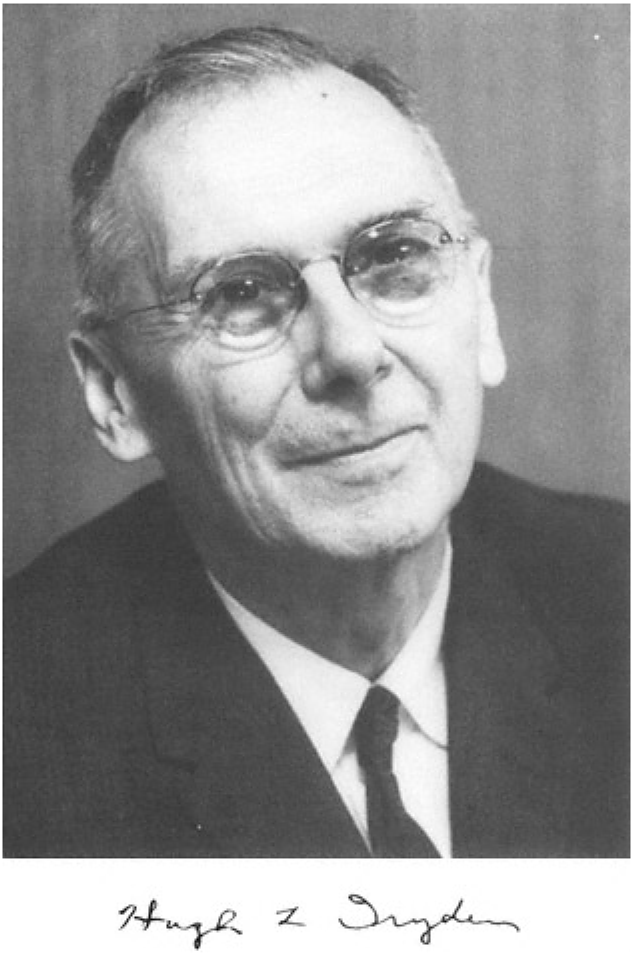

Hugh Latimer Dryden

1898-1965

By Jerome C. Hunsaker and Robert C. Seamans, Jr.

Hugh Latimer Dryden was born in Pocomoke City, Maryland, on July 2, 1898, and died on December 2, 1965, after a lengthy illness.

Hugh Dryden's father taught school and later kept a general store. This business failed in the panic of 1907 and the family moved to Baltimore, where the father became a street car conductor, following this occupation for the rest of his life. Young Hugh attended public schools and a high school, then called Baltimore College, graduating in 1913 just short of age fifteen.

Entering Johns Hopkins University with advanced standing, he completed a regular Bachelor of Arts curriculum in three years, receiving his degree with honors in 1916 and his Master of Arts degree in 1918.

It is of interest to observe that Dryden did not come from a scholarly family. But he was endowed with the highest order of intelligence; brought this gift to the realms of physics, engineering, and Government service; and developed a vigorous philosophy supported by strong Christian principles.

He married Mary Libbie Travers, on January 29, 1920, and their three children were highly educated. The son, Hugh, Jr., an organic chemist, graduated from Johns Hopkins and the Massachusetts Institute of Technology. The elder daughter, Mary Ruth Van Tuyl, graduated from Goucher College and is married to a mathematician at the Naval Ordnance Laboratory. Daughter

Nancy Travers graduated from American University and teaches school in Montgomery County, Maryland. There are five grandchildren.

In June 1918, Hugh Dryden joined the staff of the National Bureau of Standards as an inspector of munitions gauges, intending to return to graduate school on a fellowship in the fall. However, because of World War I and with the encouragement of Dr. Joseph S. Ames, Head of the Johns Hopkins Physics Department and Chairman of the National Advisory Committee for Aeronautics, his plans were changed. He obtained a transfer into the Bureau's newly formed Wind Tunnel Section. After Dr. Ames arranged to give courses to a number of Hopkins graduate students at the Bureau, Dryden was able to complete his thesis work on experiments carried on after hours in the wind tunnel. He was granted the Ph.D. in physics in 1919, when he was just under twenty-one, the youngest student ever to obtain a Ph.D. at Johns Hopkins. His thesis, entitled "Air Forces on Circular Cylinders," addressed itself to the fundamental problem of scale effects on the flow over circular cylinders normal to the wind. His results stimulated some of the more sophisticated inquiries into the same subject in the decade which followed.

In 1920, Dr. Dryden was placed in charge of the wind tunnels. Here his research on the problems of wind tunnel turbulence and boundary-layer flow brought him international recognition. He and his colleagues were first interested in accurately measuring turbulence in wind tunnels and in understanding its effects on force measurements. They devised an electrical network that restored the loss in amplitude and compensated for the lag. Extensive tests were made of the intensity and scale of turbulence produced by the wire screens at various distances from the working station. Having means for varying the intensity and scale of the turbulence, and for measuring these quantities with a compensated hot wire anemometer, Dr. Dryden built wind tunnels of very low turbulence and measured on models the effect of turbulence on aerodynamic forces. The theoretical equations of laminar flow within a boundary layer had been previously announced by Prandtl in 1907. Dr. Dryden and his collaborators were able experimentally to verify Prandtl's theories.

In collaboration with Dr. Lyman J. Briggs, Dr. Dryden made some of the earliest experimental measurements of the aerodynamic characteristics of airfoils at high speeds. The early motivation for this work had its origin in the effects of the high propeller tip velocities that were being encountered with high-powered engines. Dryden and Briggs carried out these investigations at a large compressor plant at the Edgewood Arsenal. Through this work, they furnished the propeller designer with airfoil data at high speeds and developed early insight into the effects of compressibility on lift coefficient and pressure distribution. They were among the first to observe experimentally the so-called transonic drag rise. Interest generated by this work led to the construction of many high-speed wind tunnels and was of pioneering significance when jet and rocket propulsion made supersonic and hypersonic flight feasible.

Although Dr. Dryden's career at the Bureau of Standards is characterized largely by his work in turbulence and boundary-layer research, his inquiring mind led him to grapple with other engineering problems with many different collaborators. His investigations of wind pressures on chimneys, mill buildings, and skyscrapers laid the basis for rational design of structures subjected to wind loads. His principal collaborator in this field was G. C. Hill. The motivation for this work was undoubtedly the strong concern during the early 1930's for the structural integrity of propeller blades under increasing speeds and disc loadings.

A summary of Dr. Dryden's scientific and engineering research would be incomplete without mention of his interest in the measurement of the acceleration due to gravity. This work took place during 1942 and 1943. This investigation, done in collaboration with E. A. Eckhardt, W. D. Lambert, and A. H. Miller, undertook to study the various determinations of the absolute value of the acceleration due to gravity and to recommend a "best value." The results indicated that only three determinations had been made with sufficient attention to the elimination of systematic error to merit consideration.

Dr. Dryden was responsible for extensive studies of the aerodynamics of aircraft bombs and for the development of a practical method of designing the tail fins to ensure aerodynamic stability. With E. J. Lorin, he standardized a form of bomb geometry that remained in use for many years. His less-known contributions ranged over aircraft noise, ventilating fans, aerodynamic design of aircraft control surfaces, automobile streamlining, and aerodynamic cooling.

As time passed, Hugh Dryden's management responsibilities at the Bureau of Standards grew, and he found less time for his own research. In 1934 he became Chief of the Mechanics and Sound Division. With the establishment of the National Defense Research Committee and later the Office of Scientific Research and Development in the early 1940's, he became Chief of a section developing a guided glide bomb. This section, located at the Bureau of Standards, was later expanded into the Navy Bureau of Ordnance Experimental Unit, with a staff of civilians from the Bureau of Standards and the Massachusetts Institute of Technology, as well as officers and men of the U.S. Navy. The radar homing missile, BAT, which saw service in combat in the Pacific, was designed by this team. The BAT missile destroyed many tons of Japanese shipping during the last year of the war. Fleet Air Wing One, under Rear Admiral John D. Price, used the BAT effectively against both ships and land targets. This was Dr. Dryden's first taste of the management of large projects with which he would have so much to do later.

Hugh Dryden once described his wartime service:

> I headed an unusual group at the Bureau of Ordinance Experimental Unit which developed the radar homing missile, BAT. I also served as Deputy Director of the Army Air Force's Scientific Advisory Group headed by von Karman. The group was appointed by General H. H. Arnold and many of us were in Europe on V-E day in uniform with simulated rank to study the use of science by the various European countries. *Towards New Horizons*, the series of reports by the von Karman group, proved invaluable in future years.

In September 1947, Dr. Dryden transferred from the National Bureau of Standards to become Director of Research of the National Advisory Committee for Aeronautics (NACA). In 1949, he became Director of NACA, its senior full-time officer. He directed from Washington the activities of the Langley, Lewis, and Ames laboratories and the flight research stations at Edwards Air Force Base, California, and Wallops Island, Virginia. The magnitude of this responsibility grew to embrace, during the last year of NACA'S existence, 8,000 employees and an annual budget of about $100 million. Under his leadership, NACA produced a vast body of new knowledge that made possible routine supersonic flight and laid much of the technological groundwork for space flight that was to come. We discern here, perhaps as much as in any other place, the impact of Dryden's leadership. The development of high-speed wind tunnels, flight testing, and a companion competence for theoretical research within the NACA contributed substantially to the leadership of the United States in supersonic flight.

In 1954, Dr. Dryden became the Chairman of the Air Force and Navy and NACA Research Airplane Committee formed to guide the development of an airplane to explore the problems of flight at the highest speeds and altitudes then feasible. The series of experimental aircraft, beginning with the X-1, X-2, X-3, D-558, and culminating with the X-15, are well known. Some of these aircraft were developed and tested prior to 1954; however, the hypersonic research airplane, the X-15, drawing on the previous flight experience, was from its conception the concern of this Committee. Before he died, Dr. Dryden saw the X-15 reach a maximum speed in excess of 4,000 miles per hour and an altitude of nearly seventy miles. It had been he who had carried the X-15 program through the political labyrinth of Washington, where funds for basic research and development were not plentiful. Much of this technology of manned flight came to bear in Project Mercury.

It was during this period that Dr. Dryden pressed for a solution to the critical reentry heating problem. This solution, based on knowledge accumulated in research, made it possible for the United States to proceed with assurance in the development of its ICBM program and manned satellites.

Hugh Dryden sustained a continuous interest in applied mechanics. He served as President of the International Union of Theoretical and Applied Mechanics and as a Member of the International Committee for the International Congress of Applied Mechanics. He took an active role in the organization of the Sixth International Congress for Applied Mechanics in Paris in 1946 and again at the Seventh International Congress in Istanbul in 1952. Together with von Karman, he was an editor of *Applied Mechanics Reviews*.

The final period in Hugh Dryden's life commenced dramatically in October 1957, with the launching of Sputnik I. The Executive Branch and the Congress prepared immediately to establish a civilian agency to conduct explorations of space for peaceful purposes. With Dr. Dryden's help at critical moments, the NACA was selected as the central building block of the new agency, and he participated in the drafting of the legislation and its defense before the Congress. On August 8, 1955, President Eisenhower appointed Dr. Dryden as Deputy Administrator of the new agency, a position he held under three Presidents until his death.

Project Mercury was conceived and organized with Hugh Dryden playing a major role. Later, he participated in the important planning for Gemini and Apollo. His hand was prominent in the studies and recommendations that led to the decision to mount a lunar exploration mission. He was clearly committed to the Apollo mission. This commitment was demonstrated in a notable letter dated June 22, 1961, to the late Senator Robert S. Kerr, then Chairman of the Senate Committee on Aeronautical and Space Sciences. Dr. Dryden said in part:

> The setting of the difficult goal of landing a man on the moon and return to Earth has the highly important role of accelerating the development of space science and technology, motivating the scientists and engineers who are engaged in this effort to move forward with urgency, and integrating their efforts in a way that cannot be accomplished by a disconnected series of research investigations in the several fields. It is important to realize, however, that the real value and purposes are not in the mere accomplishment of man setting foot on the moon, but rather in the great cooperative national effort in the development of science and technology which is stimulated by this goal....
>
> The national enterprise involved in the goal of manned lunar landing and return within the decade is an activity with critical impact on the future of this nation as an industrial and military power, and as a leader of a free world.

Had Senator Kerr heard the Wilbur Wright Lecture of 1949, he would have perceived a remarkable thread of uniformity in Dr. Dryden's approach to widely separated problems; a thread that dominated his thinking and will most certainly dominate national planning in science and technology for years to come.

As Director of the National Advisory Committee for Aeronautics for ten years, Dr. Dryden had great success in leading scientific and engineering research into important technical applications. When NACA was abolished in 1958 and the National Aeronautics and Space Administration (NASA) was set up by the Congress in response to Sputnik, Dr. Dryden was proposed by senior NACA members to be the Administrator of the new agency. This recommendation was seriously considered by the White House. However, his professional integrity may have antagonized members of the House Select Space Committee when he objected to an untested crash program to put a man on top of a missile in a sub-orbital space flight for propaganda purposes. He said this would have no more value "than shooting a woman out of a cannon at a circus."

The first NASA Administrator, President T. Keith Glennan of Case Institute, insisted that Dr. Dryden be Deputy Administrator and overseer of all scientific and technical aspects of space research.

Dr. Dryden felt a special responsibility for the 8,000 civil service people of NACA who were to be taken over by NASA. These people had been led, supported, chastised or promoted and, in many instances, recruited by Dr. Dryden. Also he carried over to NASA a most cordial and constructive relation with the military services, Government regulating bodies, the universities, the air transport and manufacturing industries, and professional societies and research establishments. These were to prove invaluable to the U.S. space program.

Dr. Dryden's public reputation permitted him to accept, in 1960, the difficult task of providing for the United States an interim "cover story" for the U-2 incident. The U-2 was a high-flying airplane used for photographic weather observations but that could be used for other reconnaissance. In providing the public explanation that the U-2 shot down over the Soviet Union had been involved in scientific exploration, Dr. Dryden placed the importance of affording to the United States a short respite in which to organize its policy response to this new development above the opinions of his personal integrity that might later result from the inevitable disclosure of the U-2's real mission.

Dr. Dryden's leadership capability itself was questioned in the report to President-Elect John F. Kennedy, dated January 12, 1961, by an ad hoc Advisory Committee on Space headed by Dr. Jerome Wiesner. This Committee found "a number of organizational and management deficiencies as well as problems of staffing and direction which should receive prompt attention. These include serious problems within NASA, within the military establishment, and at the executive and other policy-making levels of government."

The Wiesner Committee recommended for NASA several "requirements that must be met." These were, in fact, outstanding features of Dr. Dryden's leadership. As Home Secretary, Dr. Dryden had close relations with the National Academy of Sciences and in particular with the Space Science Board that was established within the Academy to advise and assist NASA. "Exert the greatest wisdom and foresight in the selection of scientific missions and of the scientists assigned." This was one of Hugh Dryden's main concerns within the policy and budget limitations of the President and Congress as the new NASA program gained direction and momentum.

The Wiesner Committee's report to President Kennedy, released to the press, did Dr. Dryden no harm. Probably it helped clear the air by requiring the new Administration to assess fully the space effort under way. When James E. Webb was asked by the White House to be the second NASA Administrator, he accepted upon the condition that Hugh Dryden remain as Deputy Administrator.

Dr. Dryden had a leading role in the sphere of international cooperation. In 1959, he was appointed to assist Ambassador Henry Cabot Lodge at the first meeting of the United Nations Committee on the Peaceful Uses of Outer Space. His activities were largely responsible for a proposal by NASA in December of that year, for joint research with other nations to promote international space cooperation.

Working toward international cooperation and peace fitted with Dr. Dryden's philosophy. A man of sincere religious faith, he was a licensed preacher for the Calvary Methodist Church in Washington during most of his adult life. He had found the bridge between science and religion.

Hugh Dryden lived under a sentence of death after October 1961, when exploratory surgery had disclosed a serious malignancy. Yet he continued on duty with frequent hospital treatments. He conceded little to the illness that marked the last years of his life.

In the last month of his life, he delivered the Thurston Lecture before the American Society of Mechanical Engineers. He pointed out that men were engineers for thousands of years before the basic concepts of science were known. Engineers now follow the scientists' step-by-step approach to develop the technology from which real benefits arise. But Dryden had a keen sense of social responsibility in planning engineering programs. He made the difficult choice among the many possibilities available to change the state of the art. In his Thurston Lecture he explained that the space program was already having an impact on engineering from new requirements in weight, size, performance, and reliability under extreme environmental conditions.

President Lyndon B. Johnson expressed the esteem of the Nation for Hugh Dryden when he said:

> No soldier ever performed his duty with more bravery and no statesman ever charted new courses with more dedication than Hugh Dryden. Whenever the first American space man sets foot on the moon or finds a new trail to a new star, he will know that Hugh Dryden was one of those who gave him knowledge and illumination.

After Dr. Dryden's transfer to the NACA in 1947, he assumed leadership in the fundamental research effort in the field in which he had made basic contributions twenty-five years before. It is fair to state that Dryden's 1920 work on supersonic aerodynamics led consistently to operational supersonic airplanes, the famous rocket-propelled X-15, and successful manned space flight. On February 10, 1966, the President of the United States presented to Mrs. Dryden the National Medal of Science awarded posthumously to Dr. Dryden: "For contributions, as an engineer, administrator, and civil servant for one-half century, to aeronautics and astronautics which have immeasurably supported the Nation's preeminence in space.

Man's steps in the advance of the art of flight are marked by the names of many researchers, designers, and flyers, but Hugh Dryden's name is rarely mentioned.

Hugh L. Dryden's life was given to helping good men get good results.