

# **Aerospace Engineering At the University of Colorado**

## **Early History**

On February 11, 1929 the University of Colorado Aero Club, with twenty members, held its first meeting. Its goal was to promote aviation, which included flying airplanes and studying airplanes and their design.

In that same year, in his biennial report, the Dean of Engineering noted there was a growing demand for a course in aeronautical engineering. This led to immediate action, as the 1930-31 College of Engineering catalog listed an aeronautical engineering option in Mechanical Engineering, supported by courses in aerodynamics, airplane stress and analysis, airplane engines and instruments, airplane transportation, and navigation.

The assistant professor in charge of the aeronautical option was Norman Parker. He built the first aeronautical laboratory, featuring the first wind tunnel in the region, in 1939. This same year the federal government established a Civilian Pilot Training program, with an annual enrollment of forty, in conjunction with the aeronautical option. Both the aeronautical laboratory and the aeronautical option curriculum expanded rapidly in the next two years. In addition, during the war the Navy, in what was named the V-12 program, sent annual classes of about forty through this option, providing the Navy with both pilots and aeronautical engineers.

In 1943, because of the growing demand both by the Navy V-12 program and the civilian students, the Regents approved the B.S. degree in aeronautical engineering with options in engines and structures. Norman Parker, as Head of the Department of Mechanical and Aeronautical Engineering, assured the continued growth of the aeronautical engineering degree.

In 1944, the Regents appropriated \$4000 for remodeling and \$32,000 for new equipment to upgrade the aeronautical laboratories, keeping the laboratories as among the most modern in the nation. A key step in raising the program to national prominence was the appointment of the nationally renowned authority of aerodynamics and aircraft design, Karl Dawson Wood. He had been head of aeronautics at Purdue, and had led wind tunnel and aerodynamics efforts at Cornell, Purdue, Cal Tech, and the Consolidated Aircraft Corporation. Interestingly, K. D. Wood is claimed by three universities as one of the founders of their aeronautical engineering programs: Cornell, Purdue, and Colorado.

## **The Department is Established**

In 1946, the Regents established the Aeronautical Engineering Department as a separate department and appointed K. D. Wood as its first Head. Three outstanding faculty members were responsible for the Department's reputation at this time. K. D. Wood, the nation's leading authority on airplane design, had two of the field's recognized standard texts, *Airplane Design*, and *Technical Aerodynamics*. Harold W. "Hap" Sibert

joined the faculty in 1946 from the University of Cincinnati. He was one of the most respected experts in aerodynamics and structures, and author of the text, *High-Speed Aerodynamics*. Franklin P. Durham came to the Department in 1947 from Pratt and Whitney Aircraft Company. He was a nationally known authority in aircraft power plants including jet engines, and perhaps the nation's top rocket scientist. He authored two texts, *Aircraft Jet Power Plants*, and *Thermodynamics*.

These three stars, and the influence of their texts, led the Massachusetts Institute of Technology in 1954 to list the University of Colorado in its "Big Ten" of aeronautical engineering programs. By 1954, the undergraduate enrollment was 198, and grew to 334 in 1957. Research expanded into several areas of rocket engine and nozzle development, aerodynamic heating at high speeds, and materials, supported by the U.S. Naval Ordnance Test Station, Marquardt Aircraft, the Martin Company, USAF Wright Field Research Center, and other government agencies.

### **The Space Era**

In the last half-century, three strong presidents dramatically advanced the thrust of the University of Colorado. Quigg Newton in the late fifties put the University on the road to becoming a premier research university. Arnold Weber in the early eighties proclaimed his Space Initiative with the goal of making the University the leading space university in the nation. E. Gordon Gee in the late eighties renewed Weber's Space Initiative and put money and resources behind the drive to become the number one space university.

In 1962, Quigg Newton brought Max S. Peters from the University of Illinois to be the new Dean of Engineering. With the new dean, the College won an award of nearly \$1,500,000 from the National Science Foundation to build a new Engineering Center. The state provided the rest of the \$9,000,000 cost. In addition, millions were spent for furnishings and equipment.

For aeronautical engineering, a new Department Chairman, Mahinder S. Uberoi, (PhD, Johns Hopkins, 1953) came from the University of Michigan in 1963, when the Department was renamed the Department of the Aerospace Engineering Sciences. Professor Uberoi had a reputation in magneto hydrodynamics, turbulent flow, and other basic sciences of fluid flow. The faculty members he added were for the most part strong in basic sciences and secondarily interested in applications to engineering.

In 1963, the Department added the greatest star in its history: Adolf Busemann, the father of supersonic aerodynamics, the inventor of the swept wing, the creator of conical flow theory, and a genius with seminal research in nearly every field of fluid flow. After joining the faculty, he continued his research in fluids, and ventured into new areas of space trajectories, propulsion, and structures. He was awarded the Prandtl Ring and gave the Prandtl Lecture in 1965. Professor Busemann remained active even after his retirement until his death in 1986.

As Chairman, Mahinder Uberoi added faculty in basic research areas in the fields of fluids, controls, and even biology. His theory was to bring in researchers strong in the basic sciences, and have them apply their work to engineering. Hence, he hired three biologists to build a bioengineering program.

During the sixties and seventies this approach worked well. The Department grew to twenty-nine faculty and twenty postdoctoral assistants. In 1975, Uberoi's reign as Department Chairman ended, and the Department entered a ten-year period of acting and short-term chairs. The absence of leadership and other turmoil in the Department took its toll. By 1984 there were only nine regular faculty members.

### **The Space Initiative**

At this time, 1984, University President Arnold Weber launched his Space Initiative. He was determined to make the University of Colorado the outstanding space university of the nation. He brought Don Hearsh, former Director of the NASA Langley Research Center, to Boulder as the University's space czar. Dean of Engineering A. Richard Seebass worked with Don Hearsh to implement this strategy in engineering.

In 1985, Arnold Weber left to become president of Northwestern University. The next University President, E. Gordon Gee, adopted the Space Initiative as his own, and announced that it would feature sizeable resources poured into aerospace engineering. George Morgenthaler was brought from Martin Marietta to Chair the department, and George Born was hired from the University of Texas to establish the Colorado Center for Astrodynamics Research. Over the next ten years, 1985-89 with Morgenthaler as Chair, and 1989-1996 with Robert D. Culp as Chair, twenty new faculty members were added and three million dollars of new offices and laboratories were built. Gordon Gee proclaimed the Aerospace Engineering Sciences Department to be "the gem in the crown" of his space university.

Research developed massively with these new faculty members. From a low of a few hundred thousand dollars in 1984, annual research expenditures grew to well over ten million dollars by 1990. The Department led the University in research expenditures for several years in the nineties, and has remained the top engineering department and one of the top four departments in the university since 1987.

The facilities added in the early nineties included several benefiting from major gifts. The Eaton Conference Suite was a gift of Maurine and Thomas Eaton. The McDonnell Douglas Laboratory, containing the Aerospace Structural Dynamics and Control Laboratory, was a gift of the McDonnell Douglas Foundation. The Lockheed Martin Room, serving the senior projects teams, was a gift of the Lockheed Martin Corporation. Two premium conference rooms were dedicated to noteworthy achievers connected with the Department: The Onizuka Conference Room and Onizuka Wing for Ellison Onizuka, an astronaut alumni killed in the Challenger explosion, and the Seebass Forum Room for A. Richard Seebass, former Dean and Chairman.

This wave of multimillion dollar construction, the major achievement of Robert D. Culp's terms as Chair, provided the wing of faculty offices housing most of the faculty in new, quality space, and a series of new laboratories for BioServe, global positioning systems, orbital systems, fluids, computers, and controls.

In this period of expansion, CU alumnus H. Joe Smead gave the Department most of the \$2,500,000 to endow the A. Richard Seebass Endowed Chair. The Department spent more than ten years searching for the outstanding professor to fill this chair, and in 2008 appointed Daniel Scheeres from the University of Michigan as the first Seebass Professor.

### **The New Curriculum**

After thirteen years as Dean of Engineering, A. Richard Seebass served one term as Department Chair, from 1996-1999. His great interest was in revamping the curriculum to take advantage of the new Integrated Teaching and Learning Laboratory, which he created, and to implement the new ABET guidelines. He had been largely responsible for the new ABET rules by helping to organize the research engineering colleges in a movement to bring greater freedom and recognition of the research colleges and their abilities. This brought about in 1997 the Department's "Aerospace Engineering Sciences 2000 Curriculum".

From 1943 through 2002, aerospace engineering has produced 2226 B.S. degrees, 720 M.S. degrees, and 220 Ph.D. degrees. The Regents authorized the PhD degree in 1948, however the Department granted its first PhD in 1965. Currently the Department produces between ten and fifteen doctorates per year. The first graduates produced completely under the new curriculum graduated in 2002.

### **The 21st Century**

In the new century, under Lee Peterson as Chair, the Department once again benefited from major investments by the University. Hiring became intense, and the faculty numbers increased to thirty. Research expenditures rose to new heights and once again the Department led the Boulder Campus with \$15,000,000 per year.

Lee Peterson was appointed to a four-year term as Chair in 2004. In 2007 he was enticed by a too-good-to-turn-down offer to join a team at JPL in cutting edge research. He agreed to go for a fifteen month sabbatical and return if appointed Department Chair for a second term. The faculty overwhelmingly voted to recommend him for a second term. During his absence, Professor Penina Axelrad served as Acting Chair, and Lee Peterson returned monthly to help with major projects.

The most dramatic of these projects was the new Aerospace Building. Lee Peterson had the vision to seek to build the Department's own building, as befits one of the largest and most recognized research departments in the University. The building, to

be constructed adjacent to the Engineering Center and the Discovery Learning Center, was approved by the Regents in March, 2008. Funding was the only delaying factor, but lack of funds prevented this project from proceeding.

In June, 2008, Lee Peterson accepted a lucrative offer from JPL, and partly for family reasons, stayed at JPL instead of returning for his second term. Jeffrey Forbes was chosen as Chair beginning in August, 2008, and served four years through 2012.

Jeff Forbes' four years were extremely successful, with an outstanding ABET review, and an updated Strategic Plan. The prime achievement was the revival of the building plans. A new building on the East Campus was initiated, and again plans were approved up through the Regents. Funding still is unclear, but all are optimistic that in the next few years the Aerospace Engineering Sciences Building will rise on Colorado Boulevard

In 2012, Jeff Forbes returned to his role as Professor, and Penina Axelrad was elected as Department Chair, a role in which she served admirably until her term ended in 2017. Thanks to her vigorous efforts, a [new, dedicated Aerospace Engineering Sciences building](#) will open for the department in Fall 2019.

In January 2017 before her tenure as chair ended, Professor Axelrad also oversaw a game-changing donor gift from Colorado residents, [Ann Smead and Michael Byron](#), establishing the [Smead Program](#) within the department to fund the prestigious Smead Scholars Program and Smead Faculty Fellowships, facilitating events, provide extra educational enrichment opportunities for students, and to help the department elevate its national prominence.

In July 2017, Prof. [Brian Argrow](#), renowned for his decades of experience in fluid dynamics, aeronautics, and unmanned aircraft systems, became the current chair of the department.

## References

Proud Past—Bright Future, *A History of the College of Engineering at the University of Colorado, 1893-1966*, Siegfried Mandel and Margaret Shipley, University of Colorado, College of Engineering, Boulder, Colorado, 1966.

“Aerospace Engineering Science at the University of Colorado at Boulder”, Brian Argrow and Robert Culp, *Aerospace Engineering Education During the First Century of Flight*, edited by Barnes McCormick, Conrad Newberry, and Eric Jumper, Chapter 34, pp.442-451, AIAA, Reston, Virginia, 2004.

**This history was first completed on June 23, 2014, and was last updated on December 7, 2017.**

<b>Department Chairs</b>	<b>Term</b>
<b>Karl D. Wood</b>	1947-1956
<b>Franklin P. Durham</b>	1955-1957
<b>Karl D. Wood</b>	1957-1962
<b>Charles A. Hutchinson (Acting)</b>	1962-1963
<b>Mahinder S. Uberoi</b>	1963-1975
<b>Louis C. Garby</b>	1975-1976
<b>Franklin Essenberg</b>	1976-1979
<b>Klaus Timmerhaus (Acting)</b>	1979-1980
<b>George Inger</b>	1980-1983
<b>Marvin Luttgies (Acting)</b>	1983-1984
<b>Klaus Timmerhaus (Acting)</b>	1984-1985
<b>George Morgenthaler</b>	1985-1989
<b>Robert D. Culp</b>	1989-1996
<b>A. Richard Seebass</b>	1996-1999
<b>Charbel Farhat</b>	1999-2004
<b>Lee Peterson</b>	2004-2008
<b>Penina Axelrad (Acting)</b>	2007-2008
<b>Jeffrey Forbes</b>	2008-2012
<b>Penina Axelrad</b>	2012-2017
<b>Brian Argrow</b>	2017-Present