

lost objects, calibration work on instruments, assistance to Arctic Research Institute on the structure of sea ice, and the use of sonar to count fish in the Columbia River for the Department of Interior. One commercial aspect of our work is the appearance on the market of handheld sonar for skindivers and sonar equipment for fishermen. NUWC test facilities are available to all Government agencies and contractors.

I believe the only nonsubjective measure of effectiveness in R. & D. must result from comparisons on a competitive basis. This means that we need more than one laboratory in each field of endeavor which is important to Government operations; or more realistically, we need two or three groups of laboratories, each having a broad scope of activities extending all the way from research through development, testing, and evaluation, and limited production of the type needed to provide guidelines for large-scale industrial production. Competition between these laboratories, or groups of laboratories, should be encouraged and the record of their accomplishments evaluated. Our abilities to satisfy society's needs are judged by competition and rewarded by success or failure. This process provides high incentives and high motivation. People work best when they feel they have set their own objectives and have control of the process. The general management can be very loose and competition can provide opportunities both to try and to judge organizational procedures. Such management will be successful only for laboratories with a broad mission since parts of the total process cannot be productive by themselves, for example, pure research without application is never profitable; the final product is the most reliable measure of productivity.

In my opinion, the most practical method of supporting interagency research and development is through a direct agreement between the laboratory and the outside agency. Joint undertakings and interagency transfer of funds, while quite feasible in principle, tend to become enmeshed in workings of the system to the point where a great deal of program effort is absorbed by administrative and communication problems unless a central focal point exists. When a program needs integrated planning the existence of a planner or a master architect seems essential. This man should have the following characteristics:

1. Technical competence.
2. Dedication and enthusiasm for the job.
3. Planned availability for the duration of the job.
4. Knowledge of, and control of, the needed resources including supporting laboratory efforts.

If such a man is not available the programs will proceed better in smaller units without overall coordination. A study of our successful and unsuccessful projects as related to the continuity of management might serve to enlighten this point.

In conclusion, gentlemen, I feel that in the management of Federal laboratories the following operational principles should be retained:

(a) Self-determination of the direction of a laboratory's programs by the skillful use of independent funds and friendly interlaboratory competition.

(b) Reward for achievements and discipline for ineffectiveness through competition.

I propose also that the management of Federal laboratories: