THE NOTS CONCEPT OF HOW TO ACHIEVE EFFECTIVE BUREAU-LABORATORY-CONTRACTOR RELATIONSHIPS ON WEAPON DEVELOPMENT PROGRAMS

January 1960

China Lake
California

U. S. NAVAL ORDNANCE TEST STATION

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FOREWORD

This paper was prepared in response to a request from the Chief, Bureau of Naval Weapons for a statement of management philosophy on the Bureau-Laboratory-Contractor relationship.

These views were synthesized by the Heads of three of the Development Departments. A mode of operating designed to expand the role of the government laboratory in high-risk development work is suggested. The attainment of this goal would be facilitated by the disengagement of personnel and facilities from production and expansion of the capacity for laboratory participation throughout the range of research, development, test and evaluation.

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Released under authority of
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INTRODUCTION

This paper presents the viewpoint of Naval Ordnance Test Station management regarding means of achieving effective interaction among the Bureau of Naval Weapons, scientific laboratories, and industry on weapon development programs. It assumes a crucial need for re-examining and optimizing this relationship "to reduce lead time between the expression of an operational requirement and the delivery to the combat forces of a fully developed and effective weapon or weapons system for service evaluation."

The present spectrum of research, development, test and evaluation resources of the Bureau of Naval Weapons includes a wide range of governmental and industrial effort with differing degrees of all-round capability. Altering this complex quickly or severely is not feasible without risking serious disruption to present effort. It is therefore appropriate that the Bureau undertake a comprehensive evaluation of these diverse resources and establish a long-range model of operational procedure to guide future program and facility decisions. Desirable elements in this model would be:

> Development of a capacity for effective participation throughout the range of research and development, from conception through technical evaluation, in as many Bureau of Naval Weapons laboratories as possible.
>
> Maximum disengagement of Navy personnel and facilities from classical large scale production.

In FY 1960, approximately 47 percent of Bureau of Naval Weapons' research, development, test and evaluation funds are allocated to program effort at government activities and government-sponsored laboratories, the balance to industrial effort. Each laboratory, in turn, contracts out a substantial share of its effort; the Naval Ordnance Test Station, for example, allocates approximately one-third of its project funding to outside procurement.

These estimates represent a rough but realistic index of the manner in which the Bureau's prime resources are divided. It is logical that industry presently supplies, and should continue to supply, a considerable share of the research, development, test and evaluation effort. Governmental and quasi-governmental laboratories do not have the capacity to accomplish the full effort, even if this were considered desirable. The crucial problem, then, is determining the ratios in which the Bureau of Naval Weapons' in-house capacities

can best be applied to the various stages of the conception-to-evaluation continuum. This requires a continuous examination and appraisal of the special competences of government and industry. These fluctuate widely between organizations and within organizations.

BASIC CONSIDERATIONS

If the spectrum of development effort is analyzed from the standpoint of the potential for success (i.e., on the basis of high-risk, medium-risk, low-risk), it can provide a guide for allocation. In this analysis, it would be assumed that high-risk development exists when a substantial advance in the state of the art is required for success and that the risk disappears when feasibility has been demonstrated.

It appears desirable to utilize the limited resources of the government's scientific laboratories as extensively as possible in a high-risk effort, given the technical and organizational competence in those laboratories to do the work. This would have the following direct results:

> It would provide the most rapid, objective, and economical basis for evaluation of ultimate feasibility.
>
> It would utilize and motivate the available talent to their highest potential.
>
> It would provide a positive stimulus to attract and retain high-caliber personnel in the government's laboratories.
>
> It would provide a vital in-house capability to investigate areas of interest left unattended or to handle programs requiring considerable effort but holding little promise of immediate reward.
>
> It would provide the Bureau with a source of information unbiased by the profit motive on which to base technical judgment.

Orientation of government laboratories to perform high-risk development work as arms of the Bureau carries with it several corollary considerations, of which the following are especially significant:

> The laboratories can provide the Bureau with consulting service on weapons and weapons systems

based on investigations into the state of the art, on analytical examinations of proposed concepts, and on experimental evaluations of feasibility.

The laboratories can through exploratory investigations produce a technological and financial yardstick by which industrial performance in a weapon development can be appraised.

The laboratories, because of their unique position, can provide a communications link between Fleet requirements and industrial capabilities. This capacity can be utilized to advise and guide industrial effort and to inform Navy leadership of technological considerations.

Even with maximum use of the laboratories in this manner, it will still be necessary to assign a large number of high-risk programs to industry. Such programs should obviously be in areas best suited to industrial competence.

In the medium- and low-risk areas, a division of effort will also be required. In some cases, it may prove desirable to conduct the development program entirely or largely within the government framework. However, such effort should be complementary to, not competitive with, high-risk commitments. It is proposed that industry assume a proportionately greater share of available work in this area than on the high-risk items.

GUIDELINES FOR ACTION

In order to implement the pattern of relationships indicated above, the following guidelines are recommended in the prime areas of the research, development, test and engineering process.

Feasibility Studies

It is considered imperative that each proposed development be subjected to an analytical and experimental evaluation of its concept and possible performance (including the building of feasibility hardware) before full-scale development is undertaken. The capability to perform such studies is present in both government and industry. For the reasons indicated above, it is considered desirable that governmental competence be used to the fullest in this area and that this be considered the most important role of the

government laboratory. In such studies, the performing organization should have authority to operate with considerable flexibility.

Development

Dual competence exists in this area as well, with possible alternatives of a largely governmental, largely industrial, or a joint development program through the stage of prototype production. The approach chosen in a particular program will depend on a host of special factors, including:

The item to be developed and the quantity required.

Relative knowledge and interest in the project in each of the organizations.

Special areas of competence among key personnel in the two groups.

Funding arrangement and time scale.

Location of key facilities.

It is vital that the organization selected to head the development be granted substantial operating leeway in conducting the program. This should include the following responsibilities, with commensurate authority:

Decision-making, generally defined in the terms "technical direction" and "design cognizance".

Cognizance and administration of funds and contracts for the program.

Selection of participating activities for the development effort, subject to Bureau review.

Determination of the development plan, including the extent and phasing of outside effort, subject to Bureau approval.

These activities are to be exercised within the framework of Bureau responsibilities and decisions which consist of:

Providing a meaningful philosophy of warfare in keeping with national diplomacy.

Translating Fleet needs into appropriate program concepts.

Selecting and utilizing resources (manpower, money and material) to accomplish these requirements.

Providing continuing review, evaluation, and major decisions across the development spectrum.

Choice of an organization to lead the effort represents the most critical single step in this process. The direction activity should ideally be the organization which is most capable and most interested in a particular concept, is convinced of its feasibility, and is actively pressing for direction responsibility. It is clear that the laboratories are not capable of absorbing all such effort, nor is this desirable.

Assignment of direction responsibility should bear a close relationship to organizational interests, past competence, or long-range goals. If these factors do not qualify a laboratory for meaningful involvement, an industrial firm should be selected and given substantial operating authority from the Bureau of Naval Weapons. It bears emphasis that direction responsibility without the need of, or capability for, technical performance is corrosive to an organization.

Where a government laboratory is designated for program leadership, allocation of both technical direction and design cognizance is vital. This lays the foundation for the flexible working relationship necessary for effective, minimum lead time, development. In many cases, the authority associated with design cognizance will be redelegated by the laboratory to other elements of the development team, both industrial and governmental. This is a necessary corollary to the laboratory's role as a broad resource of scientific background and skills. In order to make the most effective use of its limited staff in high-risk work, the laboratory must, of necessity, share a considerable amount of its work with industry.

There is a lack of clarity as to the responsibility and authority that go with the assignment of technical direction and design cognizance. The concept to be stressed is that technical knowledge, rather than authority, is the only valid medium of exchange in research and development. The organization with greatest technical competence ordinarily does, and should, exert the greatest influence. Without such competence, the authority implied by technical direction and design cognizance has an empty ring. In the subtle balance that exists when three complex organizations must collaborate closely on a sophisticated weapon, insistence on their "rights" by any of the three can effectively thwart progress and understanding. It is

equally true that the Bureau, laboratory, and contractor individually have contributions which they are best able to make. It is the goal of this concept to stimulate these mutual contributions to common problems.

RECOMMENDATIONS

To optimize the effectiveness of the Bureau-laboratory-contractor relationship, the Bureau of Naval Weapons should:

Assure that an analytical and experimental evaluation of a concept is completed, preferably by a government laboratory, before a full scale project is undertaken.

Assign the maximum amount of high-risk work to its own and affiliated laboratories.

Move toward disengagement of government activities from production.

Broaden the technical scope of all retained laboratories in the whole spectrum from research to evaluation.

Designate clearly both the technical direction and the design cognizance of a development package, allowing for the redelegation of design cognizance at the discretion of the directing organization.

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