A Tribute to the Life and Work of Hugh L. Dryden

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As you will understand, I feel a mixture of responsibility and awe on this very special occasion, the opening scientific session of the first annual meeting in our new auditorium. Since the topic of the session is closely related to a lifetime interest of our cherished colleague, Hugh L. Dryden, and since a substantial part of the funds for this auditorium were given in his name, the planners of this session have asked me to speak briefly about Dr. Dryden.

I am particularly pleased to make these remarks at this time, following the achievement of the several lunar manned missions. Dryden's professional life was directed as if by fate to the scientific and technological triumph represented by a successful Apollo program. Today we have scaled that peak and are privileged to inspect new vistas.

As we all know, the completion of our building is the realization of a dream which burned brightly in the soul of George Ellery Hale more than 50 years ago after he became actively involved in Academy affairs, and which began taking tangible form just after World War I, when Charles Doolittle Walcott—one of our most remarkable and effective presidents—and his colleagues procured this plot of land with the aid of a small group of private donors. The generosity of the Carnegie Corporation then made it possible to erect the façade wing and great hall of this building. Wallace Harrison, one of the junior architects involved in the original work, led by Bertram Goodhue, has been the architect for what has been erected since.

In the prosperous years following World War II, Dr. Bronk revived the original dream of completing the building, and succeeded in procuring the funds for the two wings which flank the original structure on the east and west. One wing was the gift of the Equitable Life Assurance Society, and the other was the result of contributions from private sources and the National Science Foundation. A residue remained which encouraged all of us to hope that the task could be completed. And it was my privilege in the mid-1960's to work with our Council to pull together the resources that were still needed for this last major unit.

Some very approximate estimates obtained about five or so years earlier had suggested that a simple, though effective, auditorium might be constructed for

somewhat over a million dollars. However, a more realistic analysis made in the mid-1960's showed that at least three times as much money would be needed. This took into account the Academy's need to maintain the quality of the original building, and to provide maximum useful space, including parking areas required by the District of Columbia. As a result, in my days as President, the Council authorized the procurement and expenditure of up to four million dollars. Dr. Handler tells me that the final cost, with all of the painful revisions characteristic of construction these days, will be nearer 4.25 million. My embarrassment at leaving him with the task of closing the gap of several hundred thousand dollars in these difficult times is fortunately mitigated by the thought that he and his colleagues will use this auditorium and the associated new space for the hundreds of conferences which it will be their responsibility and pleasure to foster in the years ahead, just as in my day we benefited from the two new wings started during Dr. Bronk's period in office.

Just after Hugh Dryden's premature death of cancer in December of 1965, a group of his friends and associates approached me with the suggestion that we seek ways to honor his memory. As you will recall, Dr. Dryden, who had been elected to the Academy in 1944, served as our Home Secretary for 10 years. Although Hugh Dryden was an exceedingly modest man, it occurred to us that we might create a Hugh Dryden Memorial fund to assist our Academy in the completion of its long-deferred plans. This fund became the cornerstone for the rather large amount of money that was needed to complete the auditorium and was accepted with the understanding that there would be suitable recognition of Dr. Dryden in the new structure. The concept met with very warm reception. It served to focus the efforts of many individuals who might not otherwise have contributed to our building fund. We also received a large number of gifts from industrial and professional organizations which had benefited from Dryden's many scientific accomplishments, as well as from philanthropic foundations. There were substantial gifts from our own membership and staff and from the employees of the National Bureau of Standards and the National Aeronautics and Space

Administration, the governmental organizations with which he had been associated throughout his entire professional life. To these was added a contribution of \$400,000 provided through the National Academy of Engineering, of which Dryden had been a charter member. It would be difficult to state precisely what portion of the total cost of this auditorium was contributed in Hugh Dryden's name; however, I believe that the figure is in the vicinity of 40%. More important, however, was the enthusiasm which accompanied the growth of the fund and which gave appreciable momentum to the drive to complete the building. In a sense the fund provided an opportunity to recognize Dryden not only as an individual, but as a symbol of many of our colleagues who, at the sacrifice of personal gain, serve the nation and the world. The remaining funds came from a variety of private sources, including special Academy accounts. Moreover, the creation of a new block of office space, above the lecture hall, for the Academy's work in medicine and health care was made possible by the assistance of the National Institutes of Health.

Let me also express very warm gratitude to James A. Webb and our colleague Leonard Carmichael. Both had worked closely with Dr. Dryden, and were not only enthusiastic about the Dryden Fund, but made very special efforts to assure its success.

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Hugh Dryden was born in Maryland in 1898 and spent his life in the greater Washington community. His entire professional career from 1918 until his death in 1965 was devoted to government service. As much as anyone I know, he epitomizes the scientist who finds professional fulfillment by working directly with his government. As a boy, he was a precocious student and deeply interested in science. He entered Johns Hopkins University at the age of fifteen, and completed his undergraduate work at the age of eighteen. He then joined the National Bureau of Standards, but kept in close touch with his admiring sponsors at Johns Hopkins, particularly Dr. Joseph Ames. In 1919, at the age of twenty, he was awarded a Ph.D. on the basis of examinations and of his research at the Bureau of Standards.

Dryden's most immediate professional interest centered on problems of hydrodynamic and aerodynamic flow, initially in the sonic and then in the supersonic range. He carried out many brilliant investigations on turbulence and boundary layer flow. This research earned him a great deal of professional recognition. The high points included the invitation to give the Wright Brothers Lecture before the Institute of the Aeronautical Sciences in 1938, the award soon thereafter of the Sylvanus Albert Reed Medal of the Institute, the award of the Langley Medal of the Smithsonian Institution in 1961, and election to the French Academy of Sciences in 1964. As mentioned earlier,

he was elected a member of our Academy in 1944. In his own listing of the honors he had received, he placed the Medal of Freedom of our own government at the top. He was also an honorary officer of the civilian division of the Order of the British Empire. During World War II, he was the leader of the development of our only successful program on guided missiles. He served on innumerable advisory committees, including the National Advisory Committee on Aeronautics.

Although Dryden's primary scientific interest lay in the field of aerodynamics, he pursued many other interests while at the Bureau of Standards. In the 1930's he initiated and headed a project devoted to means of lowering the cost of housing construction, a need which is still very much with us today.

In 1947 he accepted the post of Director of Research at the National Advisory Committee for Aeronautics (NACA), a title which was shortened to that of Director, with broadened responsibility, 2 years later. It was at this time that through my own advisory work in the field of materials research I first came to know Hugh Dryden reasonably well. Although my links with the Bureau of Standards go back to 1932, at which time Dryden was quite celebrated among those who moved in Bureau circles, it was not until 1948, at the Cleveland laboratories of the NACA, that I had the privilege of participating in full-fledged professional discussions with him, and appreciating the scope of his knowledge and wisdom.

When the Soviet Union launched the first successful Sputnik in the autumn of 1957, the trauma which affected our country brought special pressures to bear upon NACA, which had been pacing our national development in flight and propulsion since 1916. Hugh Dryden became one of a small number of central figures, perhaps *the* central figure, in the orderly transition to the space age. It fell, to a very substantial degree, upon his shoulders to help prepare the legislation which would transform the National Advisory Committee for Aeronautics to the National Aeronautics and Space Administration. In carrying out this responsibility, he drew upon his 40 years of experience with the government, and upon his creative genius, to help devise an administrative and operational instrument which would make flexible use of the resources of our country and focus, in a relentlessly systematic way, upon well-defined missions. Many individuals have contributed to the success of our space program, but no one has contributed more than Hugh Dryden, working as scientist, administrator and visionary.

His attitude toward the space program, particularly the part of it designed to land man on the moon, is indicated by this extract from a letter to Senator Robert Kerr in June of 1961:

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 values 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 billions of dollars required by this effort are not spent on the moon; they are spent in the factories, workshops, and laboratories of our people for salaries, for new materials, and supplies, which in turn represent income to others. It is unfortunate that space exploration is still so new that journeys of man to the moon are synonymous with foolish or visionary enterprises as described in science fiction. 50 years ago flying through the air had the same connotations—risky, expensive, useful only as a sport. Our lack of appreciation of the potentialities of aeronautics extended through the early years, forcing the Wright Brothers to go abroad. We entered the first World War with no design capability and no manufacturing experience, dependent completely on foreign designs. Only after the war did we begin to devote effort to research in the new aeronautical technology. We must not undergo the same experience in space science and technology. The national enterprise involved in the goal of manned lunar landing and return within the decade is an activity of critical impact on the future of this nation as an industrial and military power, and as a leader of a free world.

One of his great interests was the international aspects of the space program. He was deeply pleased to lead this nation's efforts to develop international agreements which would make the benefits of our space program available to other nations and enhance cooperation between nations.

When I came to Washington in 1962 as President of the Academy, Hugh Dryden, then Home Secretary, was already fatally ill of cancer. However, one had to be told this explicitly to realize it fully. He was an indefatigable worker until his death in 1965. Along with his heavy burdens as Deputy Director of NASA, he concerned himself on a day-to-day basis with the affairs of the Academy. We had countless discussions about details of Academy affairs. These discussions

were models of constructive harmony. I was privileged and pleased to follow his lead about as often as he did mine. On one occasion during my early days in office, I proposed that we increase the size of the principal administrative staff upstairs, which at that time consisted in the main of Douglas Cornell and Donald Meid. He frowned and shook his head for a moment, but then suddenly brightened with the comment, "That's right, you have 450 advisory committees to manage, and more ahead".

During the 4 years of his final illness, Dryden displayed an ability which has always astonished me—although I did observe it in two other great men, Enrico Fermi and Lloyd Berkner—namely the ability to impersonalize his own illness, as though mind and body were completely separate from one another. He had the strength of will to treat a major affliction as though it were a minor inconvenience. Dryden would work along in a completely normal way for many months, both at his desk and while traveling, at home and abroad, and then disappear into the hospital for a few days for a readjustment of the chemotherapy being used. Occasionally, one would note that he looked a bit peaked, but he never faltered. We became so accustomed to this pattern that we were inclined to think it would go on forever. Then, in December of 1965, the cycle terminated abruptly, while he was still in the midst of his life's work.

Dryden's great contributions to our society rested upon more than his native genius, professional experience and balance. First, he was deeply religious, and, as a result, had added strength to look over and beyond most of the petty matters of everyday life. Second, he had a thoroughly devoted wife, Libbie Travers Dryden, who sustained him with great devotion and love through both bright and dark days. I hope that the spirit of Hugh Dryden will prevail in our auditorium and will continue to make our work worthy of him.