tion of the innovative, creative, adaptable individual who sets as his goal the translation of technology for society's needs. He will require a command of the growing body of managerial knowledge. He will need a continual refreshment of that knowledge through contact with the university as he seeks to deal with a world in change. If his firm is to encourage and use his creative capacity, it will be careful about his entry into the organization and his movement up the ladder, stressing only the values that count, that are pivotal, and taking care not to drive him into rebellion or conformity. The firm will be inventive about ways to give him opportunities to test his ideas. It will experiment with organizational forms which promote creativity. It will encourage adventure and accept risk. And in its success, it will be serving the needs of our societies in ways that will make our greatest hopes for technology a full and human reality.


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# Federal Research Laboratories


Donald F. Hornig


There is a tendency for Americans to criticize the federal government, to object to its growth, and to take exception to its undertaking activities which have counterparts in the private economy. As a result, and without substantive criticism of their productivity, government laboratories in general tend not to receive the recognition they deserve in comparison with research and development activities and accomplishments in universities and in industry. This dedication is an appropriate occasion to help redress the balance.

All federal laboratories have programs related to the missions of their parent agencies and departments, and their principal activities center about some or all of the following functions: (i) providing the parent organization with permanent capabilities for solving new problems in less time than would be possible if the government had to contract with industry on each occasion that such needs arose; (ii) through their expert staffs providing an effective and direct route for the parent organization to take quick advantage of progress in science and technology all over the world; and (iii) providing a capability within the parent organization for expert supervision and evaluation of the scientific and technical services and products that are supplied to the government by industrial research, development, and production.

Such activities are essential if agency missions are to be expeditiously carried out, and the use of in-house governmental aid to these ends is not only the most appropriate route but is also the one most likely to be cost effective in the long run. If cost effectiveness is to be realized, the laboratory's scientific and technical staffs must be fully competent to understand and to apply the new knowledge being generated at the frontiers of the applicable disciplines. And to insure that such continuing competence exists, the laboratory's staff must be directly and personally involved in frontier research and development.

There are many to whom it seems contradictory that mission-related laboratories should be concurrently engaged in frontier research and in the more mundane support activities needed by the parent agencies and departments. But there is no such contradiction, and, to understand this, it is only necessary to know that the great bulk of the best research almost everywhere is a part-time activity of the staff, the remaining time and energy generally going into much more mundane and less glamorous occupations. This is certainly true of the research being done by the faculties in our universities. Teaching is, and is likely to remain, the principal obligation of the university's staff and it is this activity which is the university equivalent of the mission-related support which government scientists and engineers provide to their agencies when they are not engaged in research.

The Naval Research Laboratory (NRL) in general and the Hulburt Center for Space Research in particular provide outstanding examples of what enlightened management and first-rate scientists and engineers can jointly accomplish in a government laboratory. The Navy's policy of encouraging research in fundamental sciences in parallel with direct mission-related work has insured an environment to which talented people have been attracted for careers permitting not only significant contributions to national defense but also meaningful additions to the growth of science and technology in general.

The origins of NRL's space-related programs go back to the beginnings of major U.S. interest in rocketry and high-altitude and space experiments. NRL's work began in 1946 when "liberated" V-2 rockets first became available for space research. Although NRL


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made important contributions to the development of American rocket technology through the Vanguard program, its major forte has always been in development of instrumentation for space aeronomy and astronomy. However, the Vanguard program also provided the vehicle, in at least two important senses, for the development of NRL's space research capabilities which are now so well integrated in the Hulburt Center for Space Research. The talents and expertise now in this Center were then responsible for the design of America's first space payloads for astronomical research. And they are still in the forefront of astronomical space research. Herbert Friedman and his asociates' studies of the sun in the ultraviolet and x-ray regions of the spectrum, and, more recently, in x-ray astronomy generally, have received worldwide recognition. No other governmental space research laboratory in the United States has the distinction of having two members of the National Academy of Sciences among its active scientific staff.

Another aspect in which the scientists at the Hulbert Center for Space Research are making a major contribution is through its program, in cooperation with the National Science Foundation and the National Aeronautics and Space Administration, to provide training in astrophysical research at the graduate level. This program provides opportunities for graduate students, doctoral candidates, and postdoctoral research fellows to acquire firsthand experience in space research. This program is well regarded not only within the Navy and the government, but also within the academic community. Since 1963 it has provided space research opportunities to some 20 scientists, and serves as a brilliant example of Navy-NRL leadership in making unique government research facilities available to the academic community. The academic support phase of the Hulburt Center's program has always had the full support of the President's Science Advisory Committee which in 1960 urged increased cooperation between the universities and governmental laboratories in graduate education.

Again the skeptic might ask, why should the Navy support research in astrophysics? In addition to the general answer I have given earlier to questions of this kind, I would like to reiterate: (i) because frontier scientific work in a field so complex and demanding from the instrumentation and measurement points of view will eventually lead, in addition to directly useful scientific results, to new ideas in sensor-related technologies which will be useful in many fields other than astronomy; and (ii) because the scientists involved in such work have the training, the capabilities, and the insights to advise the Navy, the government, and the U.S. economy in these fields.

NEWS AND COMMENT

# Du Pont and Delaware: Academic Life behind the Nylon Curtain

*Newark, Delaware.* Tucked away in this tiny eastern seaboard state that considers itself the "chemical capital of the world" is an institution whose overall quality is considered only average but which has nevertheless achieved considerable eminence in engineering and somewhat lesser recognition in science—the University of Delaware. As is true of many institutions in this area, the university has been greatly influenced by Delaware's wealthiest family, the du Ponts, and by the nearby chemical complex created by E. I. du Pont de Nemours & Company, the world's largest chemical company. Indeed, the university comes close to being a du Pont-directed enterprise. Of the 14 trustees currently serving on the university's executive committee, nine are either members of the du Pont family by blood or marriage, or are executives of the Du Pont Company or of a family-owned bank. The university draws great strength from its ties with the du Ponts, but, according to many faculty members and students, it has also been "distorted" and "intimidated" by the du Pont presence.

The university is an unusual blend of public and private characteristics. National surveys often lump it in the "public institution" or "state university" category, but Delaware generally refers to itself as a "state-related" or "state-assisted" university. It is a land-grant institution; it admits all qualified residents of the state; it performs various service functions for the state; and it draws about 35 percent of its operating budget from state sources. Yet the ultimate authority is vested in a 32-man board of trustees which is largely self-perpetuating and thus not directly controlled by the state. And within that unwieldy board, power tends to reside with the du Ponts. When *Science* asked John A. Perkins, president of the university from 1950 to 1967, to name the most influential current trustees, he cited eight men—six of them Du Pont executives or family members.

The university's largely independent status was underlined a few years ago when a state budget director tried to force the university to give a detailed accounting of all its expenditures and finances instead of merely an audit of its use of state funds. After a bruising and bitter fight, the university pushed through legislation that assured it of fiscal autonomy. Local politicians still reminisce about "Rolls Royce Day" in Dover, the state capital, a reference to the assemblage of multimillionaire trustees who descended on the legislature to support the university's cause.

Though the university is of only average reputation and medium size (about 6500 full-time undergraduates, 1800 full- and part-time graduate students, 425 full-time faculty), the du Pont presence has made it richer than many larger and more prestigious institutions. A survey by the American Alumni Council and the Council for Financial Aid to Education indicates that Delaware had an endowment of $65.5 million (book value) in 1965–66, the fourth highest endowment among 183 public institutions surveyed and an amount exceeding the endowments of such well-known private universities as Duke, Brown, Southern California, and Tulane. Delaware's first major benefactor was H. Fletcher Brown, a Du Pont executive, and its greatest contributor by far has been H. Rodney Sharp, a member of the du Pont family by