MAM 67-4

IN-HOUSE R&D IN SUPPORT OF THE COMBAT SOLDIER

BY

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MANAGEMENT ANALYSIS MEMORANDUM
OFFICE FOR LABORATORY MANAGEMENT
OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

7 DECEMBER 1967

IN-HOUSE R&D IN SUPPORT OF THE COMBAT SOLDIER

KEYNOTE ADDRESS

BY

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AT THE

FOUNDER'S DAY CELEBRATION
U.S. ARMY NATICK LABORATORIES
NATICK, MASSACHUSETTS

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I welcome the opportunity to come here—not only to participate in this celebration, but also because at this time of year in Washington one is in the process of making up the budget, and it is a very harrowing and anguishing experience. As someone said recently, "One suffers death by a thousand cuts." I am awfully pleased that Natick has $35 million worth of plant, because this would be a rough year to try getting any more.

Today we commemorate the founding of the Natick Laboratories. In short, congratulations!—you have been successful. Your role has been extremely significant for our country. And you have an important and exciting future.

The Natick Labs are primarily concerned with the combat soldier. We know that his courage, training, morale and effectiveness mean the difference between victory, stalemate or defeat. No matter how sophisticated our weapons and logistic systems, the soldier is the key to combat effectiveness. Vital ground always must be gained and held by foot soldiers, who must fight the environment as well as the enemy. So your job —to consider the man and his needs—is absolutely essential.

This Army in-house laboratory is a tribute to the foresight and wisdom of such men as General Doriot, head of the Quartermaster Corps' R&D in 1942, and General Gregory, Quartermaster General in 1945. These men and their associates understood the R&D system. They saw the need to bring together several scattered fragments of the Army's R&D activities and fashion a full-spectrum R&D center, with activities ranging from research through product standardization. Equipped with the most modern tools of science and engineering, you are now concentrating on high-priority programs carefully tuned to the urgent needs of the combat soldier. Many steps being taken today to strengthen other in-house laboratories emulate the concepts underlying the creation of the Natick Laboratories.

Let me be quite clear about the fundamental reasons for requiring absolutely first-class in-house laboratories in each of the military departments.

First, we need—and the conflict in Southeast Asia has strongly reinforced our understanding of this need—a technological capability for quick responses to unpredictable needs and opportunities emerging from actual combat.

Second, we need an experienced "coupling agent" between the entire R&D community and the military commanders and planners. This coupling can be cahieved best through an in-house lab structure, when the structure is carefully designed and astutely managed.

Third, there are some unique military needs that can be most effectively met through an integrated in-house lab team without contractors' support. For example, when we do not expect a large production requirement, a lab may be the most efficient means of fulfilling a need.

Fourth, there are technical areas and situations in which we have not stimulated, or cannot stimulate, an adequate capability outside the government, and we must pursue an orderly program of R&D. For example, much of the work of your lab on the design of field food systems can be regarded as this sort of problem.

We are enthusiastic about the need for, and the potential of, in-house laboratories, now and in the future. There are always difficult administrative problems in any large organization, no matter what its function. But, because in-house labs are a critical component in the system to attain national security goals, both Secretary McNamara and I are prepared to give any member of any in-house lab staff and any manager influencing any lab's effectiveness our whole-hearted personal support for the improvements that we all recognize are necessary.

Over the past 18 months, we have worked hard to improve certain technical management procedures and operations of the Defense laboratories. Last week I met with the Directors of Laboratories, including Dr. Jay Tol Thomas, to appraise our progress thus far. We have made more progress than many thought we would, and we will make more. We are on the verge of solving all the 42 administrative problems identified early last year. Let me summarize and give you two examples.

At the present time, with respect to 80 percent of the identified problems, either they have been "solved" or we have implemented a time-phased method of solution. We are concentrating on the remainder, and by the end of this month we will have made a major dent in each of the unsolved ones.

Let me cite two examples of problems and actions:

(1) The problem—There is a relative lack of involvement of many labs in important systems and military decisions.

The action—At least five major laboratories in each military department have been given new or augmented assignments with clear responsibilities in an important problem area and with respect to the associated systems.

(2) The problem—Laboratories do not have adequate local control over their research and exploratory development programs. Control over programs is fragmented.

The action—In FY 1967 we experimented in the Air Force with a concept of "one program element per laboratory." This worked out

well. Both the Navy and the Army have agreed to select, on a trial basis, three or four of their principal mission-oriented laboratories and provide single-element funding of research and exploratory development with a high degree of local reprogramming flexibility. I expect this concept to see expanding application.

The Assistant Secretaries of the military departments will prepare summary reports to their in-house laboratories delineating all of the problems and their solutions so far. For the coming year, we plan to solicit from you another set of problems to which we should address our attention and energies. These, plus the observations that emerged from visits by the Civil Service Regional Directors to laboratories such a yours, will be our action agenda for 1968. We will not be satisfied with "Washington solutions." These new flexibilities must penetrate the hierarchical structure and become operational, a way of life throughout the laboratories.

Thus we are trying to make it easier for you to do your work. These management problems are tough, and they absorb a great deal of time. But let us not forget the main point: We are in the business of research and development. So permit me to sketch some of your accomplishments.

As a good laboratory generally does, Natick has not only contributed directly to the Army's needs through high-quality in-house research and development, but also has helped link the nation's technical competence to the solution of critical military problems. Your partnership with the National Research Council, the scientific community, and the industrial R&D sector has been productive. We have made impressive strides in coming to grips with the problem of properly equipping and supporting the soldier and protecting him from the hardships of terrain and weapons with a high degree of efficiency under almost all environmental conditions.

Perhaps as much and as well as any other laboratory, your talents have been applied to the situation in Southeast Asia. The fine results of all your SEA efforts are too far-ranging to describe here. Some are products such as these:

. Spike-protective tropical combat boot--To protect against hidden, poisoned punji stakes and other contaminated spikes.

. Blast-protective boot—To reduce foot and leg injuries due to antipersonnel-type mines.

. New ammunition pouches—To eliminate rattling noises, and to permit one-handed opening and closing.

. Bullet-proof body armor—To protect torso, thighs and legs from small-arms fire.

. Improved helicopter trooper's ladder—To enable more reliable lowering and retrieving of troops from a CH-47.

. Free-fall water containers—To supply our troops in remote areas.

. Improved lightweight tropical clothing—To give greater comfort and improved wear characteristics.

For some time you have contributed to the improvement of food for the military departments as well as for NASA. During the coming month I intend to issue a new DoD Instruction that will clarify the Army's executive agency assignment for the DoD's entire RDT&E program on military foods and related items and functions. The instruction will concentrate at the Natick Laboratories the research and development of foods, feeding systems and food packaging for all military services.

Let me pause here to say that you have participated in what we see as revolutionary advances in the materials and processing technologies. Many of these advances have already been incorporated into our systems for food and for clothing. Yet much remains to be done.

Our experience in Southeast Asia has tested in a demanding way almost all of our tactical (and some strategic) military equipment and concepts. We have experienced great success with comparatively recent combat innovations arising out of R&D efforts. We have also learned of many inadequacies in our ability to deter and fight limited wars. Our R&D has yet to give our troops sufficient advantage over the enemy operating in his own environment (a difficult one) and employing fairly unsophisticated, often primitive hardware and usually unconventional military tactics.

In a broader perspective, one of our key problems, the major direction for future R&D, is really a cluster of problems pertaining to people—not just combat troops, but all of the people with widely varying backgrounds and functions. All these people participate in "the systems." But too often our systems do not fit the man. We are too frequently confronted with a magnificent new machine that our men find hard to use. The machine usually is not poorly designed for <u>its</u> function. Often, however, man/machine interactions have not been considered carefully.

One of our urgent goals, then, is to develop really matched capabilities for men, equipment and operational environments. We have begun to expand our efforts in education and training, in human factors engineering, in manpower analyses for equipment in advanced R&D, and in improving our understanding of the environmental conditions affecting man/machine performance. Still greater emphasis is needed.

To meet these goals, we must take advantage of the lessons learned in all areas of technology. We must consider the combat soldier as a

total "system," the most complex one in our inventory. We must examine him in relation to his weapons, his sensors, his logistical support, his feeding and his protection—all in an integrated way—if we are to achieve major advances in our military capabilities.

What are the functions of the individual infantry soldier in any future military operations? Those functions should become our goals. Clearly, many tasks will not change: He needs to eat, sleep and survive. Other tasks will change, and the changes will involve Natick Laboratories.

For example, some new opportunities will occur because of improvements that are being made in miniaturized sensors. Man's ability to perceive and communicate can be greatly improved through the use of miniaturized electronics. But these possible improvements in effectiveness may lead to potential increases in the load a man must carry. The military value of this load must be weighed against the value of other loads and the degradation of performance that results from hauling the load around. Thus, the desire for a man to do more things is in direct competition with his physical ability to do them. As you know, this is a common system-design problem. Weight reduction becomes an increasingly urgent task for our tradeoff analyses of "man in the system."

As another related example, consider the long-range reconnaissance patrols. The information gathered by these small units can be of significant benefit to the larger units they support. At present, they carry a large amount of equipment, which may total as much as 100 pounds per man. If it were possible to reduce this weight while increasing the ability of the unit to acquire information, obviously the unit's overall effectiveness would be increased. In applying systems engineering to patrol equipment and exploiting the full range of modern materials and packaging technology, why don't you aim to reduce the current weight by a factor of 2? If we can greatly lessen the weight of any major part of the load, we can consider adding new components to further improve or extent a man's capabilities.

As we see it, Natick's overall mission is this: To provide the combat soldier with an integrated set of equipment, including clothing, personal equipment, lightweight armor and food. These systems must exploit all relevant areas of technology and must capitalize on all our analytical tools for system design. Man must be at the center, not at the periphery of our thinking about defense R&D. Natick must help the entire defense R&D community to understand and apply this guideline.

I have touched briefly on the history of the Laboratories, on some of your recent contributions, and on a few of your goals. Before closing, I should return to the reason for our coming together.

What does it really mean to celebrate a Founder's Day? It is an opportunity to ask broad questions and attempt to set priorities on fundamental jobs. Without doubt, the fundamental job of the military R&D community is to seek and to exploit new ideas for improving our

military capability. There is no technological plateau now, and there will be no technological plateau in the future as long as we continue to do this job. But we must continue.

We need all of your new ideas. We need to energize you and your colleagues throughout the Department of Defense who are concerned with "man in the system" to produce more ideas, to sort them out, to test them, and to find those few that are genuinely excellent. You have done this in the past—you are doing it now.

But thinking is tough, and is easily postponed by day-to-day urgencies. The time to explore that brainstorm is today.

There is a striking anecdote about the great French Marshal Lyautey. He once asked his gardener to plant a tree. The gardener objected that the tree was slow growing and would not reach maturity for 100 years. The Marshal replied, "In that case, there is no time to lose; plant it this afternoon!" That is precisely how I feel. So many of our R&D goals are so tough that we may tend to postpone action on the argument that "It's going to take a long time, so why hurry?" Believe me, you must not fall into this mood. R&D activities are driven successfully by a clear understanding of the objective and insistence on standards of high quality.