GENERAL SCIENCE

Science for Defense

"Selective Emphasis" must govern decisions on research and development programs. Freedom and encouragement for creative talent essential to new ideas.

By WALTER G. WHITMAN

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Address delivered at the Awards Banquet of the Science Talent Institute in Washington, D. C., March 3.

➤ IT IS a real pleasure to have the opportunity of congratulating you—the winners in the annual Science Talent Search. As I looked at the impressive exhibits of your work last Friday evening I was thrilled by the realization that a new phalanx of scientists is advancing each year through the high schools and into the universities. Your personal accomplishments at this early stage are harbingers of great deeds ahead.

The opportunity is unusually significant to me because only last year I was a college professor whose primary interest was the undergraduate education of scientists and engineers. And to me the greatest challenge was to further strengthen and improve freshman education, working with young people in their first year of university life. Frankly, I envy those professors who will next fall be your teachers.

New Applied Science Problem

Many of you will, after graduation, enter careers in research and development. You will never be quite satisfied, because the good research man is never satisfied, but I believe that you will find much happiness in doing the things which you most want to do, and being paid for it to boot. Some of you will become pure scientists, absorbed in discovering something new. Others, and probably the greater number, will become engineers and applied scientists, ever searching to utilize science more effectively for the good of society.

I want to talk tonight to you and to your elders here about a vast new problem in the realm of applied science which has been forced upon us by the compulsions of international tension.

When I was a boy, research belonged only to the universities. Industry and business were not concerned with these preoccupations of the long-haired scientist.

After World War I, industry became aware of the tremendous potentialities of technology for practical purposes and it built up and supported strong and vigorous industrial laboratories. These industrial laboratories have brought forth new processes and products, greatly enriching our national health and standards of living.

Today much of our wealth of technological talent and resources is, perforce, being channeled extensively into the defense effort. Government funds are now supporting some two-thirds of the total research and development of the country. While the figures are not as reliable as we would like, it appears that well over 40% of the professional men who are engaged in research and development in the United States are on Defense Department problems. Nearly half of the total who are on Defense Department work are employed in industry, working on government contracts. Our figures indicate that over a third of the total industrial research and development and over one-third of the university research is on Defense contract.

Implications Revolutionary

The recent emergence of Defense as the biggest single factor in the country's research and development has revolutionary implications.

The revolution is perhaps most keenly felt in the Department of Defense itself, which faces problems and responsibilities on a scale which was unthought of ten years ago.

It is well to remember that the research which private industry conducts is relatively mature, and that its policies and management have been developed over some 35 years, under highly competitive conditions, with many failures and new beginnings. Industrial research policies are not standardized—they vary from company to company, both with the type of industry and the people who manage it. Yet today a single government agency—the Department of Defense—is called upon to administer a technological program which is bigger than the combined programs of all research and development enterprises in the country only a decade ago. It is easy to see that the very magnitude of the task presents many new problems. But it is also evident that we can and must learn from the experiences of research direction in universities and industry, often so dearly acquired, if we are to provide competent direction and leadership for what many of us believe to be the most vital element to our national defense.

I want to discuss two factors which are essential to such direction and leadership.

The first problem of research direction is the decision as to what fields should be tilled. Businessmen can point sadly to expensive research projects which successfully developed what they were intended to develop but which only produced red ink on the balance sheet because nobody wanted the results after they were achieved. After a number of such failures, it became evident to the research directors that an intelligent and objective appraisal of the possible value of a proposed project should be conducted before investing much money and talent in the technological effort. The same necessity faces defense research. A new idea for a weapon may highly ingenious, but an enlightened analysis of its potential worth is essential before extensive support of its development is justifiable.

It is to this field of evaluation that the efforts of skilled and imaginative but objective teams like the Weapons System Evaluation Group and similar groups of the three services can contribute tremendously. Both imagination and cool objectivity are required to foresee the war-time situations which may face us and the kinds of equipment and systems which might best accomplish our objectives. Such analyses call for a combination of military and civilian talents and experience of the highest order. The conclusions which they reach, when combined with estimates of the probability of technical success for new developments, can indicate the most promising lines for research.

This problem of deciding which efforts should be supported and to what degree can be characterized by the term "Selective Emphasis." We cannot hope to do everything which is suggested, even though it appears to be technically attainable. Such a policy would so spread our resources of talent and money that the vitality of the most important programs would be sapped by the dilution of trying to do too many things. It is perhaps only to be expected that our present program, which has rapidly expanded over the past two years, particularly challenges the "Selective Emphasis" approach today.

Challenge to Management

I have spoken about the problem of deciding which field of endeavor should receive greatest encouragement and support. But there is an equally important—perhaps an even more important—policy problem—one that concerns the individual laboratory, the individual project group and the individual scientist and engineer. We hear so much about the achievements of big organizations that it is easy to be lulled into the illusion that the organization's top men, with their impressive titles, generate the bright ideas and the resourcefulness to push them to successful fruition. The cold fact is that things don't work that way. Bright ideas can spring up anywhere down the line, and some of the best come from teams and individuals at the working levels of experiment and design.

The challenge to higher management is to establish an environment which will en-

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courage creativity at the working level. The history of an idea through research and development is scarred by countless discouragements and frustrations—by false leads and mistakes—which can be surmounted only by persistence, resourcefulness and the confidence that the goal can be achieved. These are qualities of the spirit as well as of the mind. And the spirit responds sensitively to the attitudes and actions of management.

So the second major problem which I want to discuss is that of creating and maintaining high morale at the working levels of research and development. The brains, the vision, the resourcefulness and the devotion of young scientists and engineers are our potential strength, which can flourish or be blighted by the understanding or lack of it displayed by management. True leadership calls for a sympathetic appreciation of the importance of the creative individual and it demands the talent and tact to see that his efforts are encouraged in directions which offer the greatest rewards if successful. Such leadership recognizes that many ideas will prove to be impracticable or unprofitable, it encourages initiative, and it tempers its harsh decisions when a project must be cancelled by a thoughtful explanation of the reasons for cancelling and constructive suggestions for future work.

Application of Principles

As we try to apply these principles in the framework of a vast Defense research and development program it is at once evident that two characteristics loom up which are foreign to academic and industrial enterprises. The first is government, with its policies and procedures and the general atmosphere which is commonly described as "bureaucracy," involving the controls developed by law and custom on expenditures of public money. The second is the military system, characterized by the chain-of-command concept which is so essential to assuring operational responsibility and authority in the conduct of war.

Superficially, these two elements—bureaucracy and the military system—may seem to present almost insuperable obstacles to a vigorous and effective technical program for better weapons and systems. Actually, they do present great problems, but I see no reason for discouragement. Government and the public have become aware of the vital significance of technology to national defense. The willingness of the executive to propose and of the Congress to support a strong budget for defense research and development proves this. And the military are not as conservatively wedded to tradition as many civilians believe. My own experience here over the last seven months has shown me that some of the ablest men in the country are in uniform, and I have been surprised to find a goodly sprinkling of younger officers who not only respect and comprehend science and engineering but who have personally participated in the joys and tribulations of research. The character of the military system is constantly changing, and will change ever more rapidly in the future because of the nation's needs for a strong defense establishment. It is my observation, both from my wartime experience in Washington and in my present post, that the work and the decisions of government are directed by individuals of character and devotion far more than is generally realized. The individual is important here, just as he is in private enterprise.

Selective Emphasis Governs

In closing, I shall suggest some tentative guide lines for this tremendous program of technology for national defense:

1. "Selective Emphasis" must govern the decisions when research and development programs reach a stake which calls for significant expenditures of money, resources and talent. Making the selection calls for cooperative judgment of the best military and civilian brains—both as to what sort of conditions our armed forces will encounter and the potentialities for developing equipment and methods to surmount them.

2. Freedom and encouragement for creative talent are essential to the birth and early growth of new ideas. By providing them, a wealth of new possibilities can be explored and the most promising ones subjected to critical appraisal as their development reaches the point where heavy investments would be needed for continuing them. Individual initiative is vital at all stages and at all levels. Directors of working groups, of laboratories, of departments and of top policy boards must ever strive to encourage and support creativity in those for whose work they are resposible.

For you young men and women with such high potentialities for careers in science, I feel a great elation. Your adult world will be different from our world. We find great satisfactions when we can feel that we have helped our world to become a better one for you. And I know that you, too, will taste the sweetest fruits of achievement as you know that your efforts have helped man a little further towards his high destiny.

Science News Letter, March 8, 1952

ASTRONOMY

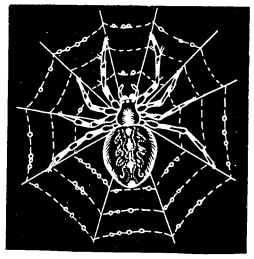
Exploding Star Discovered By Mexican Astronomer

➤ A BRIGHT star has blazed forth in the southern sky. It is in the constellation of Sagittarius the archer. The nova is of the seventh magnitude but too far south for most U. S. observers to spot.

The "new star" was located on Feb. 21 by Dr. G. Haro, director of Mexico's Tonanzintla Observatory. News of his discovery comes from Harvard College Observatory, Cambridge, Mass.

Science News Letter, March 8, 1952

Living Worlds Around Us



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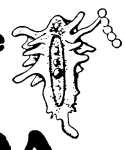

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