John B. Hurlbut.

JOHN C. HOUBOLT

1919–2014

Elected in 1990

"For the concept of lunar-orbit rendezvous in lunar exploration and sustained contributions to structural dynamics, aeroelasticity, aircraft loads and orbital mechanics."

BY DENNIS BUSHNELL

JOHN CORNELIUS HOUBOLT was born in Altoona, Iowa, on April 10, 1919. He grew up on a dairy farm in Joliet, Illinois, and earned BS (1940) and MS (1942) degrees from the University of Illinois in civil engineering and a PhD (1957) in technical sciences from the ETH in Zurich.

After early positions in civil engineering for the city of Waukegan and the Illinois Central Railroad, he entered on duty at the National Aeronautics and Space Administration (NASA; then NACA) Langley Research Center in 1942 in the Structures Research Division, conducting research on the stability and dynamics of aircraft structures. Within a short time compared to most such promotions he was made the associate division chief of the Dynamic Loads Division in 1949, serving until 1961, when he was appointed chief of the prestigious Theoretical Mechanics Division, researching special problems of space flight including rendezvous, communication satellites, launch vehicle dynamics, and other "hard problems." His wife Mary said, "He was always scribbling equations. He wrote equations on grocery bags, envelopes and even the sides of the bathtub while taking a bath."

In 1963 he left NASA and joined the Aeronautical Research Associates of Princeton, which was founded and led by Coleman Dupont Donaldson, the editor of the *Princeton Series*

that documented the state of the art in aerospace at the time across the board. He served from 1963 to 1975 as senior vice president, researching and applying concepts in aeroelasticity, structures, flight mechanics, systems analysis, and guidance and control. In 1975 he rejoined NASA Langley Research Center, where he served as chief aeronautical scientist until he retired from government service in 1985. After retirement he served as a private consultant.

John Houbolt taught throughout the 1945–1963 time period for the graduate extension of both the University of Virginia and Virginia Polytechnic Institute, instructing in mathematics, elasticity, vibration, and flutter. He is the author of some 140 technical reports, was an exchange scientist with the Royal Aircraft Establishment in Farnborough, England, in 1949, and received a Rockefeller Public Service Award for graduate study at the ETH. He received the NASA Exceptional Scientific Achievement Award in 1963, the first American Institute of Aeronautics and Astronautics (AIAA) Structures, Structural Dynamics and Materials Award in 1968, and the University of Illinois Distinguished Civil Engineering Alumni Award in 1969 and Illini Achievement Award in 1970, and was selected as the 1989 Peninsular Engineer of the Year and elected to the National Academy of Engineering in 1990. The AIAA awarded him the Dryden Research Lecture Award in 1972 and made him an honorary fellow in 1975. He was awarded honorary doctorate degrees from the ETH in 1975, from Clarkson University in 1990, and from the University of Illinois, Urbana-Champaign in 2005. He served the NATO Advisory Group for Aerospace Research and Development (AGARD) for more than 20 years giving lectures, as a member of panels, and chairing working groups. He served on the US Air Force Scientific Advisory Board for some 20 years and served in many capacities in support of AIAA. He received the ASME "Spirit of St. Louis" Medal in 2000. The street in front of Joliet Junior College, which he attended, was renamed Houbolt Road.

John Houbolt was married, had three daughters, and was a private pilot with multiple-engine rating. His wife remembers her husband "had many interests with aeronautics and

space flight at the top of the list; but skeet and trap shooting, flying, sailing, water skiing, and snow skiing ranked near the top, too. He, also, especially enjoyed woodworking, working with mechanical items like clocks and watches, and electronic things and was always available to take care of such things around our home or for neighbors up and down the street. He thoroughly enjoyed helping people. When some items had no parts available, he made the parts, so he could do the job. For the fun of it, he taught himself how to pick locks and was able to get an elderly woman back into her apartment on the third floor when surrounding college students were about to scale the exterior of the building to climb into a window! With his newfound talent, he also rescued a friend's fur coats from a safe she had had built into her home. Our cars and often those of neighbors were well taken care of by John. There seemed to be nothing that he couldn't fix."

John Houbolt's most important technical contribution in the societal context, the one for which he is best known, is his analysis and efforts to convince NASA of a better way to land on the moon in the Apollo program. John was a member of the Lunar Mission Steering Group and had been studying the technical aspects of space rendezvous starting in 1959. There were at the time, in the early 1960s, three major approaches to sending humans to the moon—directly from the Earth, after Earth orbit, and from lunar orbit. John studied and amassed arguments in favor of the third approach, called lunar orbit rendezvous (LOR), which he calculated was less costly and the only approach that could meet President Kennedy's goal of reaching the moon by the end of the decade. He referred to this as the Chevrolet versus the Cadillac option. In a private letter to an incoming NASA administrator he stated, "Do you want to go to the Moon or not?... Why is a much less grandiose scheme involving rendezvous ostracized or put on the defensive? I fully realize that contacting you in this manner is somewhat unorthodox, but the issues at stake are crucial enough to all of us that an unusual course is warranted." John prevailed, the Apollo program adopted his lunar rendezvous approach, and the program successfully, safely landed on, and

returned humans from, the moon within the decade of the 1960s as specified by presidential order.

John received many plaudits for his lunar orbital approach to the Apollo project, including, after his death, an extensive speech from the Illinois congressman in the congressional record. NASA Administrator George Low stated, "It is my strongly held opinion that without the lunar rendezvous mode, Apollo would not have succeeded; and without John Houbolt's letter, we might not have chosen the lunar orbit rendezvous mode." John's concept was hailed by space historians as "Langley's most important contribution to the Apollo program." The Joliet Illinois Historical Museum has a permanent exhibit dedicated to John Houbolt and his family entitled "The Soaring Achievements of John C. Houbolt."

In addition to his Apollo contributions, John conducted pioneering and seminal research in most of the discipline fields within both aeronautics and space flight including gust analysis, torsional analysis for rotary wing blades, flutter, impact loading, and finite element methods.

John combined superb conceptual and detailed technical capabilities with the clearheadedness to envision application issues and the drive to prevail, a very effective combination. Working with John was an absolute joy; he was an extraordinarily clear thinker whose technical arguments were well grounded and presented in an easily understandable manner. Today, as NASA is again faced with the quandary of how to send humans to another place in space, this time to Mars, we are faced with the same three options: Mars direct, from Earth orbit, or from Mars orbit, plus others such as utilizing a moon (Earth's moon or a Mars moon) or Lagrange points.

If only we had John Houbolt's sage advice for this critical decision for the future of our space program.