorcycle Company.

Seitz's tenure would last for 33 years, from 1920 – 1953, and would come to be known as an era marked by expansion and adaptation to the needs of Virginia citizens. Seitz, for example, broadened his area of expertise to include rural electrification and came to be regarded as a pioneer in bringing this relatively new amenity into the homes and lives of tens of thousands of Virginians. Enabled by new members of the Department, work in land drainage continued, supplemented by programs in irrigation, power and machinery, land clearing, farm structures, and rural housing. Beginning at the onset of Dust Bowl conditions in 1930, the Department adapted its focus to include soil erosion control, collaborating with the newly created Soil Conservation Service. The Department's service, expertise, and ability to successfully adapt firmly established its value to VPI and to the Commonwealth. Consequently, while the U.S. was in the grip of the Great Depression, the Agricultural Engineering

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Department was designated to occupy one of VPI's new buildings to be constructed using Works Progress Administration (a Depression-era federal program) labor. Work on what was then known as the Agricultural Engineering Building began in 1937, and the 51,000 square-feet facility – built at a cost of $50,000 and containing offices, classrooms and laboratories – was sufficiently complete to enable occupancy during 1939. For the first time, all Agricultural Engineering faculty and staff were housed in the same building, which would remain home to the Department to the present time and that would eventually bear Seitz's name.

Challenges would again face the newly-located Department, and again in the form of war. World War II broke out in 1939, with the U.S. drawn into the conflict in late 1941. The national effort assumed an unprecedented scale, and over the next three-and-a-half years, Agricultural Engineering programs would shift to support the war effort. Numerous Agricultural Engineering faculty, staff, students and alumni would serve as uniformed members of the armed services. In the post-war years, the Department's work on rural electrification continued with the organization of the Virginia Farm and Home Electrification Council and in collaboration with the Tennessee Valley Authority. Programs in drainage, irrigation, and soil and water conservation resumed while the post-War economic boom created new needs in the areas of farm structures, power and machinery, and post-harvest handling and processing. Enrollments in the Bachelor of Science degree program rebounded to pre-War levels of 20-25 graduates per year.

The Engineers Council for Professional Development (ECPD, the forerunner of the Accreditation Board for Engineering and Technology, referred to as ABET) was established in 1932. Among its responsibilities was the accreditation of professional degree programs leading to a B.S. degree in engineering disciplines, a critical function that promoted public safety by introducing standardization among engineering curricula. Accreditation by ECPD became a touchstone among engineering departments nationwide. Given the facts of Agricultural Engineering's professional and administrative origins and the College of Engineering's overarching responsibilities for accreditation of VPI engineering departments, uncertainties arose as to how Agricultural Engineering, a department within the College of Agriculture, would be accredited by an organization that interacted primarily, if not solely, with Colleges of Engineering. As a result, a 1949 policy specified that at the beginning the following year, the College of Engineering would be given responsibility and authority in instructional and related functions to facilitate ECPD accreditation. The College of Agriculture would to retain responsibility and control of all remaining functions (extension and research). This policy was clarified in 1968 and continues in its essentials today.

Weir/flume combination used in Soil and Water Conservation research in the Dust Bowl/Great Depression era.

1954 – 1969: The Next Era

Charles Seitz retired from VPI in 1954 and succeeded as Department Head by Earl T. Swink, who had joined the Agricultural Engineering faculty in 1935. Swink was a native of Churchville, Virginia and among the Department's first Agricultural Engineering degree recipients, having graduated from VPI in 1930. Having already served in the Department for nearly 20 years, Swink was well positioned to continue the trajectory established under the leadership of Charles Seitz. During Swink's 15-year tenure as its second Department Head, and consistent with the growing number of peer departments across the U.S., the Department solidified its reputation for excellence in the four existing specialty areas (soil and water conservation, farm structures, rural electrification, and farm power and machinery) while continuing to adapt in each area to meet emerging needs. Research and extension programs in irrigation and erosion control expanded, and the work in pollution control would sow the seeds of significant future transitions in the specialty and the Department. Work in farm structures and rural electrification was significant in its own right but also anticipated the development of programs in controlled environments and food processing as Agricultural Engineering focus areas. Moreover, power and machinery programs in planting, fertilization and pesticide application would lay the groundwork for additional advances with the coming of the guidance and control systems of the future.

Earl T. Swink, 1907 – 1996.
Department Head, 1954 – 1967.

It was also during Swink's tenure that the Dr. Essex E. Finney graduated with a Bachelor of Science in Agricultural Engineering degree in 1959, the first African American to do so. Finney later earned his M.S. from Penn State in 1960 and his Ph.D. from Michigan State in 1963 (again, the first African American to earn the distinction in that degree program at Michigan State). A native of Powhatan County, Virginia and member of the Corps of Cadets while at VPI, Finney achieved a distinguished career culminating in service at the senior levels of the U.S. Department of Agriculture and induction into the inaugural class of the Department's Hall of Fame.

Essex E. Finney, B.S. Agric. Engr. (1959)

1967 – 1979: Changing Times

J.P.H. Mason, 1930 – 2011. Department Head, 1969 – 1979.

In 1967, Swink rejoined the faculty as Extension Leader for Special Programs until his retirement in 1970. After an interim period of approximately two years during which the Department was administered by committee (U.F. Earp, J.H. Lillard and G.D. Kite, representing the Department's three mission areas), Dr. J. Philip Mason was named the third Department Head in 1969. A Virginia native, Mason was a 1951 alumnus of VPI and earned his Ph.D. from the University of Missouri in 1962, making him the first Department Head to hold a terminal degree in the discipline (as would all future tenure-track faculty beginning in 1968). Mason was also a Korean War veteran and Bronze Star recipient who retired from the Army Reserve at the rank of Colonel. Mason's decade-long tenure began near the end of the highly-turbulent 1960's, a decade marked by an unpopular war, highly-visible civil rights struggles, political assassinations, and widespread social unrest. While the 1970s would present significant new challenges, there were also positive movements on the national scale that would prove foundational to the Department's future direction, particularly in the area of Soil and Water Conservation. Awareness of human impacts on the environment had been growing, partly in response to Rachel Carson's *Silent Spring* published in 1962. The first Earth Day was held in 1970 to highlight environmental problems worldwide, and the U.S. Environmental Protection Agency was created that same year. In 1972, the Clean Water Act was signed into law to set the stage for an enduring nationwide commitment to preservation of water resources. Extension and research programs that had focused largely on erosion control shifted to a more expansive view that encompassed the wider aspects of environmental quality. The Agricultural Engineering faculty were well-prepared by virtue of training and experience to make this transition. Another external force, the 1973 Oil Crisis, initiated research and extension efforts to maximize efficiency and use of alternative sources – both on the farm and in the home – such as solar energy and biofuels. At the same time, advances continued in the Department's established areas of expertise and impact, particularly in dairy, beef and sheep production systems. Undergraduate enrollments trended upward during Mason's tenure, from 6 – 8 graduates per year at the beginning to 10 – 12 at the conclusion.

Power and Machinery field demonstration in 1950s.

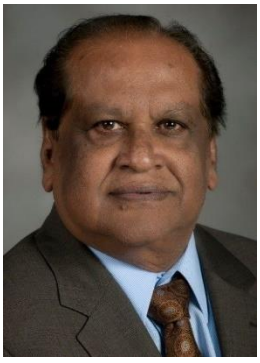
Agricultural Engineering parade float from 1960s.

1979 – 1986: Dawn of the Revolution in Computing

C. Gene Haugh, Department Head 1979 - 1986

In 1979, following Mason's return to the faculty, Dr. C. Gene Haugh was selected as the Agricultural Engineering's fourth Department Head. Haugh was educated at Penn State (B.S.), Illinois (M.S.) and Purdue (Ph.D.), after which he established a highly productive career in food processing and engineering on the faculty of Purdue University. Haugh was thus the first Department Head not to have been an alumnus of the Department or to have spent a significant portion of his career on the faculty of the Department. Haugh's seven-year tenure was marked by transformation into a "modern" Agricultural Engineering department with emphasis on expanding the Department's research and graduate programs as well as external funding. Consistent with national trends, an earned doctorate in Agricultural (or closely-related field) evolved as the standard for initial appointment to the faculty ranks. The Department maintained productive expertise in all the traditional areas of research and extension faculty but with expansion in the burgeoning area of food process engineering to capitalize on opportunities presented by increased vertical integration within the food industry. The advantages provided by advances in computer technology were increasingly recognized, and faculty were quick to recognize their applications. All specialty areas benefitted from the availability of computing resources, and the new field of simulation modeling – particularly in the Soil and Water Conservation Engineering area – became both feasible and fruitful as a research focus. Even though some computers were referred to as "personal computers" or PCs and marketed as "portable" (e.g., the suitcase-sized Osborne 1 with its five-inch display), card-operated or remotely-accessible "mainframe" computers remained prevalent, and PCs would not become indispensable to education for several more years. Undergraduate enrollment remained relatively stable, with 20 – 25 graduates per year. The Department's first female to earn a B.S. degree, Jane Janney, graduated in 1976.

1986 – 2003: Sea Change



John Perumpral, Department Head 1986 – 2003

Dr. John Perumpral was selected as the fifth Department Head in 1986 following Haugh's return to the faculty. Perumpral was educated at Allahabad University, India (B.S.) and Purdue University (M.S. and Ph.D.). Perumpral was appointed an Assistant Professor in the Agricultural Engineering Department at VPI&SU (Virginia Polytechnic Institute and State University, the legal name by legislative act of 1970) in 1970 and advanced through the faculty ranks on the strength of his research and extension programs in soil mechanics and soil dynamics. Three years after his promotion to Professor, Perumpral was named the William S. Cross Professor and Head of the Department of Agricultural Engineering. The challenges facing the Department were significant, including low and declining enrollments and the increasingly inadequate teaching and research space in the half-century-old Seitz Hall. The challenges being highly related and interactive, both would require solutions to secure the Department's future. Due to successful efforts on the part of the entire Department, Perumpral's 17-year tenure would be exceptionally consequential and chart the Department's course for the next 30 years.

Whereas the Department offered Ph.D. degrees under the administrative support of other departments, it began to offer the Ph.D. degree under its own name and administration in 1986. A year later, the Department developed its first strategic plan. Under pressure from external forces including nationally-diminished federal support for higher education, the Department made the decision to reorganize its traditional areas of technical specialty into (a) Soil and Water Conservation Engineering, (b) Wood Engineering and Agricultural Structures, (c) Food Engineering and (d) Decision Support Systems (which heavily leveraged increasingly affordable and practical computing technology). This interim reorganization reflected the Department's judgment as to the areas having the greatest likelihood of sustained success and in which the Department could differentiate itself in an increasingly competitive market. Budgetary challenges continued, however, and undergraduate enrollments continued to slip as the Department fought to reinvent itself in a time of new economic realities and professional priorities among young engineering students. It should be noted that, the Department was by no means alone in the nature of its challenges; these issues were widespread among peer departments across the U.S. as well as in some smaller departments of other engineering disciplines. Indeed, not all peer departments survived the period with an intact administrative structure and departmental identity. In a risky refusal to temporize or adopt half-measures, the Department decided to "go all in." After many spirited and passionate discussions, the Department made a landmark decision in 1992 to collapse their four specialty areas into only two: (a) Land and Water Resources Engineering and (b) Bioprocess Engineering. The Department had made the assessment that the explicit integration of biology into engineering practice and design was the key differentiating feature of the profession, and that the Department's future would be secured only by embracing a transformed identify that was based on this principle. Accordingly, future faculty hires were conditioned on an academic fit within one or the other of these two areas, instructional materials were overhauled to emphasize the role of biological principles in engineering, and the Department's name was changed in 1994 to the Department of Biological Systems Engineering (anticipating a similar name change in the professional society by nearly 10 years). In a mix of private funds, equipment-designated funds, Virginia Tech capital funds and Departmental Resources, nearly $1M in renovations in Seitz Hall (formerly the Agricultural Engineering Building, renamed after founding Department Head Charles E. Seitz in 1978) established the Land and Water Resources Engineering and Bioprocess Engineering Laboratories. The hard work and boldness of the Department was rewarded; enrollments first stabilized and then rebounded with the first degrees in Biological Systems Engineering (BSE, as it is known today) awarded in 1996. New synergies and faculty hires established an enduring, highly visible profile for the Department within its professional society, and promising prospects were established on a transformed footing. The Department welcomed its first female faculty member, Dr. Lori Marsh, in 1989, who was soon joined by Dr. Mary Leigh Wolfe in 1992. Dr. Foster A. Agblevor, the Department's first Black faculty member, joined the Department in 1996.

Agricultural Engineering students outside Seitz Hall, early 1980s.

Classroom scene in the 1990s.

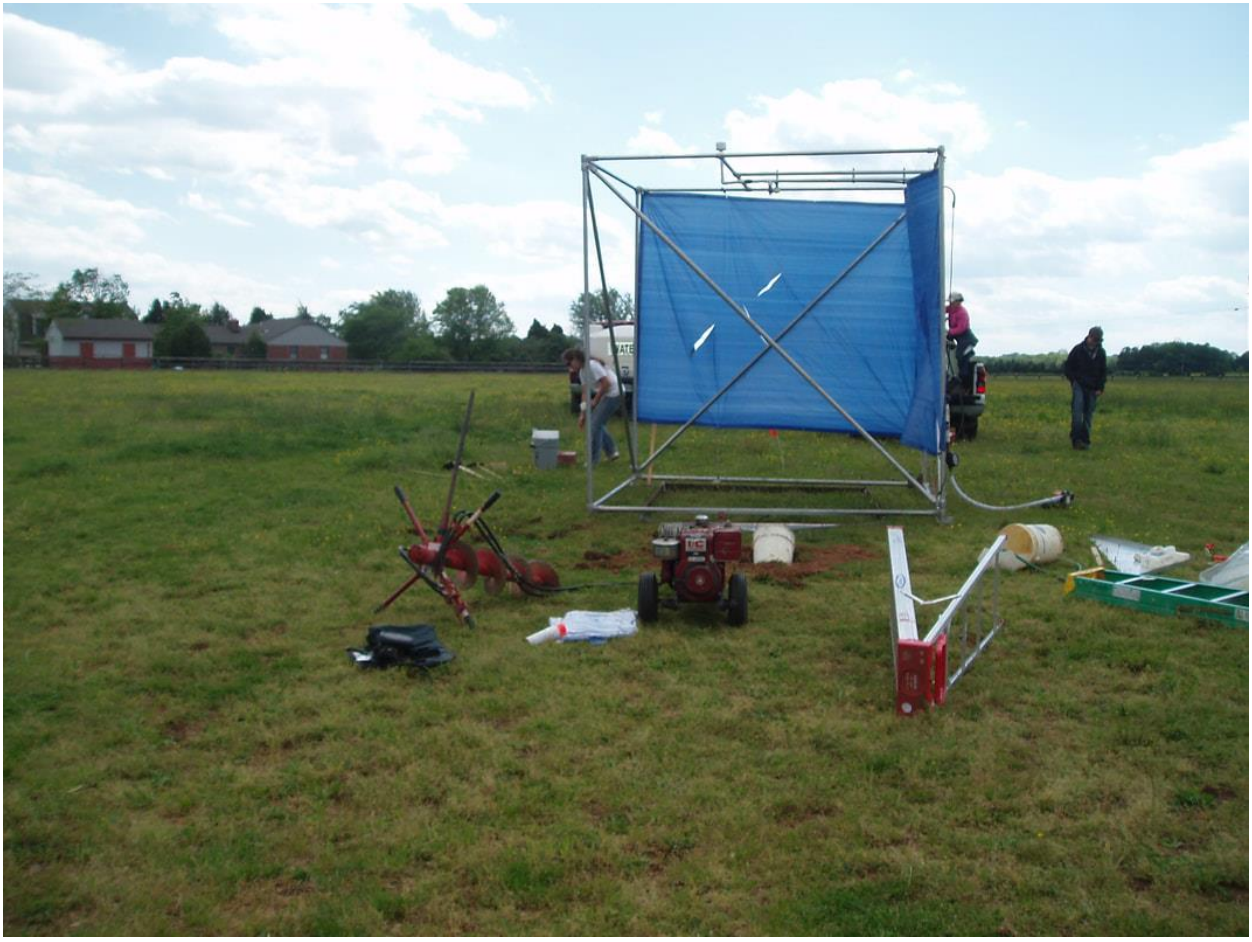
In 1995, the Department celebrated its 75th Anniversary in a well-attended event comprising alumni, former staff and faculty, and friends and supporters of the Department. During the celebration, the Department established the Biological Systems Engineering Department Hall of fame and inducted Joseph H. Barlow, Henry B. Boynton, Essex E. Finney, John K. Hale, Frank E. Lanham, J. Lyle Shaver and James E. Turner as its inaugural class.

2003 – 2009: Getting to the Next Level

Saied Mostaghimi, Department Head 2003 – 2009.

In July 2003, Dr. Saied Mostaghimi began his six-year tenure as the sixth Department Head following John Perumpral's retirement. Mostaghimi earned his B.S. in Irrigation Engineering at Pahlavi University in Iran and, after coming to the U.S. to continue his studies, his M.S. and Ph.D. degrees in Agricultural Engineering at the University of Illinois at Urbana-Champaign. Mostaghimi joined the faculty of the then-named Agricultural Engineering Department at VPI&SU in 1984 and advanced through the academic ranks to Professor in 1994, later being named H.E. and Elizabeth Alphin Professor. Mostaghimi, who established himself as a premiere researcher and educator in the Land and Water Resources Engineering specialty, faced significant challenges in the form of recently-declining graduate and undergraduate enrollments, regarding which (especially Ph.D. graduates) the Department had been formally warned the previous year by the State Council of Higher Education for Virginia. In addition, several faculty positions were vacant with more retirements anticipated, and additional laboratory space would be required to support the increased emphasis on the Bioprocess Engineering specialty established during Perumpral's tenure. Ten new faculty (taking the department from 12 to 20 tenure-track faculty) joined BSE during Mostaghimi's tenure. Mutual support from the Deans of Engineering and Agriculture and Life Sciences as well and a new direct-to-Ph.D. admission program, along with a concerted effort on the part of the faculty, led to a leap in enrollments from 25 in 2003 to 63 in 2009, including an increased Ph.D. enrollment from 8 to 30 over the same period. External funding for BSE faculty members increased from $0.9M to $3M, third in the College of Agriculture and Life Sciences. Significant improvements and additions to laboratory space were achieved, including renovation of 2500 square feet in Seitz Hall as well as acquisition of 8100 square feet in adjacent Agnew Hall and three new lab spaces in Latham Hall. In addition, the Department leased over 9000 square feet of space in the Virginia Tech Corporate Research Center and, during the planning phases of the new Human and Agricultural Biosciences Building 1 (HABB1), secured a commitment for 24,000 square feet of space to be designated for BSE use. These developments solidified the Department's reorganization along the lines committed to in 1992 and established Departmental leadership in completely new research areas such as biotechnology, nanotechnology, genetic engineering, and medical applications of engineering. The inclusion of these novel specialties into the curriculum and the creation of a degree option that would serve as a pathway into medical professions (including Biomedical Engineering) reversed the trend in declining enrollments that rose near the beginning of Mostaghimi's tenure. Mostaghimi would serve as Department Head until late 2009, he accepted the position of College of Agriculture and Life Sciences (as it had been known since 1971) Associate Dean for Research and Graduate Studies and Director of Virginia Agricultural Experiment Station.

Independent study in applications of Bioprocess Engineering, 2000s.



Rainfall simulator in use during field research, 2000s.

Julia K. Pryde

On April 16th, 2007, Virginia Tech (as it had been increasingly referred to since the early 1990s) experienced the deadliest school shooting in U.S. history. Julia K. Pryde, a 23-year-old BSE alumna and M.S. student, was among the 32 students and faculty who lost their lives that day. Julia, a native of Middletown, NJ, was a richly gifted and highly active advocate for the environment who was on a path to an academic career. Her passion for making the world a better place, and particularly her interests in international outreach, are honored in the form of the endowed Julia Kathleen Pryde Fellowship which supports BSE students who share her spirit of international service. A permanent memorial to Julia is located just outside the entrance to Seitz Hall.

2009 – 2019: Raising the Profile

Mary Leigh Wolfe, Department Head 2009 – 2018.

Dr. Mary Leigh Wolfe was named to succeed Mostaghimi as Department Head on an interim basis and was subsequently selected to serve on a permanent basis as the BSE Department's seventh Department Head. A native of the Baltimore area, Wolfe is a two-time Virginia Tech graduate, having earned her B.S. and M.S. in Agricultural Engineering. After earning her Ph.D. in Agricultural Engineering at the University of Minnesota, Wolfe was selected in 1986 as the first female in a tenure-track position at Texas A&M University's Department of Agricultural Engineering. After six years at Texas A&M, during which she was promoted to Associate Professor, Wolfe returned to Virginia Tech as an Associate Professor. In a pioneering career, Wolfe was among the first females to be named as a department head among for peer departments in the U.S., president of her international professional society (ASABE), and president of ABET as well as the only individual to have been elected president of both of those organizations. During Wolfe's tenure, the Department invested heavily in leveraging relationships with alumni and employer networks, promoting the degree programs and graduates, integrating professionalism into the curriculum and graduate programs, cultivating new job markets and significantly enhancing undergraduate student support services. As a result, the Department would experience the "Golden Years" of undergraduate enrollments (50 or more graduates per year) that continue to the present. The Human and Agricultural Sciences Building 1 (HABB1), a 92,000 square-feet building containing office space and state-of-the-art laboratory facilities, was completed in 2014 at a cost $54M. The building is home to all BSE Bioprocessing faculty (and some Watershed Science and Engineering faculty) as well as colleagues in the Department of Food Science and Technology. The substantial investment in the HABB1 Building was a clear acknowledgement of the potential rewards from the Department's efforts in the expanding Bioprocessing area and an exceptional recruiting tool for new faculty and graduate students alike.

Stream Research, Education and Management (StREAM) Lab on Stroubles Creek, Blacksburg, 2010s.

Research in the newly-constructed Human and Agricultural Biosciences Building 1 (HABB1), 2010s.

Robert "Bobby" D. Grisso, Interim Department Head 2018 - 2019

Dr. Robert "Bobby" D. Grisso served as Interim Department Head from July 2018 until December 2019. A native of the Roanoke area, Grisso has two degrees (BS & MS) from Virginia Tech in Agricultural Engineering. After earning his Ph.D. in Agricultural Engineering at the Auburn University, he served on the faculty at University of Nebraska for sixteen years, during which he was promoted to Professor. Grisso returned to Virginia Tech as a Professor in 2001. He also served for 6 years as Associate Director for Virginia Cooperative Extension. During Grisso's tenure as interim Department Head, he maintained the daily operations and, though the University and colleges (both CALS and COE) were developing strategic plans, his goal was to hire a permanent Department Head within 18 months (which he achieved). During this time, ABET reviewed all the COE departments using the newly developed guidelines of curriculum self-assessment and continuous improvement. Under the leadership of Dr. Durelle Scott and his team, the review and final recommendations were very positive. A new budget model from central administration (referred to as PIBB – Partnership for an Incentive Based Budget) was implemented at the college level, impacting departmental budgets. Much needed renovations of three restrooms in Seitz Hall were completed and the Senior composite photos were moved to their current locations along the stairwells and lobby areas. Undergraduate enrollments have continued to grow, and current (Class of 2021) Senior Capstone Design course has 79 students working on 17 projects under the mentorship of 24 advisors, consultants and clients.

Centennial Year: 2020

Dwayne R. Edwards, Department Head 2020 -

Dr. Dwayne R. Edwards was named BSE's eighth permanent Department Head in Fall, 2019 and began work at Virginia Tech in early 2020. Edwards, a native of central Arkansas had been educated at the University of Arkansas (B.S., M.S.) and Oklahoma State University (Ph.D.) and progressed through the faculty ranks at the University of Arkansas and the University of Kentucky. Similar to several of his predecessors, Edwards had previously served in the U.S. Army Reserve, having retired as a Brigadier General. Soon after Edwards's arrival, what would be known as the COVID-19 pandemic erupted, causing massive disruptions throughout society. All classes at Virginia Tech transitioned to an online/virtual format after the extended Spring Break, in-progress searches for faculty members were suspended, and nearly all work was conducted remotely, from students' and employees' homes. The Fall 2020 semester saw most courses taught in a virtual format, and Spring 2021 is anticipated to follow a similar pattern. At this writing, numerous events and functions have been cancelled or substantially altered out of consideration for health and safety. Even so, all in BSE have adapted along with the larger Virginia Tech community to ensure the continuation of high-quality instruction, focused and relevant extension programs, and continuing innovations in research. Mercifully, very few in BSE have experienced health effects attributable to the pandemic, and there is cause to hope for better circumstances by mid-2021.

Next

It is perhaps our nature to wonder, "What's next?" At the same time, we would do well to heed the words of a wise person who said, "It is difficult to make predictions, particularly about the future." Meaningful speculation is especially difficult in heavily technology-dependent professions such as engineering, given that advances are occurring at an exponential rate. Over the course of his life, Charles Seitz saw the first automobile manufactured in the U.S. (Duryea Motor Wagon Company, 1893), the first human landing on the Moon (1969), and everything between. The term "everything in between" includes radio, motion pictures, television, special and general relativity, Hoover Dam, the Interstate Highway System, radar and jet engines. Seitz also lived through two world wars (serving during the first), the 1918 – 1920 flu pandemic, the Great Depression and Dust Bowl, and the development of thermonuclear weapons. Those who belong to the "Baby Boom" generation (1946 – 1964) and are members of the Department's more senior faculty saw different changes over their lifetime, but comparable in terms of the pace of the changes. Communication technology has evolved from "party line" telephones connected through a series of copper wires to Bluetooth and Wi-Fi-capable "smart phones" that communicate over a world-wide network of cellular towers. Computers have evolved from the "mainframe" models that occupied an entire room to "notebook" computers the size of, well, notebooks. Automobiles, some of which are electric-powered, are safer and more efficient than ever. Some can literally drive themselves, and thanks to a constellation of geosynchronous satellites and "global positioning systems" that use them to determine three-dimensional positioning with an accuracy of centimeters, maps (as well as the ability to read them) experience a threatened existence. We now use our unique genetic coding to identify relatives and solve crimes, but we can also manipulate it to modify characteristics of plants, animals and even humans. Powered by advances in genetics, computing and electronics technology, and chemistry, medicine has experienced a quantum leap. The true answer to the question of, "What's next?" is, "Who knows?" Post-Renaissance history shows us that the reality of the future remains consistently beyond the grasp of our ability to imagine it. Notwithstanding the difficulty, it is perhaps possible to meaningfully extrapolate some of the current trends into the near future

Contemporary trends in the major technologies (medicine, genetics, chemistry, computing, communication, geolocation, nanotechnology, etc.) will almost certainly continue, representing opportunities in both of the Department's current specialty areas (Bioprocessing/Biotechnology and Watershed Science and Engineering). Technology-fueled improvements in diagnoses are likely, as is an expansion of the range of diseases and maladies that can be treated effectively with the aid of nanotechnology and next-generation vaccines. Even now, BSE faculty are engaged in research that can lead directly to quicker, less expensive and less invasive diagnoses of some illness as well as treatments for some diseases and addictions that have plagued society for decades, if not centuries. The continued collection, archiving and publication of georeferenced, high-resolution data over increasingly large areas, along with developments in supporting visualization and analysis technologies, will be of significant benefit to Watershed Engineering and Science research and extension. More accurate analysis of conditions and site-specific solutions will be possible along with conclusive assessments of environmental responses to time and altered conditions. Advances in sensors and communications technology can permit high-density, near-continuous monitoring networks that shorten decision cycles while improving the quality of decisions made in natural resource management.

The world population was less than two billion when the Department was created 100 years ago. It had more than doubled to four billion 47 years later, and it is projected to double again to eight billion four years from now (2024). The need for ample supplies of safe food therefore seems destined to increase. At the same time, average global temperatures are projected to increase from 1.1 – 5.4^{o}C by the end of the 21st century due to anthropogenically-driven climate change. As of this writing, and for reasons that might seem inconceivable in the coming decades, the U.S. has not been a consistent world leader on the issue in terms of policy and response, despite its disproportionate contribution to greenhouse gas emissions. Even so, empirical evidence supports the consensus conclusion within the scientific community, and present research within BSE will continue to evaluate the local and regional effects of climate change as well as strategies to protect natural resources. Thus, technological advances are likely to support progress on topics that are natural outgrowths of current BSE research and extension efforts, and global-scale external factors promise enduring relevance of these topics.

It seems certain that educational philosophies and techniques will continue to evolve. The first century of BSE saw technology evolve from the chalkboard through the overhead to the projected (or displayed directly on large monitors) PowerPoint presentation. Instructional techniques evolved from rote memory to context-based critical thinking, creativity, and experiential learning. Whereas engineering instruction has generally been centered on physical classrooms within "bricks and mortar" universities, it is possible that approaches to education might be in significant transition as of this writing. As mentioned elsewhere, the U.S. currently is gripped by the COVID-19 pandemic that has disrupted many aspects of life for the last seven months while killing over 215,000 Americans. Nearly all universities and colleges that have survived the initial economic consequences of the pandemic are conducting instruction in a fully or mostly online/virtual mode, re-introducing the word "Zoom" (a technology enabling easy, high-quality remote personal interaction) into the American lexicon. The same is true, even if to a lesser degree, of many primary and secondary schools. This development has not been met with universal approbation. There are significant concerns – shared by students and faculty alike – regarding the quality of education that can be reasonably expected in an online/virtual mode. Moreover, interpersonal interactions are severely curtailed, and "hands-on" labs and practical exercises are axiomatically impossible. But not all experiences have been negative, and there might be opportunities to use virtual technologies to gain efficiencies and to make education – particularly graduate education – more accessible to "non-traditional students" and more tailored to the increasingly diverse backgrounds and learning styles of the students.

The relationships between the Department, its graduates, and its affiliated professional societies are evolving. The Department and its peers have historically operated according to a common "virtuous circle" model, in which the professional society supports and advocates for the departments; the departments, in turn, graduate engineers who become active and supportive members of the larger professional society, with all elements of cycle connected by the common thread of educational background and purpose. The successful expansion of BSE into new topics has been a self-evidently positive development that might necessitate a strengthening the commonalities of the current cycle or adapting the cycle to contemporary circumstances.

Predictions about the future are notoriously tricky things. Perhaps only one prediction is certain, and it is this: regardless of the time, the name or the administrative structure, our profession will provide services, information, and engineers that the Commonwealth and the world will need. And the people of BSE will be right here, on the campus of Virginia Tech and elsewhere, to provide it. They will add

value to every team, sometimes working quietly and other times very visibly, they will always achieve, and their accomplishments will always exemplify the true spirit of *Ut Prosim*.

Human and Agricultural Biosciences Building 1 (HABB1), completed in 2014 for graduate students, faculty and laboratories of the BSE and Food Sciences and Technology Departments.