From *Aerospace Engineering During the First Century of Flight*, edited by Barnes McCormick, Conrad Newberry, Eric Jumper. Reston VA: American Institute of Aeronautics and Astronautics, 2004.

Chapter XX

A Brief History of Aerospace Engineering at the Virginia Polytechnic Institute and State University

Robert W. Walters

Professor and Department Head

and

Jane Echols Johnston

Program Support Technician

The Early Years (circa 1913-1947)

In many ways, the roots of the current Aerospace and Ocean Engineering (AOE) department at Virginia Tech can be traced back to a time prior to 1913, when according to old timers, a flying field was set up at a farmer's pasture about a mile south of Blacksburg. During the 1920's, aviation grew in popularity and development such that the Civil Aeronautics Authority (CAA) of the federal government began a project to create a national airway system. Blacksburg was strategically located close to the CAA approved route between Washington, D.C. and Nashville, Tennessee and was considered to be a desired location for an emergency landing field in the national airway system.

On the afternoon of November 11, 1926, President Julian A. Burruss of V.P.I. appointed a special committee of faculty members to study the aeronautics situation at the college and to consider possible sites for a landing field. The committee was appointed with the definite understanding that the college did not intend to teach flyers, but would concentrate on aeronautical engineering. At least one farmer that owned level land within a mile of V.P.I. thought that defying the law of gravitation through aviation was immoral and refused to lease his property because he "did not want anything to do with such goings-on." Finally the problem was resolved and during the last week of July, 1929 engineers of the Virginia Highway Department began work on the land which today constitutes the Virginia Tech airport.

At that time the V.P.I. Airport was the only one in the United States to be owned or operated by a college or university. Most of the early airplanes at the airport were open cockpit biplanes. Enterprising pilots charged a cent per pound for passenger weight for a ten-minute flight or a flat rate of $3. If the passenger wanted a bit of stunt flying (loop-the-loop, barrel roll, spin, etc.) the charge was $5.

During the 1928-1929 academic year President Burruss was appointed to membership on the permanent committee on aeronautics of the Association of Land Grant Colleges and Universities of America. At its 43rd annual convention, the V.P.I. Dean of Engineering, Earl B. Norris, was chosen secretary of the Aeronautical Section of the association. Fifty colleges and universities were represented at the conference.

The nation's institutions of higher learning promoted Aeronautical education at the time and the academic world recognized V.P.I.'s role.

Faculty taught courses in Aeronautics in 1929 as an Aeronautical option under the Mechanical Engineering curriculum. The first Bachelor of Science degree in Mechanical Engineering with an Aeronautical Engineering option was granted in 1937. Interestingly, the 1938 Course Catalog under the Aeronautical Engineering option states*, "The technical studies in aeronautical engineering are exceedingly difficult and only a few of the fundamental subjects can be mastered by undergraduate students."* In addition to a typical mechanical engineering background in Statics, Dynamics, Materials, Fluid Mechanics, etc., fourth year students were required to take courses in Airplane Design, Aerodynamics, Principles of Aeronautics, Airplane Engines and an Aerodynamics Laboratory course. As a side note, the entire academic year fee in 1938 was $100 for tuition and $260 for board, room and laundry.

In 1941, the Aeronautical Engineering Department was formed as a separate engineering curriculum and granted its first degree in 1942 to Edwin Faunce Burner. In 1943, the number of students was large enough to warrant a separate discipline and the Department of Aeronautical Engineering was created with Professor Leon (Lee) Z. Seltzer taking the role as the first Department Head. Professor Seltzer served as department head until 1947 when he left V.P.I. to accept the position of Professor and Chairman of the Department of Aeronautical Engineering at West Virginia University. During his tenure, the entire equipment inventory consisted of a three-foot diameter open throat, single return wind tunnel located in McBryde Hall. The tunnel was later renamed the "Green Monster."

In the 1943 time frame, V.P.I. had approximately 3300 total students. Approximately 150 were women, predominately studying the Home Economics curriculum. The first woman graduate of the Aeronautical Engineering department was Jane Hardcastle (B.S. 1944) and was noted by Professor Seltzer as a top student. Perhaps our most famous alumnus, Dr. Christopher Kraft (former head of the NASA Johnson Space Center) was also a member of that graduating class. The catalog from that era states, *"Only those students who demonstrate ability in the elementary aeronautical engineering courses and advanced mathematics are allowed to continue with the fourth year curriculum in aeronautical engineering."* Clearly, high standards of excellence were expected of the students back then just as they are today.

The Japanese attack on Pearl Harbor before the end of the first trimester of Professor Seltzer's tenure had a large impact on the department. The curriculum was accelerated and the army called up the ROTC students. Seniors reported first followed by the juniors. V.P.I. became a part of the Army Specialized Training Program and the biggest problem faced was the shortage of faculty for the enormous student class load. During the remainder of the war, Professor Seltzer taught 27-30 credit hours per quarter! By 1944, the curriculum had expanded to include courses in Airplane Propellers, Airplane Structures and Applied Air Loads.

During this same time period, the College had a flight-training program at the Blacksburg airport composed mainly of Fleet model biplanes. One interesting feature of these planes (or more accurately a lack of feature) was that they did not have brakes. Apparently, it was quite an experience to make a crosswind landing on the narrow airstrip without the aid of brakes. Moreover, Fleet biplanes would occasionally be flown to campus and landed on the Drill Field for full dress parades. The only things that fly around the Drill Field today are Frisbees and footballs. Back in that day, students were not even allowed to walk across the Drill Field, a tradition that has long since passed.

Post World War II Era (1947-1967)

In 1947, Professor Arthur E. Rowland became Department Head serving until 1951. Under his leadership, the curriculum expanded to include courses in Rotary Wing Aircraft and Aircraft Performance. Compressible flow was added to the Aerodynamics II course. In addition, students were required to take a 9 quarter credit (6 semester hours) summer term after the sophomore year that had once been part of the senior year. In 1951, a third course in Aerodynamics and a fourth course in Structures had been added to

the senior year to bring the total hours required for graduation to 225 quarter credits (=150 semester credits), significantly more than the 136 credits required today.

Dr. Robert W. Truitt headed the department from 1951 to 1961. Under his dynamic leadership, new wind tunnels were added and the department moved into the newly built Randolph Hall. Courses in Vibration and Flutter, Boundary Layer Theory and Hypersonic Aerodynamics were added to the curriculum and students were (strongly) encouraged to write papers for IAS (Institute of Aerospace Sciences - now AIAA). V.P.I. students set records by taking awards in as many as three IAS meetings in one year. The department also began to offer advanced degrees including the Ph.D. degree in this period. Sadly, Dr. Truitt passed away in 1972 at the age of 51.

In 1958, Charlie L. Yates became the first black student to graduate from V.P.I. earning a degree in Mechanical Engineering. Dr. Yates received his Ph.D. from the John Hopkins University and later joined the faculty of the Aerospace and Ocean Engineering Department. Charlie retired in 2000 and is currently a Professor Emeritus of the department. In 2002, Peddrew-Yates Residence Hall was named in the honor of Dr. Yates and Irving L. Peddrew III (the first black student to enroll at V.P.I. and a man who spent his career in the aerospace industry).

The dawning of the space age brought about significant changes of emphasis. In 1961 the department changed its name to the Aerospace Engineering Department under the direction of its new head, Dr. James B. Eades, Jr. Dr. Eades had previously served on the faculty for 13 years. The facilities were significantly expanded to include the six-by-six foot stability wind tunnel graciously donated by NASA, two supersonic blow-down tunnels, and a "plasma-jet." An instrumentation lab was also added and an analog computer became available to the faculty and students. The laboratory work consisted primarily of aerodynamic investigations in the speed ranges from 150 miles per hour up to a Mach number of 4.75.

The 1962 Course Catalog shows that the curriculum expanded substantially to include 18 undergraduate course offerings and 17 graduate courses. A wide range of courses were offered with additions in Hypersonics, Aeroelasticity, Magnetoaerodynamics, Mechanics of Space Flight, Molecular Flow of Gases, and Energy Systems for Space Operations to name a few. This list is amazing considering that only five faculty members served in the Aerospace Engineering Department that year. A minimum of 223 quarter credits (149 semester credits) were required for graduation in 1962.

University records show that in 1963, there were 12 Bachelor of Science degrees, 10 Master of Science degrees and 1 Ph.D. awarded by the department. By contrast, in 1972, 34 B.S. degrees, 4 M.S. degrees and 8 Ph.D. degrees were awarded.

In looking back, we found a hand-written note that read *"Dr. J.B. Eades, Jr. called his secretary and told her that he would be in the Spherical Dynamics Lab (pool hall) for an hour. When Dean Whittemore called and asked for Dr. Eades, she told him, 'He is in the Spherical Dynamics Lab'".* Apparently it satisfied the Dean and possibly a tactic that is worth remembering. Unfortunately, our current Dean will probably read this and I (RWW) will have to try something new.

A bulletin written by the senior class of 1962 also offers some insights into the times. In that document the following hints written for the benefit of entering students can be found:

1. You must learn that you will have to do things that you do not want to do.
2. You must learn to wait for rewards.
3. You must recognize that learning does not end in college.
4. You must be realistic about your relations with other people – be cooperative.
5. You must become more self-confident.
6. You must have clear in your mind what it is <u>you</u> want to do.

Finally, one other section in that document reads,

"It is through the medium of these men (the faculty) and machines that you will receive the training necessary for a career in the Aerospace field. The fact still remains, however, that the most important contribution to your education must come from <u>you</u> – the student."

The students of that time really had a great grip on the educational process and something that we need to continually reinforce today. As a side note, V.P.I. students were not allowed to own or ride in automobiles in the expansion Post-War era (1945-1955).

The Modern Era (1967-Present)

Although dating back 36 years, we refer to this as the modern era primarily because in 1968 women were given the right to wear pants on campus. Dr. Fred DeJarnette served as Interim Department Head of Aerospace Engineering at V.P.I. from 1967-1969 prior to joining NCSU. One personal comment (from RWW) about Dr. DeJarnette is that he is an excellent teacher and writes so fast on the chalkboard that he can almost disappear in a cloud of chalk dust - literally.

Dr. Joseph A. Schetz took over as Department Head in 1969 serving for an amazing 24 years until 1993. Dr. Schetz currently holds the Fred D. Durham Chair and remains as an extremely valuable faculty member to this day. Both the university and the department went through many changes during his tenure as Department Head. In 1970, V.P.I. officially changed its name to the Virginia Polytechnic Institute and State University and began its expansion from approximately 5,000 to over 25,000 students. In 1972 the department changed its name to the Aerospace and Ocean Engineering (AOE) Department drawing on the synergy that exists between the two disciplines. At first, a joint AOE degree was offered. Later, a separate accredited OE degree was offered in parallel to the AE degree. Under the direction of Dr. Schetz, the faculty tripled in size and undergraduate students were given significant roles in sponsored research programs. In addition, the department's record in winning AIAA student papers continued to grow and its exemplary record in winning student design competitions began.

After leading the department for almost a quarter of a century, Dr. Schetz decided to devote his efforts to research and teaching. Dr. Bernard Grossman began his nine year tenure as Department Head having served on the faculty for eleven years. One of Dr. Grossman's goals was to build on the design program and to emphasize the multi-disciplinary aspects of aerospace and ocean engineering in both the undergraduate and graduate programs. The Multidisciplinary Analysis and Design (MAD) Center for Advanced Vehicles began under his direction and resulted in numerous awards and graduate student fellowships. In 2002 Dr. Grossman stepped down from his position to assume the role of Vice President of Education at the newly formed National Institute of Aerospace under contract from the NASA Langley Research Center.

As a testament to the outstanding faculty members in the department (especially Dr. William Mason and Mr. Nathan Kirschbaum), Virginia Tech students placed first, second, third or received honorable mention in each AIAA undergraduate design competition over the 12 year period spanning 1989-2001 (with seven first place teams). Dr. James Marchman also played a key role in establishing international student design teams that contribute to the success of the department. Dr. Fred Lutze, the most senior faculty member to ever serve the department is retiring this year. His work with student organizations including AIAA and DBF (Design-Build-Fly) and his academic and graduate advising for over 30 years denote special historical recognition.

In 1999, the AOE department was named an exemplary department for its excellence in effectively linking research with teaching with particular emphasis on innovative undergraduate programs. In the past three years, numerous other awards have been given to the faculty and students of this department including our three-time World Champion Human-Powered Submarine Team.

In August of 2002, Dr. Robert (Bob) W. Walters assumed the position of Professor and Department Head of Aerospace and Ocean Engineering. Long before ever having stepped foot on the Virginia Tech campus, Bob had been strongly influenced by the Aerospace program in Blacksburg. His Ph.D. advisor, Dr. Hassan A. Hassan had been a Professor here before joining NCSU. Moreover, Dr. Fred DeJarnette (Interim Department Head) was one of his major professors as was Dr. James Williams, a 1951 graduate of Aerospace Engineering at Virginia Tech who later when on to assume the position of Department Head of Aerospace Engineering at Auburn.

Today, our curriculum covers fundamental courses in structures, fluid mechanics, dynamics and control, ship design and optimization techniques as well as a wide range of advanced courses in these areas. We

have a world class faculty with Ph.D. degrees from many fine institutions including MIT, Princeton, Stanford, Georgia Tech, Purdue and Michigan to name a few. The first female faculty member, Dr. Naira Hovakimyan (Ph.D. from the Russian Academy of Sciences and currently at Georgia Tech) will be joining the department in the fall of this year. We wonder if the faculty from the 40's and 50's could ever have imagined this possibility!

Our facilities are first-rate, including a flight simulation laboratory with a 2F122A Operational Flight Trainer donated by Naval Air Station Oceana valued at $13 million. We also operate one of the largest university owned Stability Wind tunnels in the world with a replacement value exceeding $15 million donated by NASA. In addition we have developed a Satellite Tracking laboratory that will be used to monitor the HokieSat, a student built satellite that will be launched into the ionosphere by NASA Goddard with the purpose of performing scintillation measurements. The AOE faculty have also developed unique diagnostic equipment including Laser Doppler Velocimeters (even credit card sized LDV's), a diode array velocimeter for which a patent has been obtained and many other one-of-a-kind devices. Moreover, we have a new Hypersonic Wind Tunnel and have been able to obtain Mach 10 flow in Randolph Hall this past year.

For many years, our enrollment data has basically tracked with ADCA data. This year, we have 95 sophomores, awarded 70 B.S. degrees in Aerospace and Ocean Engineering, 31 Masters degrees and 11 Ph.D. degrees. Enrollment is on the rise, which we expect to continue for some time to come.

Research in the department is also on the rise with a 16% increase over the previous year. Our faculty members not only perform research in the basic and applied aerospace sciences spanning an amazingly wide variety of topics but also have extended their efforts to include work in bioengineering, automotive engineering, nanotechnology, and information technology. We are also focusing a great deal of effort on Autonomous Vehicular Systems leveraging our expertise in vehicle design that has been developed over the years.

Notable Alumni

The success of our graduates has truly been amazing and it is not possible to list them all in this article. At the risk of excluding some remarkable people, we have decided to list a very few.

Dr. Christopher C. Kraft Jr. ('45) – Director of NASA's Lyndon B. Johnson Space Center;
Mr. Paul Holloway ('60) – Director of the NASA Langley Research Center;
Dr. William Grossmann, Jr. ('58, '62, '64) - Vice President of Technology and Chief Scientist, SAIC;
Dr. Fred DeJarnette ('65) – Director of the Mars Mission Research Center; VPI Department Head;
Dr. Douglas Dwoyer ('64, '68**,** '75) - Associate Director of the NASA Langley Research Center;
Mr. John B. McKay ('50) – NASA X-15 Test Pilot,
Mr. Jerry C. South ('59, '59) – NASA Langley Chief Scientist;
Dr. C. Howard Robins, Jr. ('58) – NASA Deputy Associate Administrator for Space Systems Development
Dr. James Williams ('51) – Aerospace Department Head at Auburn University;
Mr. Toby Bright ('77) – Vice President of Boeing Commercial Airplane Group;
Dr. Joseph W. Meredith, Jr. ('69) – President, Virginia Tech Corporate Research Center;
Mr. Norris E. Mitchell ('58) - President and Owner, Garden-Homes Realtors;
Mr. Nicholas J. Moga ('76) – President, PCSS;
Mr. Philip R. Compton ('47, '50) – Douglas Aircraft/NASA;
Mr. Robert J. Hanley ('79) – Deputy, U.S. Navy Airworthiness Office;
Mr. Marc W. Sheffler ('73) – Director of Apache Integrated Product Teams, Boeing;
Dr. Thomas F. Swean, Jr. ('72) – Program Manager, Ocean Engineering Office of Naval Research;
Mr. Kevin Crofton ('82) – Vice President for CMP, Lam Research Corporation;
Mr. Larry Marshall ('66) – Senior Research Fellow, E. I. DuPont;
Mr. Lester W. Roane ('58) – Chief Engineer, H.P. White Laboratory;
Dr. Robert H. Tolson ('58, '63) – NASA Langley Chief Scientist;
Dr. Thomas H. Thornton ('55, '58) – Division Director, JPL;

Mr. John W. Boyd, Jr. (’47) – NASA Associate Administrator for Management;
Mr. Robert Warrington (’68) – Dean of Engineering, Michigan Technological University.

Acknowledgements

The authors wish to acknowledge Lynn Nystrom in the College of Engineering for her helpful information and suggestions. We also want to thank each of the previous department heads whose notes and materials made writing this brief history possible. In many cases, we used text written by them verbatim or made very slight changes to their descriptions.