Edward O. Hulburt:
Frederick Ives Medalist, 1955

John N. Howard

Edward O. Hulburt, recipient of the 1955 Frederick Ives Medal, was a pioneer in atmospheric research. He is best known for his rocket experiments that examined ultraviolet and X-radiation in the ionosphere and for establishing optics research at the Naval Research Laboratory in Washington, D.C., U.S.A.



Edward O. Hulburt, 1953.

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Edward O. Hulburt was born in Vermillion, S.D., U.S.A., on 12 October 1890. He completed his graduate work at the University of Chicago, earning a Ph.D. in physics in 1915. Hulburt's dissertation was on the reflecting power of metals in the ultraviolet region of the spectrum, which he published in 1915. In 1924, he joined the Naval Research Laboratory (NRL) in Washington, D.C., and served as head of the physical optics division until 1949. From 1949 until 1955, he was the first director of research at NRL.



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Hulburt initiated optical research at NRL and focused the division's work on an array of topics, including the upper atmosphere of the earth, especially the ionosphere; gas discharges; the optical properties of the atmosphere and ocean; visibility; ultraviolet and infrared physics; and photoelasticity. NRL rocket experiments involving ultraviolet and X-radiation were an outgrowth of scientists' continuing interest in the upper atmosphere at the time. These investigations led to the establishment of the E.O. Hulburt Center for Space Research in February 1963.

In the 1930s, Hulburt hypothesized that the Sun emits X-rays that cause ionization of the E layer of the Earth's atmosphere (90 to 160 km above the surface). This ionization appeared to affect radio communication around the globe—a subject of vital interest to the U.S. Navy. In 1949, Herbert Friedman, another NRL scientist, used a modified German V-2 rocket to launch a Geiger counter 150 km into the air, verifying Hulburt's theory while obtaining the first data concerning the nature of solar X-rays. Throughout the 1950s, Friedman and colleagues at NRL refined their instruments and their rocket techniques to obtain almost all the empirical information about the Sun's X-radiation.

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In 1955, Hulburt was given OSA's highest award, the Frederick Ives Medal for overall distinction in optics. During his Ives Lecture at the OSA annual meeting, he presented many images of NRL optical apparatuses and methods of collecting data via rocket launches. He concluded his talk with warm praise for the *Journal of the Optical Society of America* (JOSA).

The editor of JOSA asked him for a written version of his Ives Lecture. Instead, Hulburt submitted a paper titled "Some recent papers in the Journal of the Optical Society of America," which did not contain any of his own research. The manuscript was published in the January 1956 issue of JOSA. It discussed about a dozen recent publications that he found interesting, including a Bell Labs article on optical coating; Paul Foote's paper on optics in the oil industry; W.F. Meggers' account of the spectroscopy of 84 chemical elements; a P. Swings article of astronomical interest; a paper on the glitter of sea surfaces; one on detecting steady or flashing lights; and a report on tinted windshields in automobiles.

In reference to the latter, Hulburt remarked,

> "I am reminded of a time a number of years ago when a Naval officer from a submarine stopped by my office. He said that on the eyepiece of his periscope there was a wheel

with colored pieces of glass: clear, red, blue, green, yellow and gray, any of which could be placed over the eyepiece. But no one seemed to know how to use the colored filters, and he would appreciate any pamphlet or advice about their use. Fortunately, I knew the answer and told him I would write a pamphlet and that it would contain only one sentence: 'Under no circumstances use any of the colored filters!' It is strange what positive, indeed, often violent views one encounters in the matter of colored or tinted glasses or goggles. In the end we desisted from argument and found the perfect answer to questions on the subject: 'Wear any kind of goggles you please, but at any time you wish to see better, take them off.'"

Hulburt retired from his position as NRL director of research in 1955 after 31 years of service. He was given the title of senior scientist for the United States National Committee on the International Geophysical Year on 1 January 1956. Hulburt continued his studies of the ionosphere until his death on 11 October 1982—one day shy of his 92nd birthday. Hulburt was perhaps the last of a remarkable generation of scientists who participated in the discovery of the ionosphere and developed much of our earliest understanding of solar-terrestrial relationships. ▲

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NRL scientists recover instruments from a V-2 used for upper atmospheric research above the New Mexico desert.

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