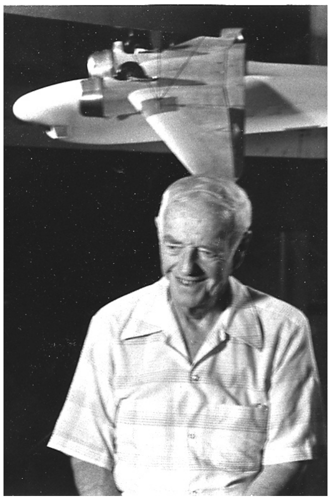
Obituaries

The Passing of a Man and His Era



William Bailey Oswald and the original DC-3 test model, shown here in Caltech's 10-foot wind tunnel, both starred in the PBS *Nova* show commemorating the plane's 50th anniversary in 1985.

William Bailey Oswald, PhD '32, who died on July 30, 1998, at the age of 92, was one of the outstanding figures of American aviation in the "heroic era" of its development, the roughly 30-year span during which commercial aviation reached maturity. He earned one of the very first PhDs in aeronautics awarded by the California Institute of Technology and was an outstanding representative of the type of modern aeronautical engineering that was the hope and aim of the new school of aeronautics led by Theodore von Kármán.

The year 1926 is remarkable in the history of aviation in the United States because in this year the Daniel Guggenheim Fund for the Promotion of Aeronautics was established with the aim of stimulating advanced training and research in the field. Robert A. Millikan recognized the importance of aviation for the U.S., in particular for California, and was able to obtain a grant of $300,000 to establish the Guggenheim Aeronautical Laboratory at Caltech (GALCIT). With surprising insight he chose von Kámán to lead the new school. Of the first three graduate students who completed their PhD degrees in the new school, one was destined to become a major player in the rapid expansion of aviation: William Bailey Oswald, known to practically everybody in or around aviation as "Ozzie."

A 10-foot wind tunnel, one of the most advanced facilities of its time, was designed and constructed as the major research facility of the new school. The GALCIT wind tunnel started operating in 1928 and, under the guidance of Clark B. Millikan, rapidly became a most important link between academia and industry. Practically every airplane designed in this country during the following quarter century was tested in this facility. Ozzie was one of the first who used the tunnel in cooperation with the Douglas Company. By a strange quirk of fate, Ozzie's first appearance at Caltech coincided with the birth of the tunnel; his last visit to the campus was occasioned by its decommissioning in 1997.

Ozzie came to Caltech in 1928 with a degree in physics from UCLA and was awarded his aeronautics PhD degree four years later with a surprisingly theoretical thesis: "The transverse force distribution on elliptical and nearly elliptical bodies moving in an arbitrary potential flow." The study was aimed at the motion of airships but consisted essentially of a rather complicated application of three dimensional potential theory. Ozzie's fame, however, originated with an NACA (National Advisory Committee for Aeronautics) report published in the same year: "General formula and charts for the calculation of airplane performance." For many years this report was the bible of aeronautical engineers faced with performance predictions. A. E. Raymond, chief engineer and later vice president of the Douglas Company, who at the time taught aircraft design at Caltech, had suggested the subject to Ozzie and in addition had hired him for the summer to work at the Douglas Company. It didn't take much longer before Ozzie was chief aerodynamicist at Douglas Santa Monica, and the summer extended to his full professional life.

The combination of a highly theoretical work, his thesis, and a very practical and down-to-earth report, NACA Rep. 408, completed in the same year, demonstrates the new trend in aeronautics of the time: in the design of a flying machine one cannot compensate for ignorance with safety factors. Even a safety factor of two

The first DC-3 (a DST—Douglas Sleeper Transport) appears about to run over a Northrop Gamma pursuit plane at Mines Field (now LAX) in 1936. The American Airlines flagship crashed at Chicago's Midway Airport in 1942.

will keep any design from getting off the ground. The designer has to be able to predict forces as well as the structural response very accurately indeed, and this requires a deep understanding of the physics, supplemented by a keen awareness of the limitation of theory and the corresponding need for empirical corrections. Even the advent of the modern computer has not much altered these requirements. When, some years later, the speed of aircraft started to approach or surpass the speed of sound, the need for a grounding in the basic physics and mathematics became even more obvious.

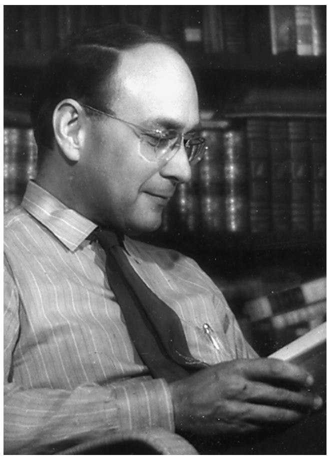
Ozzie's professional life spans the time in which commercial aviation developed from an adventure to routine and the speed range of aircraft progressed from low subsonic to transonic and supersonic speed. Probably the most spectacular success of the early Douglas team, in which Ozzie became a prominent member, was the legendary DC-3, an airplane that put commercial flying on the map and, as a byproduct, demonstrated the importance of a solid grounding in the basic science of aeronautics, competent wind-tunnel and flight testing, and the interaction between industry—Douglas—and academia—GALCIT. This cooperation, which involved not only aerodynamics but the structural dynamics of thin shells as well, is a classic example of the mutual beneficial interaction between an upcoming industrial corporation full of plans for new products and an academic research and educational team full of enthusiasm and new ideas. Of course, the number of design engineers at Douglas and the number of faculty members at GALCIT were at the time of the same order. The increase in speed, size, and sophistication of aircraft led obviously to an ever-increasing divergence in the number of professionals within the industry and academia. Similarly the necessary test facilities became too large and expensive to incorporate within academia. The rather short-lived Co-op wind tunnel owned by five cooperating aircraft industries and operated by Caltech required for its operation up to 30,000 kilowatts, some 40 times more than the GALCIT 10-foot tunnel. The interplay between academia and industry is certainly as important as ever, but necessarily and regrettably has to take a different shape than the easy intimacy in Ozzie's era.

Today transatlantic flights in aircraft with two engines has become routine, but the DC-1, prototype for the DC-3, had to demonstrate a flight, including take off and landing, with only one engine before the airlines accepted the configuration (three engines were usual). Once the two-engine plane was accepted, it completely dominated commercial flying until the end of WWII. During the war the DC-3 became the C-47, the flying jeep, and during the early Cold War made the Berlin Airlift possible. In many parts of the world the DC-3 still serves today, and short-hop airlines even in this country occasionally employ reconditioned DC-3s. No other commercial plane has approached this success.

With Ozzie as chief of aerodynamics, the Douglas commercial series went on through the propeller-driven DC-4 and DC-6 to the jet-propelled DC-8. Each one adopted an essentially new design feature: the DC-4, the nose wheel; the DC-6, pressurization; and the DC-8, turbo-jet propulsion. Ozzie's hopes and expectations for an American supersonic, commercial plane unfortunately did not materialize during his time.

Ozzie is survived by his wife, Lucia, and any account of Ozzie's life would be incomplete without a few words about her. Indeed Lucia, known to all Douglas team members as the genial hostess for their famous yearly party, already appears in the early days of the DC-3: as part of the Douglas team, Ozzie participated in a sales trip to TWA in Kansas City. He apparently directed and delayed the return car trip to California by insisting that every day he had to be in a preprogrammed city where a letter from his fiancée was waiting for him in General Delivery. Sixty-three years later Lucia brought Ozzie in a wheel chair to GALCIT for his last visit.

Hans W. Liepmann
Theodore von Kármán Professor of Aeronautics, Emeritus
Director, GALCIT, 1972–85



John Scott Campbell 1912–1999

John Scott Campbell, who was an instructor in engineering design at Caltech from 1947 to 1954, died in Pasadena on January 7, 1999, at the age of 86. Although Caltech was only one square in his checkered professional career, he was an extremely popular teacher, several of whose devoted former students called or wrote in to note his death. He taught drafting on the top floor of Throop Hall, under the eaves, remembers Howell Tyson Jr., '50. Campbell assisted Tyson's father, who was professor of mechanical engineering, in courses on descriptive geometry and kinematics, and edited the senior Tyson's textbook for publication after the professor's death in 1966. During the war Campbell had also worked on Caltech's Eaton Canyon rocket project, where he developed instrumentation for pressure and thrust at the static-firing bay for the Sidewinder, Tiny Tim, and Bazooka rockets.

Campbell also wrote the music and lyrics for an opera called *Spooks in the Basement*, which, as well as his "Double Double Concerto" for two base viols and orchestra, was performed in Caltech's late Culbertson Hall. This was recalled by Walter Chamberlin, who had been a student of Campbell's at Pasadena Junior College (now Pasadena City College), where Campbell had written a play for the engineering club that climaxed in a sword fight with slide rules. He also wrote science fiction for *Amazing Stories* magazine.

His sense of adventure kept pulling him away from his Hill Avenue home, across from the Athenaeum. In the 1940s, according to an obituary Chamberlin wrote for the *Pasadena Star-News*, Campbell bought a bus and ran tours of Southern and Central California. In the '50s, he founded the Pacific Institute of Technology, which failed to attract the necessary funding, and in the '60s he conceived the idea of a floating college to offer "A Semester at Sea." He tried to buy a French ocean liner but had to settle for the 570-ton *Aquillo.*

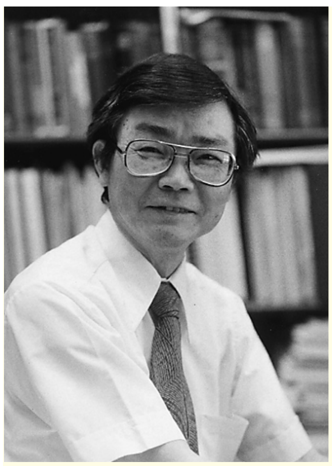
"John well knew the physics principles," wrote Chamberlin, "but lacked hands-on maritime experience. Therefore, there were at least three significant accidents. First, he miscalculated the stopping time of 570 tons and, on returning to the harbor, smashed a pier. . . . Second, he managed to get the *Aquillo*

Albert W. Atwood Jr., BS '32, MS '33, died September 2, 1998, in Pasadena. Atwood was the first editor of the *Caltech Alumni Review*, predecessor of *Engineering & Science* (R. A. Millikan rechristened it in 1943). In June 1937, when the first issue was published (on an Alumni Association grant of $150), Atwood was back on campus as the resident engineer for the Metropolitan Water District at Caltech's Pump Lab. Atwood said in a 1987 interview that he was able to manage his job and the magazine at the same time because the Pump Lab shared motors with the 10-foot wind tunnel and could perform tests only when the wind tunnel wasn't running. This was usually at night, leaving him the daylight hours for his journalistic activities. Atwood had never intended to be a journalist, but, since his father was a well-known writer for the *Saturday Evening Post* and *National Geographic*, he seemed to inherit a reputation. It was "the bane of my life all through school," Atwood said in 1987. "English teachers would expect me to be a writer too, and I wasn't." In September 1938 Atwood turned over the editorship of the *Caltech Alumni Review* to Ted Combs, BS '27, and went on to a long and distinguished career as an electrical engineer with Southern California Edison.

tightly wedged under a bridge. That tied up traffic for hours. . . .” The final mishap occurred during a run from Seattle to Long Beach, when the *Aquillo* encountered a storm that sent various unsecured items, including a piano and a propane tank, banging loose around the ship. The propane tank set the engine room on fire, and when the Coast Guard responded to save the *Aquillo* for the third time, “they kept right on pouring water until at last, to their great relief and John’s disappointment, they sank both the fire and *Aquillo*. That put a real damper on the hoped-for semester at sea in 1963.”

Despite the collapse of his entrepreneurial educational efforts, Campbell continued to teach engineering design at Art Center College of Design in Pasadena until a few months before his death. And, undefeated, he persevered at his extracurricular activities as well.

“John was also an inventor,” wrote Chamberlin. “In about 1925 he was awarded a patent for the inverse feedback circuit, a vital part of all modern electronic systems. Unfortunately, that patent expired long before it was recognized by industry. Also, about that time he invented the metal detector. Neither of these inventions gained him anything.” More recently, he invented a mechanism that could create a force without a reaction, which he thought would make fixed-wing aircraft and helicopters obsolete. The final crucial test failed last summer, according to Chamberlin. “As you can imagine, John’s heart was broken. That failure, along with a serious heart condition, sent his health in a downward spin and hastened his demise.”



Toshi Kubota, professor emeritus of aeronautics, died February 1, 1999, at the age of 72.

A native of Westmorland, California, Kubota received his bachelor of engineering degree in 1947 from the University of Tokyo. Returning home from Japan for graduate studies at Caltech, he earned his MS in 1952 and his PhD in 1957. Kubota remained at Caltech as a research fellow for two years before becoming an assistant professor in 1959. He was named associate professor in 1963 and full professor in 1971.

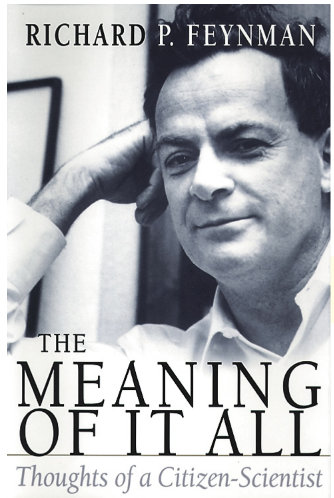
When he retired in 1990, he was honored with the establishment of the Toshi Kubota SURF Aeronautics Fellowship to “perpetuate the spirit and tradition of outstanding teaching, mentoring, and interest in undergraduate students demonstrated by Toshi.” The SURF (Summer Undergraduate Research Fellowship) fund “will ensure that Toshi’s legacy of commitment to the education . . . of young people continues.”

During his 43 years at Caltech, Kubota did much research in the field of fluid mechanics, focusing on topics such as hypersonic wake flows, supersonic turbulent shear flows, and supersonic boundary layer separation. He also served as a consultant to several engineering companies ranging from TRW to Lockheed.

In addition, Kubota held positions in the Society of Sigma Xi, the Physical Society of Japan, the American Physical Society, and the American Institute of Aeronautics and Astronautics.

He is survived by his wife, Yoshiko Phebe Nihira, and his three children, Misa Sophia, Miya Eliza, and Yuri Susan.
—DT

Letters



Feynman’s Meaning

“Look at the ideas themselves and judge them directly. . .” (p. 61). Do not accept them on the basis of authority. Question, question, question, especially, your own ideas. Look at problems from all angles. Try to determine what is wrong with your solution (before someone else does).

If there was one admonition Richard Feynman tried to convey to everyone, this was it. Regrettably, until *The Meaning of It All* came along, this message was imparted only indirectly, as in Feynman’s contribution to the *Challenger* investigation.

At long last this material is available to those who did not have the memorable opportunity to witness the occasional, impromptu gatherings where R. P. would expand on these, and somewhat more technical matters, at some length and in considerable detail. These were not “off-the-cuff” meanderings, but carefully thought-through analyses, delivered straight and seasoned with his special touch of humor. Despite the intervening years, Feynman’s voice rings in every word of the text, and his playful, adventuresome spirit of discovery is unmistakable.

While it is Chapter III, “This Unscientific Age,” in which Feynman goes to considerable lengths to advise us on how to judge the validity of an idea, it is in Chapter I, “The Uncertainty of Science,” and Chapter II, “The Uncertainty of Values,” where he